

PART III

DAT PRACTICE TESTS

Answer Sheets for Practice Test 1

Remove these sheets and use to mark your answers.

Natural Sciences

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Perceptual Ability Test

Part 1

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Part 4

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| 87 | A | B | C | D |
| 88 | A | B | C | D |
| 89 | A | B | C | D |
| 90 | A | B | C | D |

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Reading Comprehension

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Quantitative Reasoning

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PERIODIC TABLE OF THE ELEMENTS

1 H 1.0079											2 He 4.0026	
3 Li 6.941											9 F 19.00	
4 Be 9.012											8 O 16.00	
11 Na 22.99	12 Mg 24.30									17 Cl 35.453	18 Ar 39.948	
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 51.00	25 Mn 54.93	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 105.42	47 Ag 107.87	48 Cd 112.41	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 +Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 § (269)	111 § (272)	112 § (277)	

§ Not yet named

* Lanthanide Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
+ Actinide Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

DAT Practice Test 1

Natural Sciences

Time: 90 Minutes

100 Questions: Biology (1–40), General Chemistry (41–70), and Organic Chemistry (71–100)

- The primary function of the mitochondria found in eukaryotic cells is to
 - carry out protein synthesis.
 - control the physical properties of the cell.
 - control the biochemical properties of the cell.
 - produce energy for cellular functions.
 - manufacture glucose.
- Which of the following statements regarding cellular respiration is INCORRECT?
 - Cellular respiration occurs only in animal cells, whereas plant cells carry out photosynthesis.
 - Aerobic respiration tends to be more efficient in terms of energy production than anaerobic respiration (fermentation).
 - Cellular respiration produces energy for the cell through the process of breaking down glucose molecules into carbon dioxide and water.
 - Cellular respiration takes place in the mitochondria of both plant and animal cells.
 - The process of fermentation occasionally takes place in human cells.
- Which of the following components is not necessary for the process of photosynthesis to take place?
 - carbon dioxide
 - oxygen
 - chlorophyll
 - light energy
 - water
- Proteins that act as catalysts to speed up the rate of a reaction by lowering the activation energy required for the reaction to take place are referred to as
 - cofactors.
 - substrates.
 - enzymes.
 - polypeptides.
 - promoters.
- The passive movement of substances across cell membranes occurs primarily through
 - plasmolysis.
 - ion pumping channels.
 - active transport.
 - diffusion and osmosis.
 - electrochemical gradients.
- An organism with a chromosome number of 24 in each of its somatic cells would give rise to gametes (eggs or sperm) with a chromosome number of
 - 24.
 - 12.
 - 6.
 - 48.
 - 36.
- Yeast, used in the fermentation process to make ethanol, is classified as a member of which of the following groups of organisms?
 - prokaryotes
 - protists
 - fungi
 - bacteria
 - slime molds

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8. Which of the following features separates angiosperms (flowering plants) from the other plant groups?
- A. the production of seeds
 - B. the presence of vascular tissue
 - C. reproduction by spores
 - D. the presence of nutritive tissue in the seed
 - E. the production of fruit
9. Which of the following animal phyla includes both invertebrate and vertebrate organisms?
- A. Arthropoda
 - B. Annelida
 - C. Mollusca
 - D. Chordata
 - E. Echinodermata
10. Which of the following features is NOT considered a defining characteristic of vertebrate organisms?
- A. notochord
 - B. dorsal, hollow nerve cord
 - C. segmented body plan
 - D. pharyngeal slits
 - E. muscular, postanal tail
11. Which of the following represents the vertebrate system responsible for eliminating metabolic waste products from the body and maintaining the osmotic balance of the blood?
- A. excretory system
 - B. endocrine system
 - C. digestive system
 - D. circulatory system
 - E. respiratory system
12. Which of the following represents the correct order in which food travels through the human digestive system?
- A. mouth → esophagus → pharynx → stomach → small intestine
 - B. mouth → pharynx → esophagus → stomach → small intestine
 - C. mouth → esophagus → pharynx → small intestine → stomach
 - D. mouth → pharynx → esophagus → small intestine → stomach
 - E. mouth → esophagus → stomach → pharynx → small intestine
13. When taking your blood pressure, you are actually measuring
- A. your heart rate.
 - B. the number of times your heart beats per minute.
 - C. the force that blood exerts against the walls of the blood vessels.
 - D. your pulse.
 - E. the rate at which blood is flowing through your blood vessels.
14. Which of the following is NOT a function of the human dermal system?
- A. gas exchange
 - B. sensory organ
 - C. protection against invading microorganisms
 - D. outer body covering
 - E. protection of internal organs
15. The primary function of the red blood cells in the human circulatory system is to
- A. produce antibodies against invading microorganisms.
 - B. initiate the blood clotting process.
 - C. stimulate the immune response.
 - D. transport oxygen and carbon dioxide throughout the body.
 - E. provide a liquid matrix within which the white blood cells are suspended.
16. Mucous membranes, phagocytic white blood cells, and the inflammatory response are all examples of
- A. specific immune responses.
 - B. non-specific immune responses.
 - C. barrier defense mechanisms.
 - D. initial immune responses.
 - E. primary defense mechanisms.
17. The transfer of antibodies from a mother to her fetus is an example of
- A. passive immunity.
 - B. active immunity.
 - C. maternal immunity.
 - D. fetal immunity.
 - E. prenatal immunity.

18. Which of the following hormones is NOT produced by the pituitary gland?
- A. oxytocin
 - B. growth hormone
 - C. prolactin
 - D. thyroid stimulating hormone
 - E. epinephrine
19. Intercellular chemical messengers released at synapses are referred to as
- A. axons.
 - B. dendrites.
 - C. neurons.
 - D. neurotransmitters.
 - E. membrane potentials.
20. The system responsible for conveying signals that regulate involuntary control of the cardiac muscles and the smooth muscles of the digestive, cardiovascular, excretory, and endocrine systems in humans is the
- A. central nervous system.
 - B. autonomic nervous system.
 - C. peripheral nervous system.
 - D. somatic nervous system.
 - E. sensory nervous system.
21. In the human males, sperm are formed in the
- A. penis.
 - B. seminal vesicles.
 - C. vas deferens.
 - D. epididymis.
 - E. seminiferous tubules.
22. Which of the following represents the correct order of development in vertebrate embryos?
- A. fertilization → cleavage → gastrulation → organogenesis
 - B. fertilization → gastrulation → cleavage → organogenesis
 - C. fertilization → cleavage → organogenesis → gastrulation
 - D. fertilization → organogenesis → cleavage → gastrulation
 - E. fertilization → gastrulation → organogenesis → cleavage
23. The three tissue layers that form during gastrulation in vertebrate embryo development each give rise to a variety of tissues and organs in the adult organism. Which of the following embryonic tissue layers is MISmatched with one of the adult tissues or organs it gives rise to?
- A. ectoderm skin
 - B. endoderm lining of the digestive tract
 - C. mesoderm skeletal system
 - D. endoderm circulatory system
 - E. ectoderm cornea and lens of the eye
24. Which of the following represents the possible gametes that could be produced by an individual with the genotype AABbcc, assuming that no crossing over takes place during meiosis?
- A. AA, Bb, or cc
 - B. A, B, b, or c
 - C. ABc, or Abc
 - D. AB, Ab, Ac, Bc, or bc
 - E. AB, or bc
25. If straight body form is completely dominant to spiral body form in earthworms, which of the following represents the correct ratio of offspring that would be produced by a cross between a worm that was heterozygous for straight body type (Bb) and a worm that was homozygous recessive for spiral body type (bb)?
- A. All offspring would have straight bodies.
 - B. All offspring would have spiral body types.
 - C. 3:1, with 3 straight bodies : 1 spiral body
 - D. 3:1, with 3 spiral bodies : 1 straight body
 - E. 1:1, with half the offspring having straight bodies and half the offspring having spiral bodies
26. Sex-linked traits refer to those traits that
- A. are carried on the sex chromosomes (X and Y).
 - B. determine the sex of an individual during embryo development.
 - C. are responsible for the development of primary sexual characteristics during development.
 - D. are responsible for the development of secondary sexual characteristics during development.
 - E. are responsible for the production of gametes during meiosis.

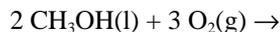
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- 27.** Mistakes that take place during meiosis can result in nondisjunction of entire sets of chromosomes, such that the resulting gamete (egg or sperm) is diploid instead of haploid. If a diploid gamete unites with a normal haploid gamete, the resulting zygote would be
- aneuploid.
 - allopolyploid.
 - autopolyploid.
 - triploid.
 - tetraploid.
- 28.** Which of the following represents the correct order of events that takes place in the conversion of the genetic code into a polypeptide?
- DNA → (translation) → mRNA → (transcription) → polypeptide
 - DNA → (transcription) → mRNA → (translation) → polypeptide
 - mRNA → (translation) → DNA → (transcription) → polypeptide
 - mRNA → (transcription) → DNA → (translation) → polypeptide
 - mRNA → (transcription) → tRNA → (translation) → polypeptide
- 29.** DNA is composed of
- chains of nucleotides arranged to form a double helix held together by hydrogen bonds between pairs of deoxyribose sugar molecules.
 - chains of nucleotides arranged to form a double helix held together by hydrogen bonds between pairs of phosphate groups.
 - chains of nucleotides arranged to form a double helix held together by hydrogen bonds between deoxyribose sugars and nitrogenous bases.
 - chains of nucleotides arranged to form a double helix held together by hydrogen bonds between nitrogenous bases and phosphate groups.
 - chains of nucleotides arranged to form a double helix held together by hydrogen bonds between pairs of nitrogenous bases.
- 30.** Which of the following techniques is frequently used in forensic science to produce sufficient copies of cloned DNA for testing from a small sample of blood found at a crime scene?
- transformation
 - genetic engineering
 - DNA fingerprinting
 - polymerase chain reaction
 - transduction
- 31.** An organism that contains segments of DNA from another organism is referred to as being
- cloned.
 - transgenic.
 - restricted.
 - amplified.
 - fingerprinted.
- 32.** Differences among individuals in a population in the ability to survive and successfully reproduce is referred to as
- evolution.
 - descent with modification.
 - adaptation.
 - natural selection.
 - inheritance.
- 33.** Genetic drift, one of the mechanisms that prevents a population from maintaining Hardy-Weinberg equilibrium, is primarily due to
- migration into or out of the population.
 - random mating.
 - small population size.
 - natural selection.
 - mutations.
- 34.** If two organisms belong to the same order, they must also belong to the same
- class.
 - family.
 - genus.
 - phylum.
 - species.

- 35.** All of the species that live in a given geographic area and have the potential to interact with each other is referred to as a(n)
- A. geographic unit.
 - B. gene pool.
 - C. ecosystem.
 - D. population.
 - E. community.
- 36.** A type of interspecific interaction in which both individuals benefit from the relationship is referred to as
- A. commensalism.
 - B. mutualism.
 - C. predation.
 - D. competition.
 - E. parasitism.
- 37.** In a typical food chain, the primary consumers are often referred to as
- A. decomposers.
 - B. producers.
 - C. carnivores.
 - D. herbivores.
 - E. predators.
- 38.** Movement of water, carbon, and nutrients through an ecosystem occurs
- A. in one direction, with a loss of water, carbon, or nutrients at each trophic level in the food chain.
 - B. in one direction, with a gain of water, carbon, or nutrients at each trophic level.
 - C. in a cyclical manner through the living organisms only.
 - D. in a cyclical manner through the abiotic elements only.
 - E. in a cyclical manner through both the living organisms and abiotic elements.
- 39.** The rapid increase in atmospheric carbon dioxide in recent years is primarily due to
- A. an increase in photosynthesis by primary producers.
 - B. an increase in respiration by living organisms.
 - C. an increase in decomposition of organic matter.
 - D. an increase in fertilizer run-off from agricultural and urban areas.
 - E. an increase in the burning of fossil fuels and wood.
- 40.** The nature vs. nurture controversy is concerned with
- A. the relative importance of genes and the environment in shaping behavior.
 - B. the various forms of learning behavior.
 - C. the roles of learning and maturation in behavior.
 - D. the evolution of social behavior.
 - E. interspecific versus intraspecific behavior.
- 41.** What type of element is arsenic?
- A. metal
 - B. nonmetal
 - C. noble gas
 - D. metalloid
 - E. transition metal
- 42.** Which of the following pairs of elements will most likely form an ionic substance?
- A. copper and chlorine
 - B. sulfur and chlorine
 - C. hydrogen and chlorine
 - D. carbon and chlorine
 - E. silicon and chlorine
- 43.** What is the name for the polyatomic ion NO_3^- ?
- A. nitrite ion
 - B. nitrous ion
 - C. nitrate ion
 - D. nitride ion
 - E. nitrogen trioxide ion

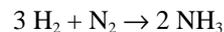
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44. Complete the following chemical equation for the complete combustion reaction. Include the correct coefficients.



- A. $\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
B. $2 \text{CO}_2(\text{g}) + 3 \text{H}_2\text{O}(\text{g})$
C. $\text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{g})$
D. $2 \text{C}(\text{s}) + \text{O}_2(\text{g}) + 4 \text{H}_2(\text{g})$
E. $2 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{g})$
45. How many mols of NH_3 will be equal to 1.0×10^{22} molecules of ammonia?
- A. 17
B. 60
C. 0.017
D. 1.0×10^{22}
E. 6.0×10^{45}
46. Which of the following is the nuclear decay equation for beta emission by carbon-14?
- A. ${}^{12}_{20}\text{Ca} \rightarrow {}^0_{-1}\text{e} + {}^{12}_{19}\text{Ca}$
B. ${}^{12}_{20}\text{Ca} \rightarrow {}^0_1\text{e} + {}^{12}_{19}\text{Ca}$
C. ${}^{14}_6\text{C} \rightarrow {}^0_{-1}\text{e} + {}^{14}_7\text{N}$
D. ${}^{14}_6\text{C} \rightarrow {}^0_1\text{e} + {}^{14}_5\text{B}$
E. ${}^{14}_6\text{C} \rightarrow {}^1_0\text{e} + {}^{13}_6\text{C}$
47. Iodine-131 has a half-life of 8.1 days. How many grams of iodine-131 will remain after 16.2 days if the initial sample had a mass of 3.00 grams?
- A. 0.750 g
B. 1.50 g
C. 1.00 g
D. 2.00 g
E. 0.375 g
48. What is the name for the process in which a solid changes into a gas?
- A. vaporization
B. evaporation
C. decomposition
D. fusion
E. sublimation

49. How does the rate of disappearance of H_2 compare with the rate of production of NH_3 for the gas phase reaction shown here?

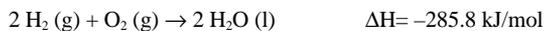


- A. The initial rates are equal.
B. The rate of disappearance of H_2 is 1/2 the rate of production of NH_3 .
C. The rate of disappearance of H_2 is 3/2 the rate of production of NH_3 .
D. The rate of disappearance of H_2 is 2/3 the rate of production of NH_3 .
E. The rate of disappearance of H_2 is 1/3 the rate of production of NH_3 .
50. Which of the following quantities when plotted versus time will give a straight line plot for a first order reaction?
- A. $1/[\text{A}]$
B. $\ln [\text{A}]$
C. $\ln [1/\text{A}]$
D. $[\text{A}]$
E. $\ln k$
51. In general which of the following statements is true about the chemical reaction rate when temperature increases?
- A. increases due to greater number of effective collisions
B. increases due to an increase in the activation energy
C. increases because bonds are weakened
D. increases only for an endothermic reaction
E. is the same regardless of temperature increases
52. Hydrofluoric acid has a $K_a = 7.2 \times 10^{-4}$. What is the value for the K_b for the fluoride ion, F^- ?
- A. approximately 1×10^{-14}
B. approximately 1.4×10^{-11}
C. approximately 7.2×10^{-4}
D. approximately 7.2×10^{-15}
E. approximately 7.2×10^{10}
53. Which of the following chlorine containing acids is the strongest?
- A. HCl
B. HClO
C. HClO_2
D. HClO_3
E. HClO_4

54. Ammonia is produced commercially by the Haber process. In this reaction H_2 and N_2 react according to this formula: $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \leftrightarrow 2 \text{NH}_3(\text{g})$ $\Delta H = -92,200$ joules
- Which of the following changes at equilibrium will cause the reaction to shift and increase production of ammonia?
- removal of nitrogen
 - removal of hydrogen
 - addition of a catalyst
 - decreasing the size of the reaction vessel
 - increasing the temperature from 200°C to 300°C
55. What is the approximate pH for the solution produced when CH_3COOH is reacted with an equal number of mols of NaOH ? **Note:** $K_a = 1.8 \times 10^{-5}$
- 9
 - 0
 - 7
 - 14
 - 1
56. Which of the following is the solubility product expression for iron (III) sulfide, Fe_2S_3 ?
- $K_{sp} = [\text{Fe}^{3+}][\text{S}^{2-}]$
 - $K_{sp} = [\text{Fe}^{2+}]^2[\text{S}^{3-}]^3$
 - $K_{sp} = [\text{Fe}^{2+}][\text{S}^{3-}]$
 - $K_{sp} = [\text{Fe}^{3+}]^2[\text{S}^{2-}]^3$
 - $K_{sp} = [\text{Fe}^{2+}][\text{S}^{2-}]^3$
57. Which of the following gas molecules effuses at the highest rate?
- N_2
 - He
 - Ne
 - CO
 - O_2
58. Which of the following gases will have the lowest density at STP?
- He
 - CO_2
 - CO
 - CH_4
 - H_2
59. Which of the following substances contains cations bonded together by mobile electrons?
- $\text{Br}_2(\text{l})$
 - $\text{KBr}(\text{s})$
 - $\text{Ag}(\text{s})$
 - $\text{MgCl}_2(\text{s})$
 - $\text{S}_8(\text{s})$
60. What is the hybridization on the carbon atoms in CH_4 and CO_2 , respectively?
- sp, sp
 - sp^3 , sp^2
 - sp^2 , sp^2
 - sp^3 , sp
 - sp^3 , sp^3
61. How many pi electrons are in $\text{CH}_3\text{C}::\text{N}$?
- 0
 - 2
 - 3
 - 6
 - 4
62. What type of orbital, if any, is designated by the quantum numbers $n = 2$, $\ell = 1$, $m\ell = -1$?
- 1s
 - 2p
 - 2s
 - 3s
 - 3p
63. Which of the following is a non-metal?
- Cl
 - Cr
 - Cs
 - Ca
 - Cu

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64. What is the net enthalpy for the reaction $\text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) \rightarrow \text{H}_2\text{CO}_3(\text{aq})$ based on the following reactions?



- A. +11.8 kJ/mol
 B. +1307.4 kJ/mol
 C. -1307.4 kJ/mol
 D. -11.8 kJ/mol
 E. +679.3 kJ/mol
65. Based on the following standard electrode potentials for the two half reactions, what is the standard electrode potential for the reaction $\text{I}|\text{I}_2||\text{Ag}^+|\text{Ag}$?
- $$\text{I}_2 + 2 \text{e}^- \rightarrow 2 \text{I}^- \quad E^\circ = 0.535 \text{ V}$$
- $$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag} \quad E^\circ = 0.7994 \text{ V}$$
- A. +0.2644 V
 B. +1.3344 V
 C. -0.2706 V
 D. +1.0638 V
 E. 2.1338 V
66. In a chemical reaction, which of the following will “stop” the reaction by running out first?
- A. the products
 B. the activation energy
 C. the limiting reagent
 D. the percent yield
 E. the theoretical yield
67. What do we know about a reaction mixture when the reaction quotient, Q , is smaller than the equilibrium constant for a reversible reaction, $Q < K_{\text{eq}}$?
- A. Reactant concentrations are higher than equilibrium values.
 B. Reactant concentrations are lower than equilibrium values.
 C. Product concentrations are higher than equilibrium values.
 D. Reactant and product concentrations are equal to equilibrium values.
 E. The reaction is at equilibrium.

68. What hybridization exists on the central atom in the molecule, PF_5 ?

- A. sp^2
 B. sp^3
 C. sp^3d
 D. sp^3d^2
 E. sp^4

69. What is the enthalpy change for the reaction between CH_4 and Cl_2 ? The reaction is $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$. Use these bond energies. The C–H bond energy is 414 kJ/mol; Cl–Cl is 244 kJ/mol; C–Cl is 326 kJ/mol; and H–Cl is 432 kJ/mol.

- A. 758 kJ/mol
 B. -758 kJ/mol
 C. 658 kJ/mol
 D. -100 kJ/mol
 E. +100 kJ/mol

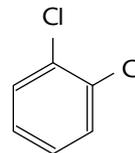
70. What is the name used to label a compound that can act as either an acid or a base?

- A. amorphous
 B. amphoteric
 C. anomers
 D. allotropes
 E. Arrhenius

71. What is the product from the reaction of $\text{Br}_2(\text{g})$ with 2-butene?

- A. 1,4-dibromobutene
 B. 2,3-dibromobutene
 C. 1,1-dibromobutene
 D. 2,3-dibromobutane
 E. 1,3-dibromobutane

72. What is the name for the molecule shown here?



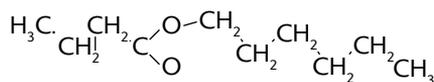
- A. p-dichlorobenzene
 B. m-dichlorobenzene
 C. o-dichlorobenzene
 D. o-chlorotoluene
 E. 1,4-dichlorocyclohexane

73. Why is the Diels-Alder reaction important?
- It is an inexpensive way to do halogen addition.
 - It converts alkane compounds to more reactive forms.
 - It extends the length of the parent chain.
 - It produces ring closure and structures.
 - It introduces a carbonyl group.

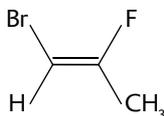
74. What is the name for this conformation of cyclohexane?



- chair
 - boat
 - twist
 - conforming
 - linear
75. What functional group is in this molecule?



- halogen
 - aldehyde
 - ketone
 - ether
 - ester
76. What is the proper name for the compound shown in the following figure?



- E-1-bromo-2-fluoro propene
 - Z-1-bromo-2-fluoro propene
 - Z-3-bromo-2-fluoro propene
 - E-3-bromo-2-fluoro propene
 - trans-3-bromo-2-fluoro propene
77. Which of the following types of alcohols will undergo dehydration the fastest?
- methanol
 - primary
 - tertiary
 - secondary
 - quaternary

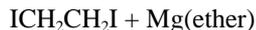
78. What type of reaction mechanism will be favored if the intermediate is very stable?

- E2
 - E1
 - S_N2
 - S_N1
 - TSA
79. What step in the formation of a polymer ends the growth of the polymer?
- propagation
 - initiation
 - termination
 - elimination
 - dissociation

80. The reaction product of CO₂ and CH₃CH₂MgCl is hydrolyzed. What functional group will result?

- ester
 - ether
 - aldehyde
 - carboxylic acid
 - ketone
81. Which of the following is the correct order for the reactivity of alkyl halides in nucleophilic displacement reactions?
- RF > RCl > RBr > RI
 - RF > RBr > RCl > RI
 - RI > RBr > RF > RCl
 - RBr > RI > RCl > RF
 - RI > RBr > RCl > RF

82. What is the reaction product for the reaction

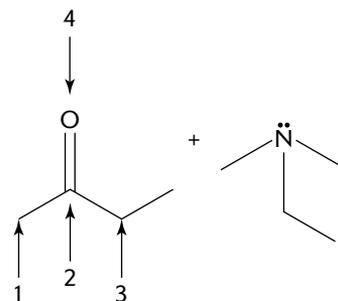
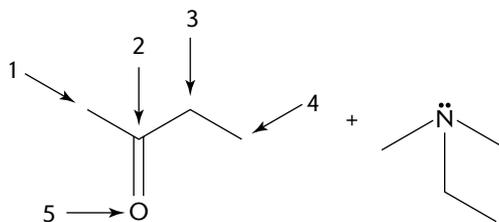


- (ICH₂CH₂I)₂Mg₂
- CH₂CH₂
- CH₃CH₂CH₂CH₃
- CHCH
- ICH₂CH₂IMg

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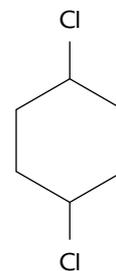
91. Which of the following bond types will have the highest infrared stretching frequency?
- C-C single bond
 - C=C double bond
 - C≡C triple bond
 - all are the same
 - carbon carbon bonds do not undergo stretching in the IR range
92. Which of the following has the largest delocalization energy?
- benzene
 - cyclohexene
 - 1,4-cyclohexadiene
 - 1,3-cyclohexadiene
 - cyclohexane
93. What is the principle type of intermolecular force acting between alkanes?
- dipole-dipole
 - van der Waals (or London)
 - hydrogen bonding
 - metallic
 - ionic
94. What type of reaction mechanism produces a chiral center if the reactant begins with a chiral center?
- S_N1
 - E2
 - S_N2
 - E1
 - all of these

95. In the following figure, which site is most likely to be attacked by the amine?



- 1
- 2
- 3
- 4
- 5

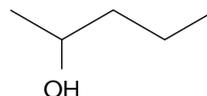
96. How many chiral carbon atoms are in this figure?



- 0
- 1
- 2
- 3
- 4

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97. Which of the following bonds is NOT present in a carboxylic acid functional group?
- A. C::O
 - B. C::C
 - C. C–O
 - D. O–H
 - E. none of these
98. Reduction of aldehydes and ketones is a
- A. one-step reaction involving the hydride ion.
 - B. one-step reaction involving the H^+ ion.
 - C. two-step reaction involving the H^- and H^+ ions.
 - D. two-step reaction involving the OH^- and H^+ ions.
 - E. two-step reaction involving the H^- and OH^- ions.
99. Which of the following compounds will give a positive Tollen's test?
- A. 2-pentanone
 - B. 3-pentanone
 - C. pentanoic acid
 - D. pentane
 - E. pentanal
100. What is the major product resulting from the dehydration of the following molecule?



- A. 1-pentene
- B. 2-pentene
- C. n-pentane
- D. 1,2-pentadiol
- E. 1,3-pentanediol

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



Perceptual Ability Test

Time: 60 Minutes

90 Questions

Part 1

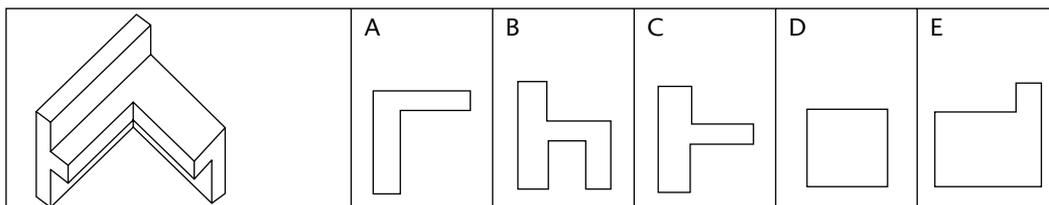
For Questions 1–15, this visualization test consists of a number of items similar to the sample below. A three-dimensional object is shown at the left. This is followed by outlines of five apertures or openings.

All of the tasks throughout this test are identical. The first step is to look at the object and imagine how it looks from every viewpoint. Then select the appropriate aperture from the five choices that will accommodate the object passing through it, if the object is inserted from the correct side. Then mark your choice on the answer sheet.

Here are the rules:

1. Prior to passing through the aperture, the irregular solid object may be turned in any direction. It may be started through the aperture on a side not shown.
2. Once the object is started through the aperture, it may not be twisted or turned. It must pass completely through the opening. The opening is always the exact shape of the appropriate external outline of the object.
3. Both objects and apertures are drawn to the same scale. Thus it is possible for an opening to be the correct shape but too small for the object. In all cases, however, differences are large enough to judge by eye.
4. There are no irregularities in any hidden portion of the object. However, if the figure has symmetric indentations, the hidden portion is symmetric with the part shown.
5. For each object there is only one correct aperture.

Example:

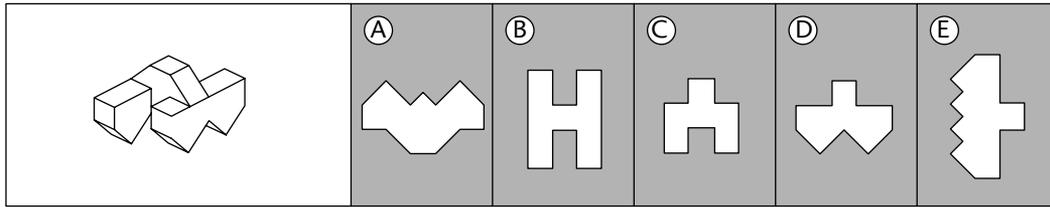


The correct answer is E since the object would pass through this aperture if the side at the left were introduced first.

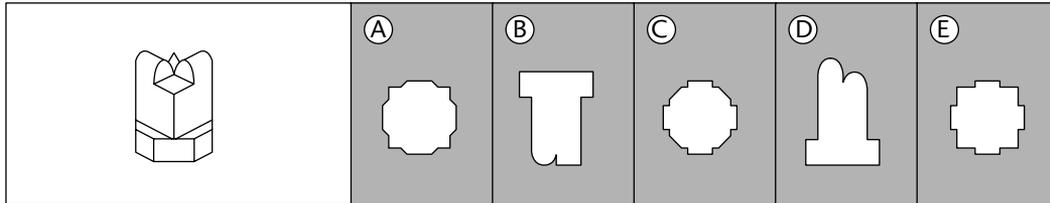
Proceed to Questions 1–15.

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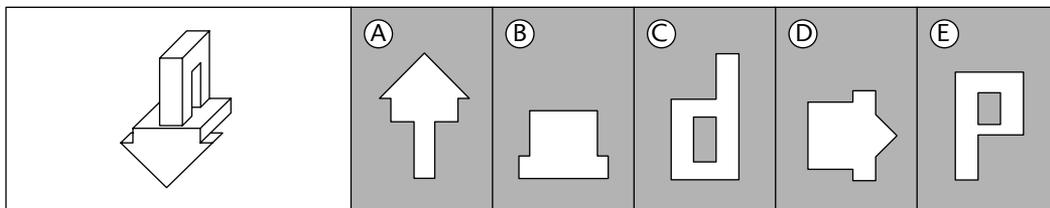
1.



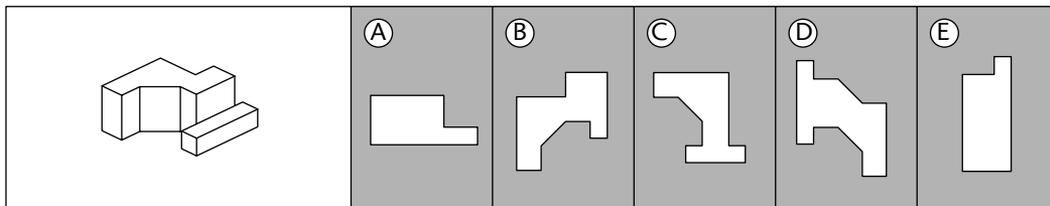
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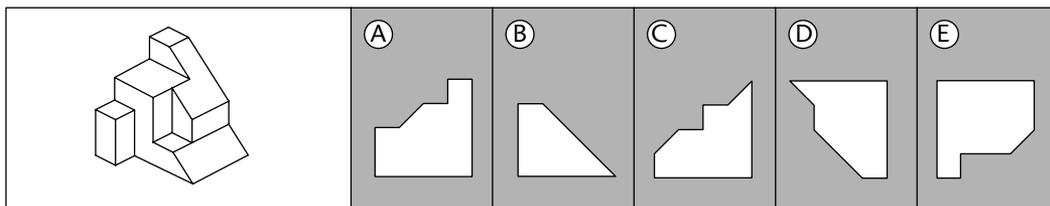
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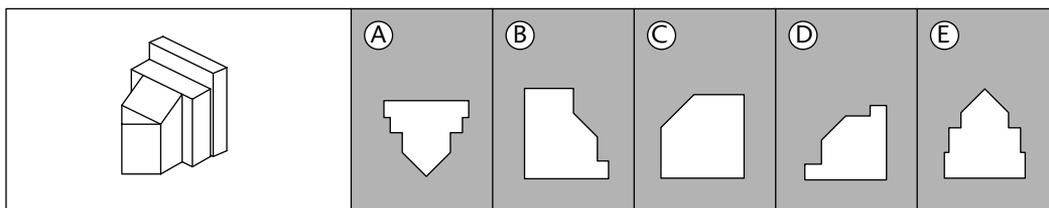
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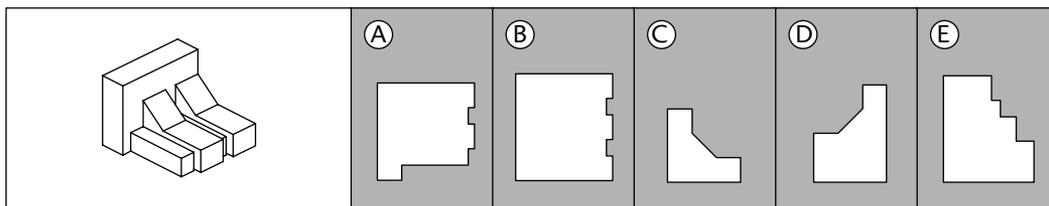
5.



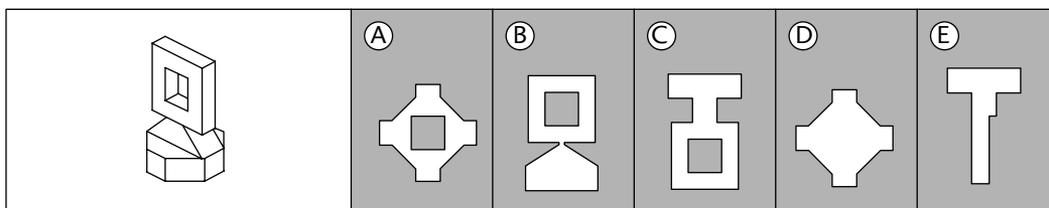
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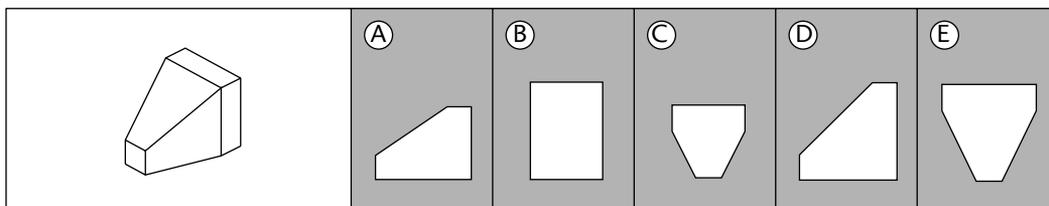
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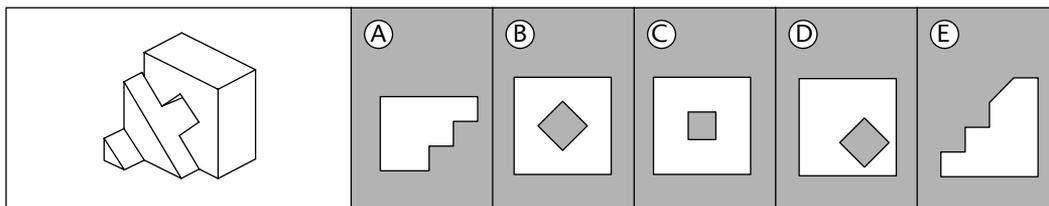
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9.

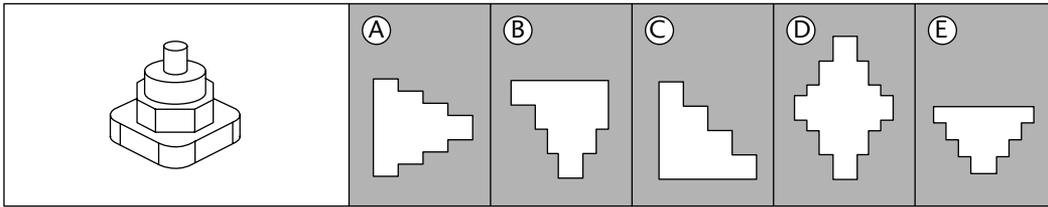


10.

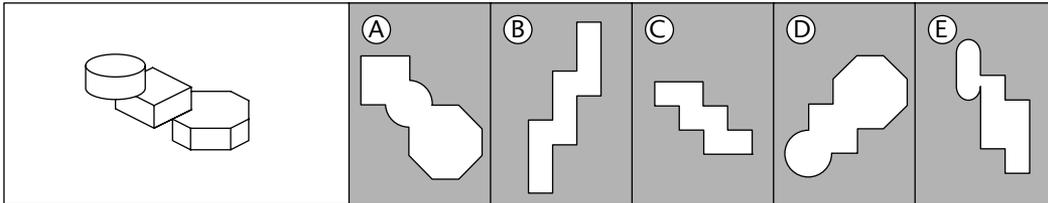


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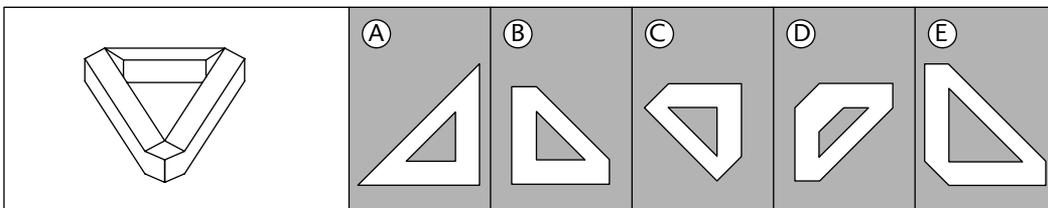
11.



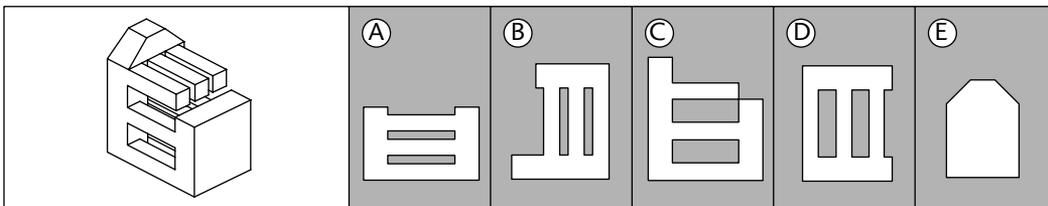
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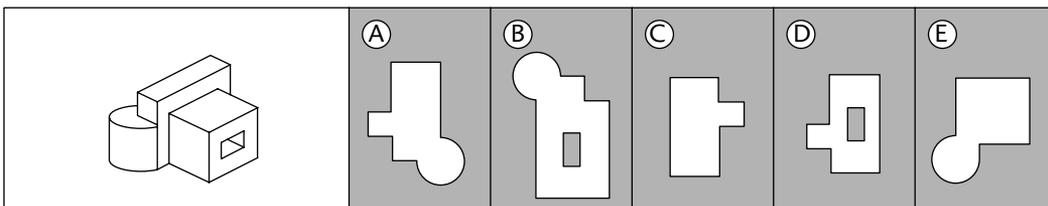
13.



14.

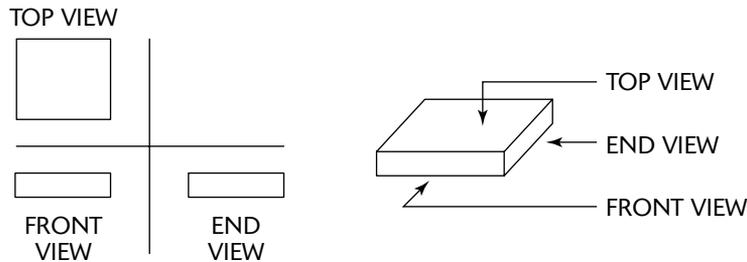


15.

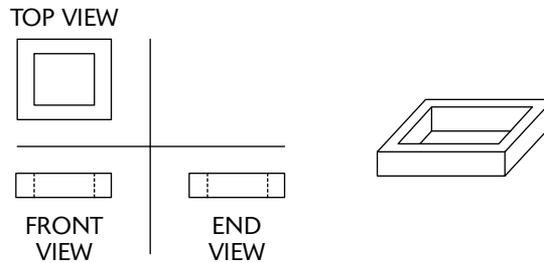


Part 2

For Questions 16–30, the following pictures illustrate top, front, and end views of various solid objects. The views are flat—without perspective, which means that the points in the viewed surface are viewed along parallel lines of vision. In the upper-left corner is the top view and the projection is looking down on it. In the lower-left corner is the front view, and the projection is looking at the object from the front. In the lower-right corner is the projection looking at the object from the end, which is labeled end view. These views are always in the same positions and are labeled accordingly.



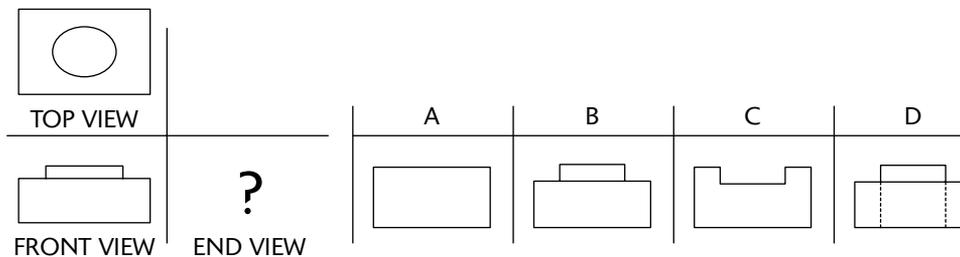
If there were a hole in the block, the views would look like this:



Note that lines that cannot be seen on the surface in some particular view are dotted in that view.

In the problems that follow, two views will be shown, with four alternatives to complete the set. You are to select the correct one and mark it on the answer sheet.

Example: Choose the correct end view.



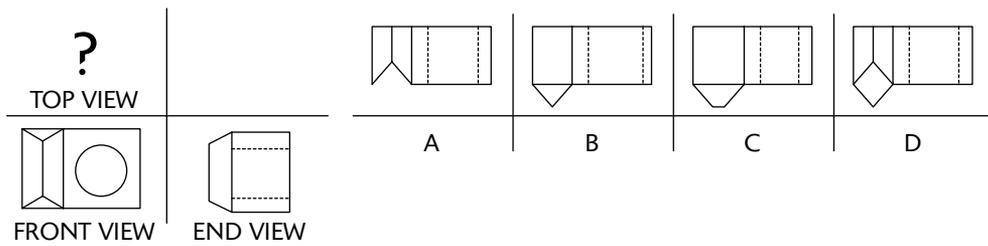
The front view shows that there is a smaller block on the base and that there is no hole. The top view shows that the block is round and in the center of the base. The answer, therefore, must be B.

In the problems that follow, it is not always the end view that must be selected; sometimes it is the top view or front view that is missing.

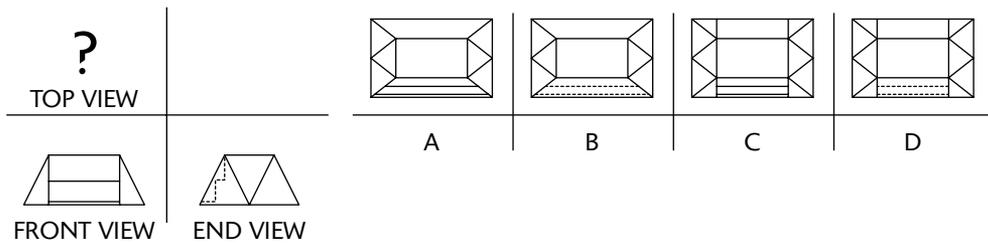
Proceed to Questions 16–30.

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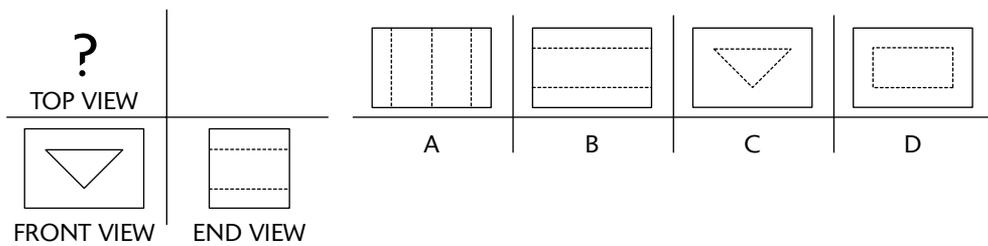
16. Choose the correct TOP VIEW.



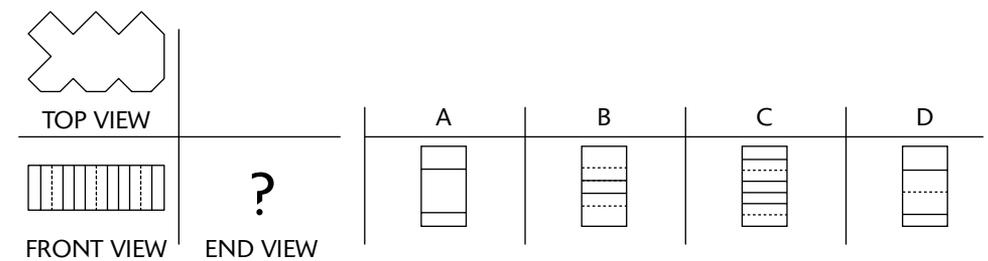
17. Choose the correct TOP VIEW.



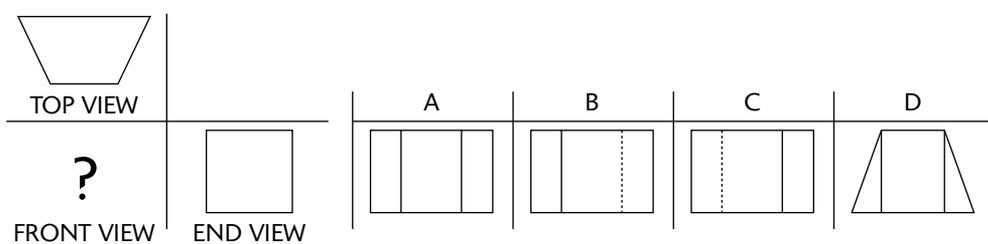
18. Choose the correct TOP VIEW.



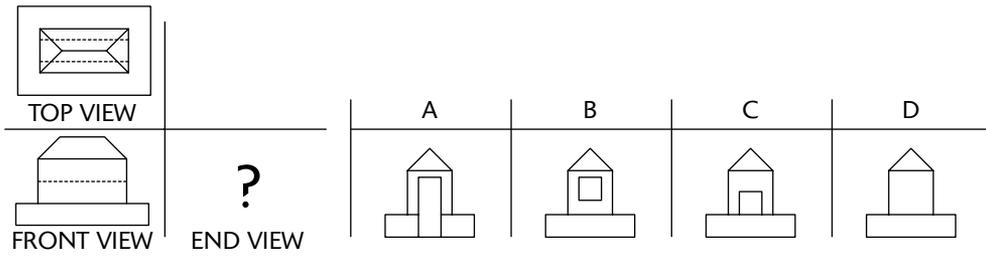
19. Choose the correct END VIEW.



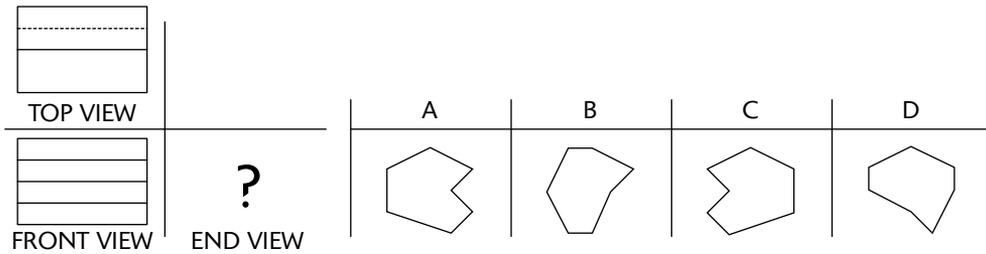
20. Choose the correct FRONT VIEW.



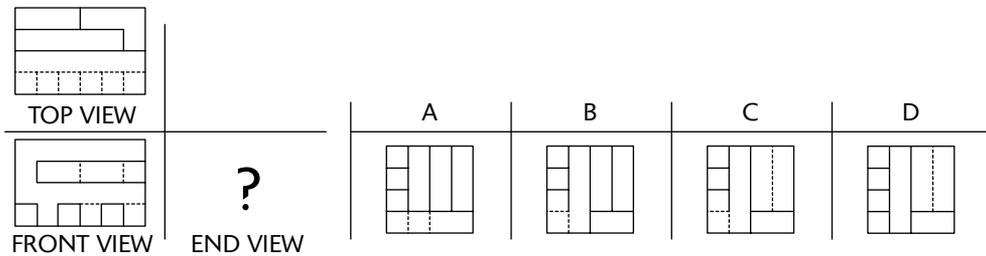
21. Choose the correct END VIEW.



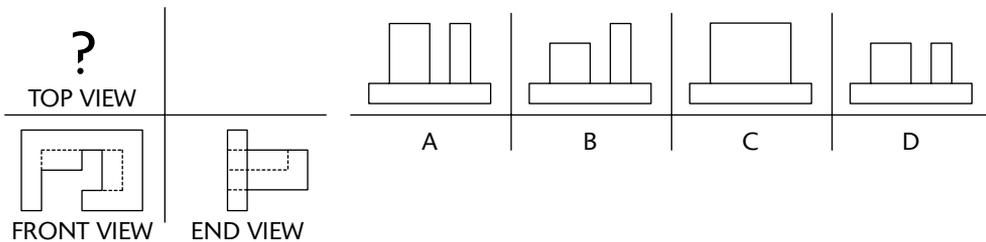
22. Choose the correct END VIEW.



23. Choose the correct END VIEW.

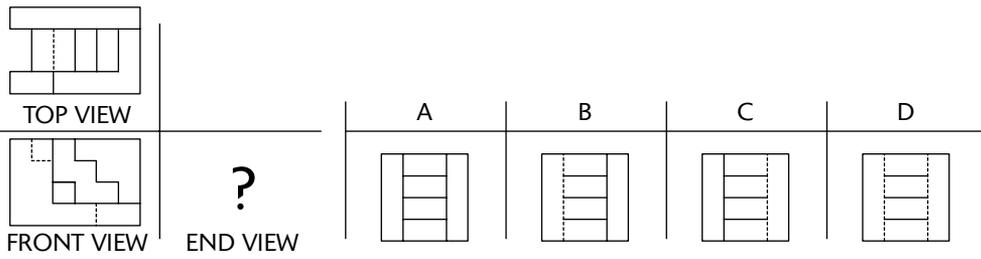


24. Choose the correct TOP VIEW.

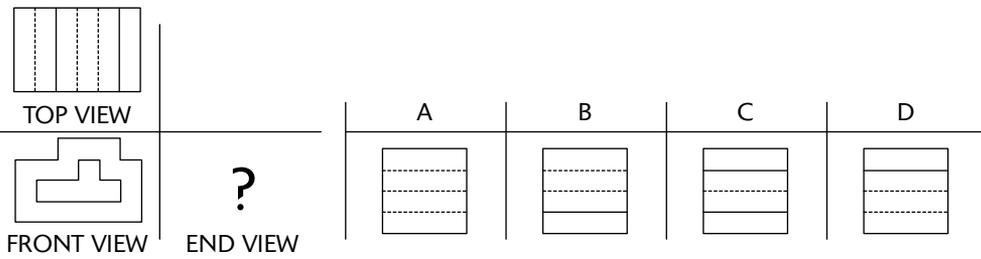


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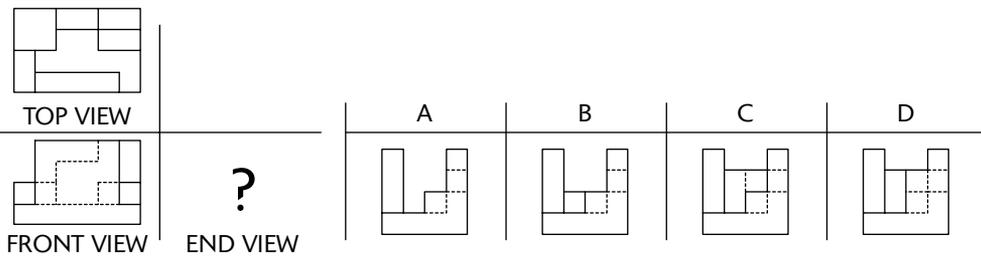
25. Choose the correct END VIEW.



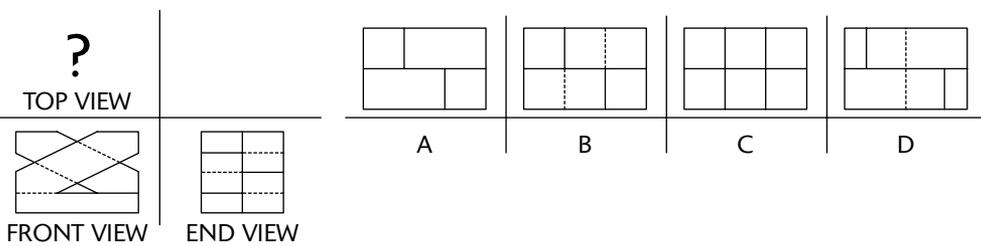
26. Choose the correct END VIEW.



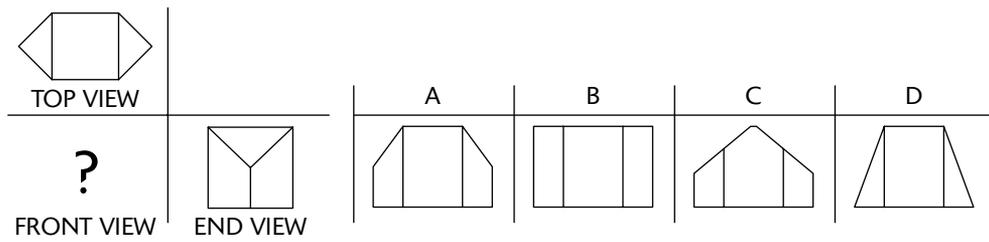
27. Choose the correct END VIEW.



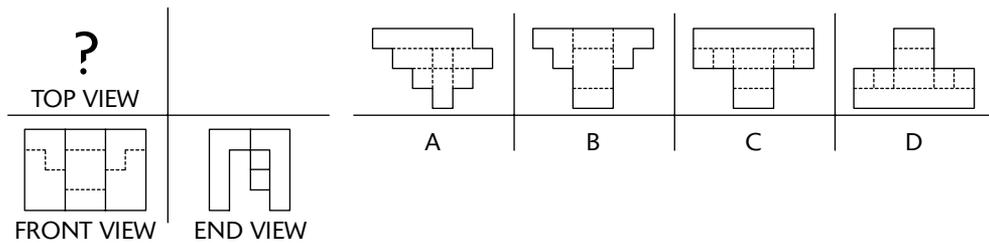
28. Choose the correct TOP VIEW.



29. Choose the correct FRONT VIEW.



30. Choose the correct TOP VIEW.

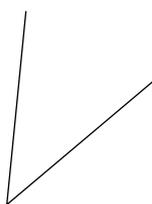


GO ON TO THE NEXT PAGE

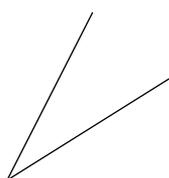
Part 3

For Questions 31–45, you are asked to examine the four INTERIOR angles and put them in order in terms of degrees from SMALL TO LARGE. Select the choice that has the correct ranking.

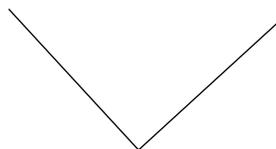
Example:



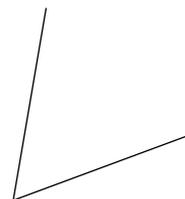
1



2



3



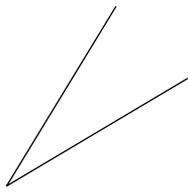
4

- A. 1 – 2 – 3 – 4
- B. 2 – 1 – 4 – 3
- C. 1 – 3 – 2 – 4
- D. 3 – 4 – 1 – 2

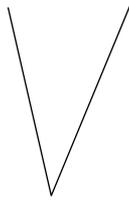
The correct ranking of the angles from small to large is 2 – 1 – 4 – 3; therefore, B is correct.

Proceed to Questions 31–45.

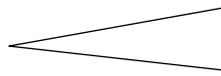
31.



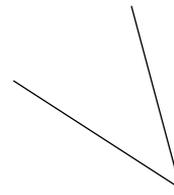
1



2



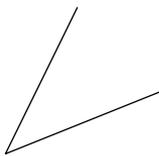
3



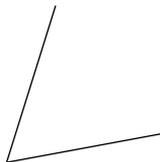
4

- A. 3-1-2-4
- B. 3-1-4-2
- C. 1-3-2-4
- D. 1-2-3-4

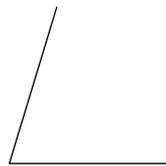
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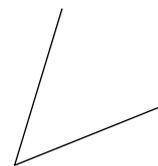
1



2



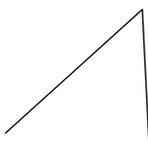
3



4

- A. 4-1-2-3
- B. 1-2-4-3
- C. 1-4-2-3
- D. 4-1-3-2

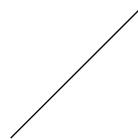
33.



1



2



3



4

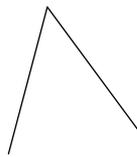
- A. 4-2-3-1
- B. 2-4-3-1
- C. 4-2-1-3
- D. 2-4-1-3

GO ON TO THE NEXT PAGE

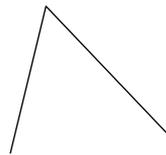
34.



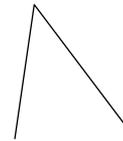
1



2



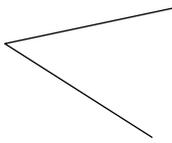
3



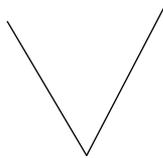
4

- A. 4-1-3-2
- B. 1-4-2-3
- C. 1-4-3-2
- D. 4-1-2-3

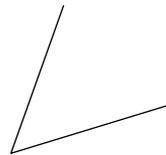
35.



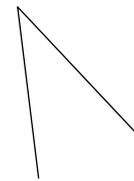
1



2



3



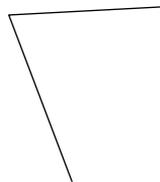
4

- A. 4-1-3-2
- B. 1-4-3-2
- C. 4-1-2-3
- D. 4-3-1-2

36.



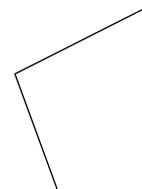
1



2



3



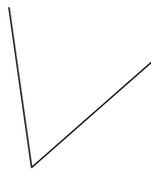
4

- A. 2-3-1-4
- B. 1-2-3-4
- C. 1-3-2-4
- D. 3-2-1-4

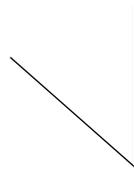
37.



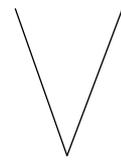
1



2



3



4

- A. 1-4-2-3
- B. 4-1-3-2
- C. 4-1-2-3
- D. 1-4-3-2

38.



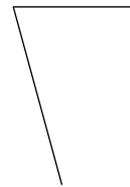
1



2



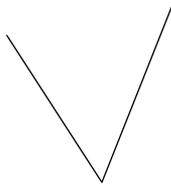
3



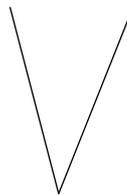
4

- A. 3-2-4-1
- B. 2-3-4-1
- C. 2-4-3-1
- D. 3-4-2-1

39.



1



2



3



4

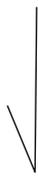
- A. 3-4-2-1
- B. 3-2-4-1
- C. 2-3-4-1
- D. 2-4-3-1

GO ON TO THE NEXT PAGE

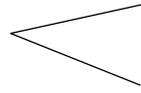
40.



1



2



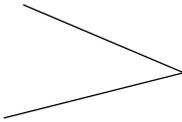
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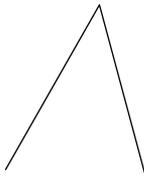
4

- A. 2-1-4-3
- B. 2-1-3-4
- C. 1-2-3-4
- D. 1-2-4-3

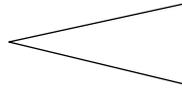
41.



1



2



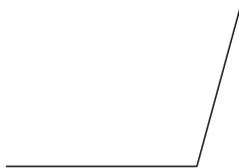
3



4

- A. 3-4-1-2
- B. 4-3-1-2
- C. 3-4-2-1
- D. 4-1-3-2

42.



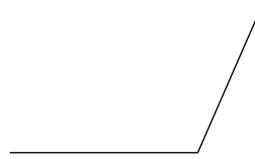
1



2



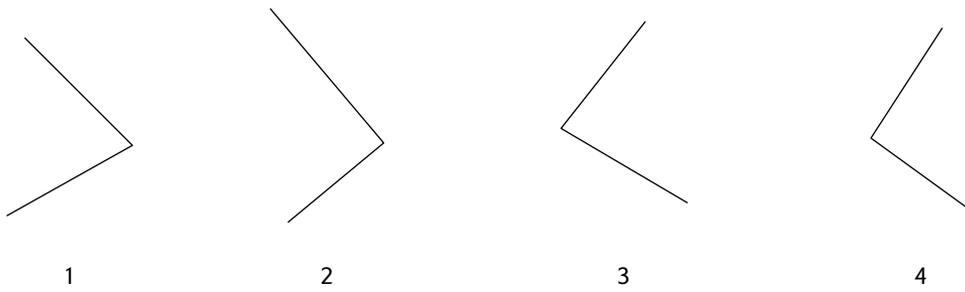
3



4

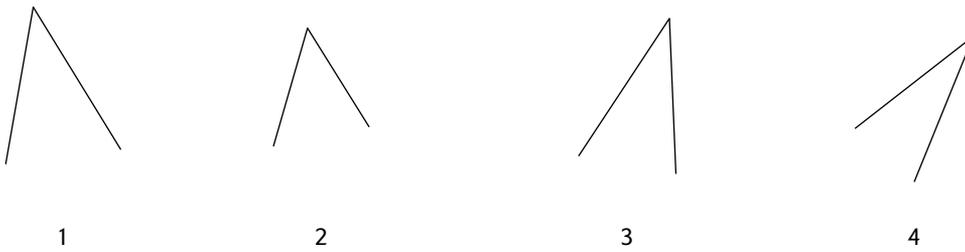
- A. 2-1-3-4
- B. 2-3-4-1
- C. 2-3-1-4
- D. 2-4-1-3

43.



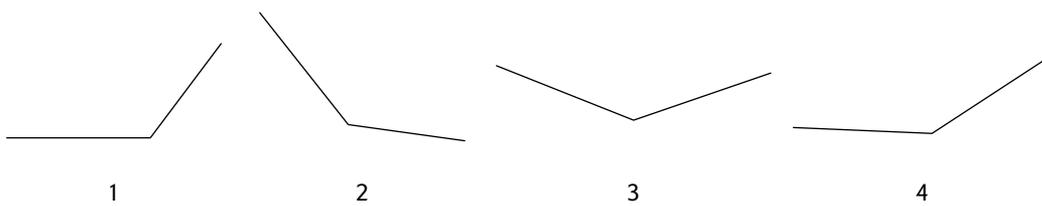
- A. 3-1-2-4
- B. 3-1-4-2
- C. 1-3-2-4
- D. 1-3-4-2

44.



- A. 2-4-3-1
- B. 4-3-2-1
- C. 4-3-1-2
- D. 2-4-1-3

45.



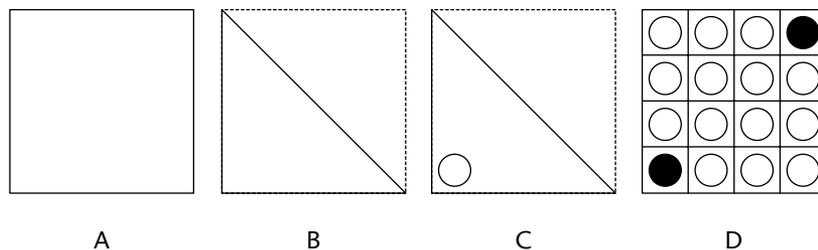
- A. 1-4-3-2
- B. 1-2-3-4
- C. 1-2-4-3
- D. 1-3-2-4

GO ON TO THE NEXT PAGE

Part 4

For Questions 46–60, you are presented with a square of paper that has been folded at least one or more times. The solid lines indicate where the paper has been folded, and the dotted lines represent where the paper was before it was folded. The paper is never turned so that when you unfold it, it should remain in the same position. The paper will always be folded within the original square. After the last fold has been made, a hole is punched in the paper. Your task is to mentally unfold the paper and determine where the holes will be on the original square. You will be given five choices (A–E) from which to make your choice.

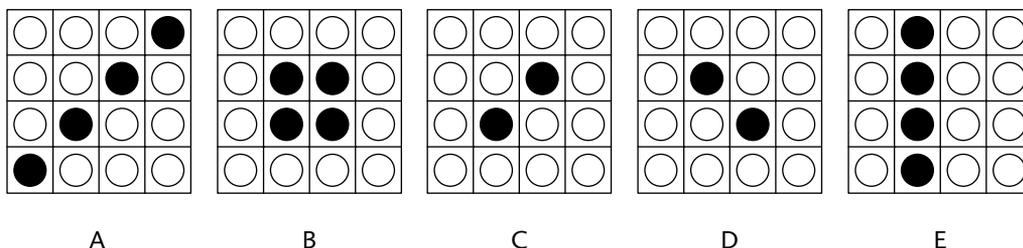
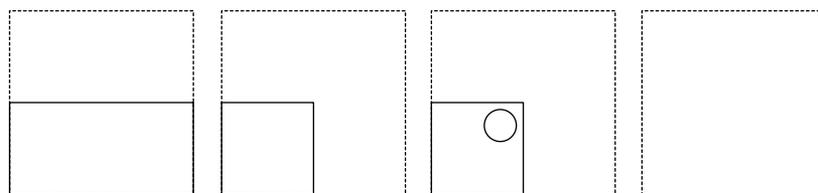
Example 1:



In Example 1, Figure A represents the original paper, unfolded. The second choice, B, represents the first fold. The third illustration shows where the hole is punched. After the paper is unfolded, there will be two holes represented by the dark circles in the last illustration (D).

The following example shows how this type of question will appear on the test.

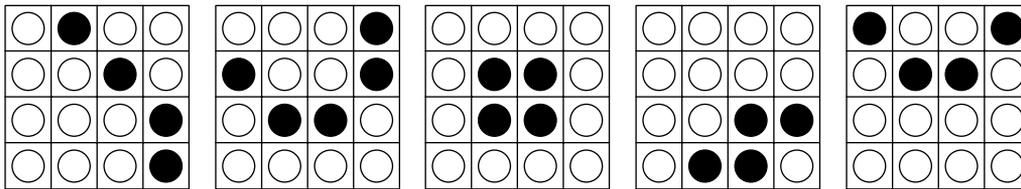
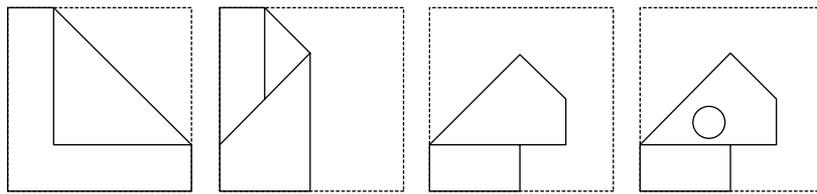
Example 2:



The correct answer to this example is B. With one fold, you would have two holes punched. With two folds, you will have four holes punched.

Proceed to Questions 46–60

46.



A

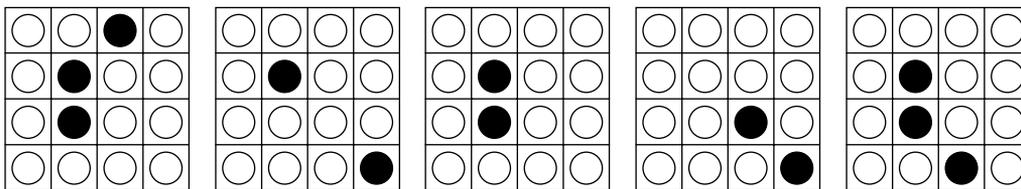
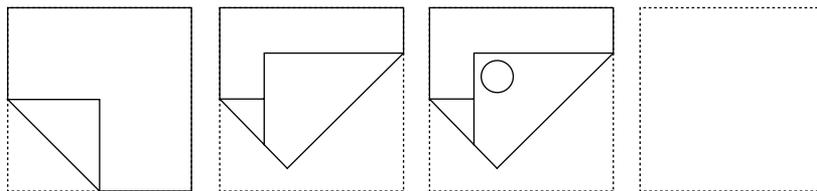
B

C

D

E

47.



A

B

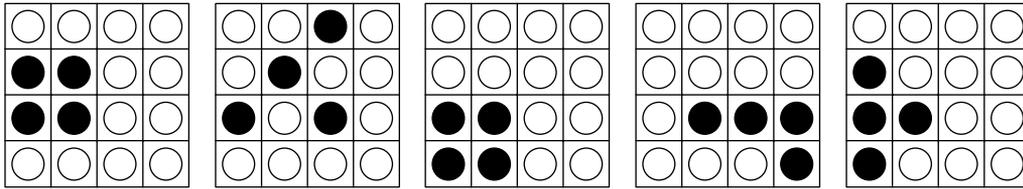
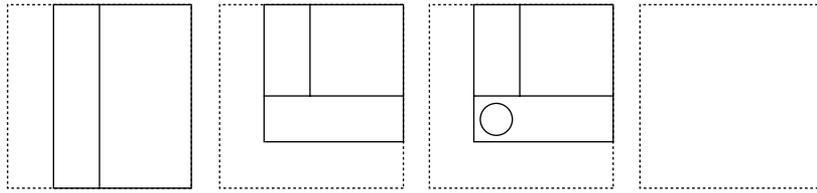
C

D

E

GO ON TO THE NEXT PAGE

48.



A

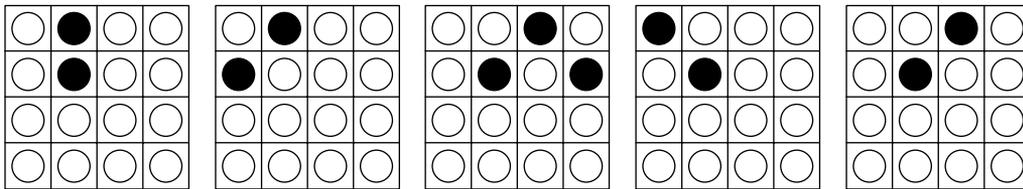
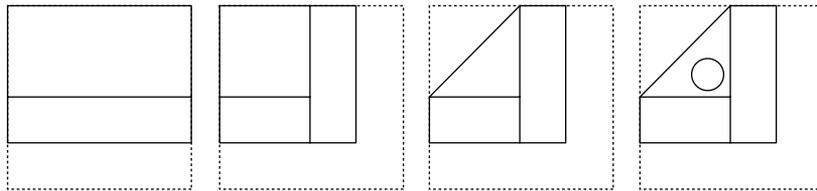
B

C

D

E

49.



A

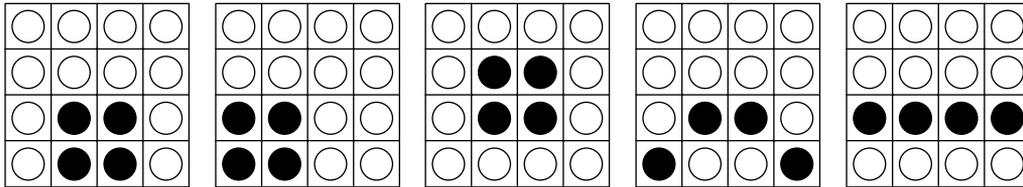
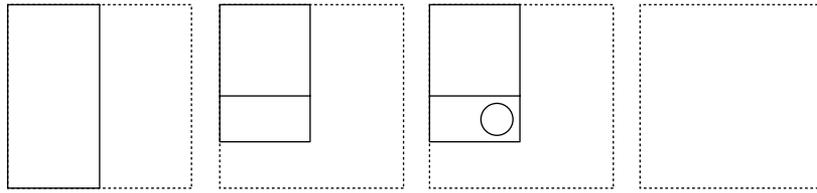
B

C

D

E

50.



A

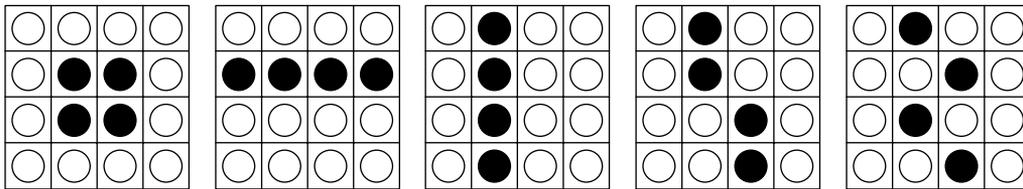
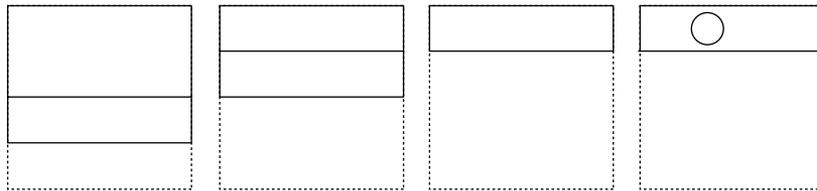
B

C

D

E

51.



A

B

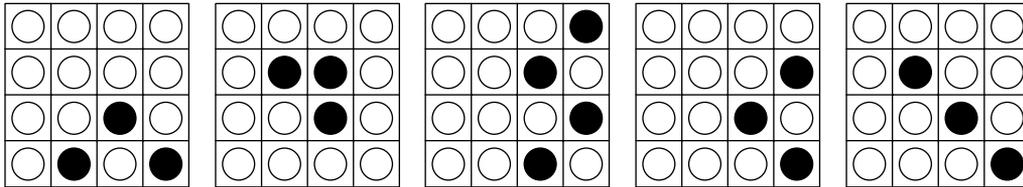
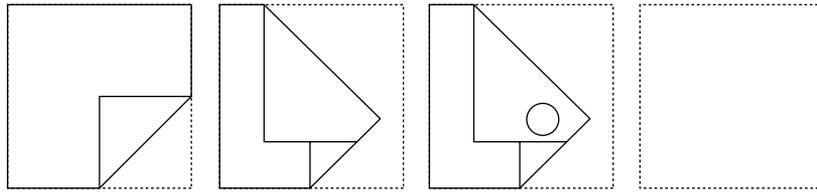
C

D

E

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52.



A

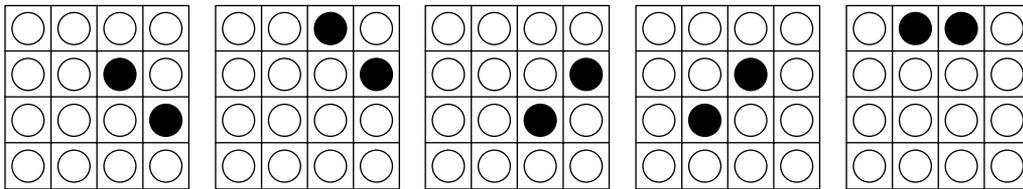
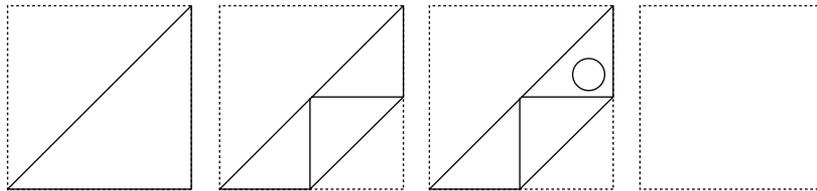
B

C

D

E

53.



A

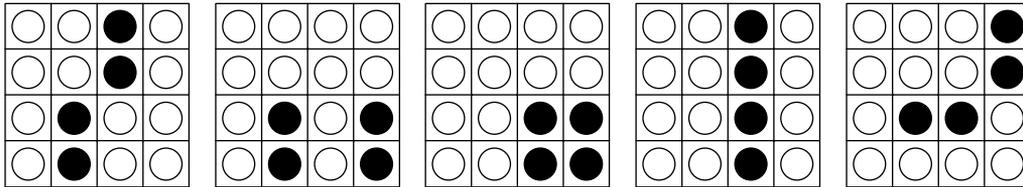
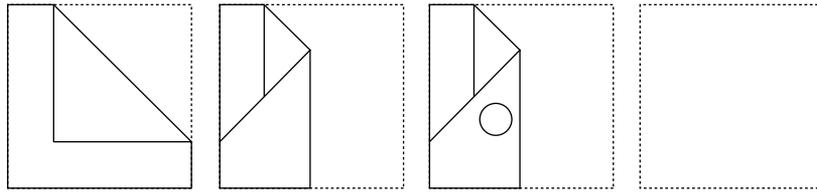
B

C

D

E

54.



A

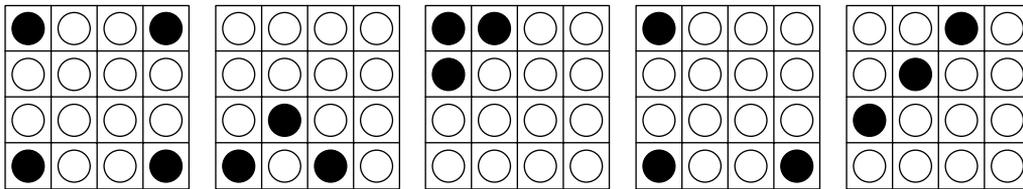
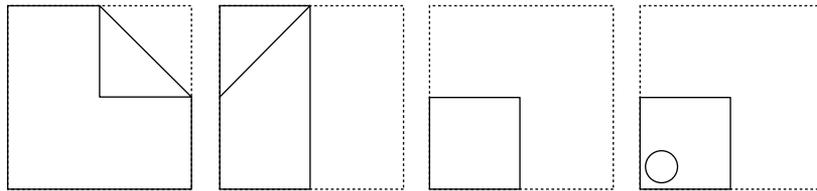
B

C

D

E

55.



A

B

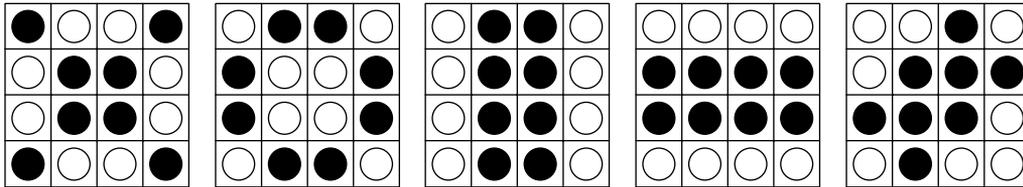
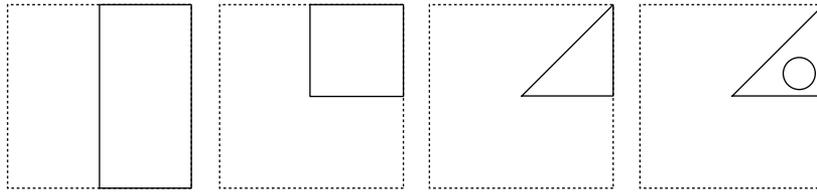
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D

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56.



A

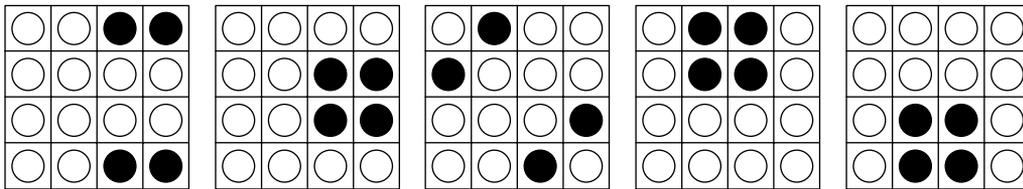
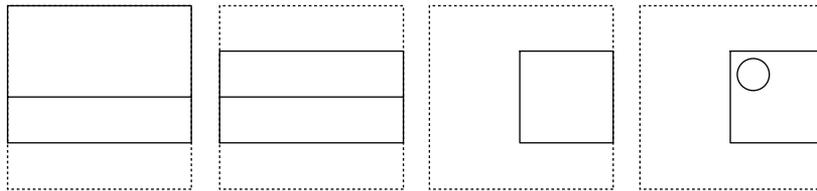
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57.



A

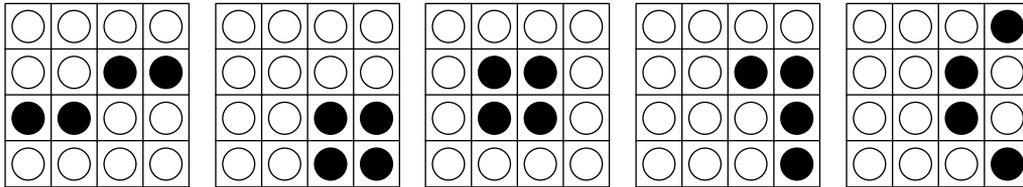
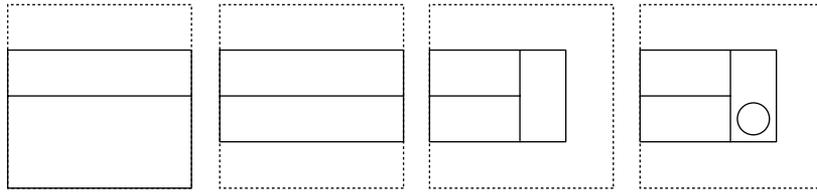
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58.



A

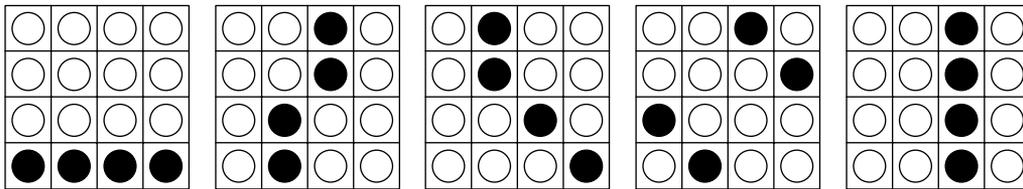
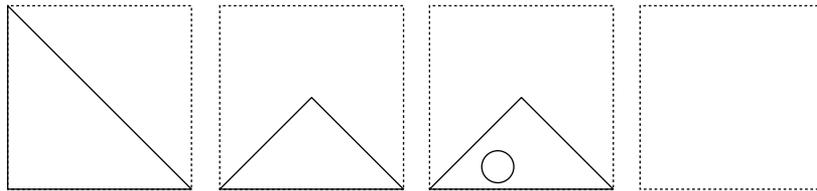
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59.



A

B

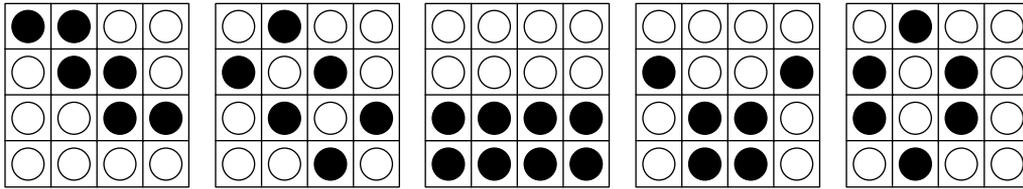
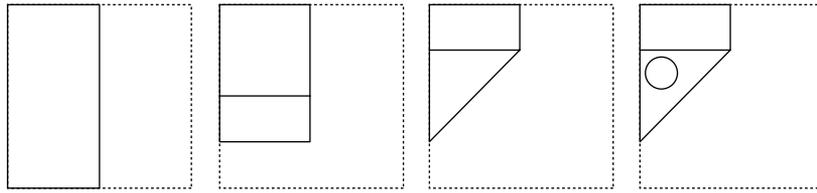
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60.



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Part 5

Each figure has been made by attaching cubes of an identical size. After being attached, each group was painted on all sides. Only the bottom sides on which each cube rests were not painted. Hidden cubes are those that support other cubes.

For Questions 61–75, you are asked to answer the following questions based on the related figure:

- How many cubes have only one of their sides painted?
- How many cubes have only two of their sides painted?
- How many cubes have only three of their sides painted?
- How many cubes have only four of their sides painted?
- How many cubes have all five of their sides painted?

There will be no problems for which zero (0) is the correct answer.

In the following figures, how many cubes have two of their exposed sides painted?

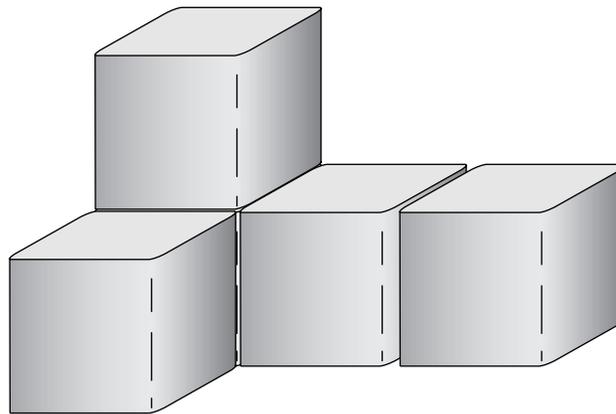


Figure 1

- A. 1 cube
- B. 2 cubes
- C. 3 cubes
- D. 4 cubes
- E. 5 cubes

There are five cubes in Figure 1. Four cubes are visible and one is hidden, which supports the cube on the top row. The hidden cube has only two sides painted. The top cube has five sides painted. The front cube and the cube on the right each have four sides painted, and the middle cube has three sides painted. The correct answer is A.

Remember that after the cubes have been attached, each figure was painted on all exposed sides, except the bottom.

Proceed to Questions 61–75.

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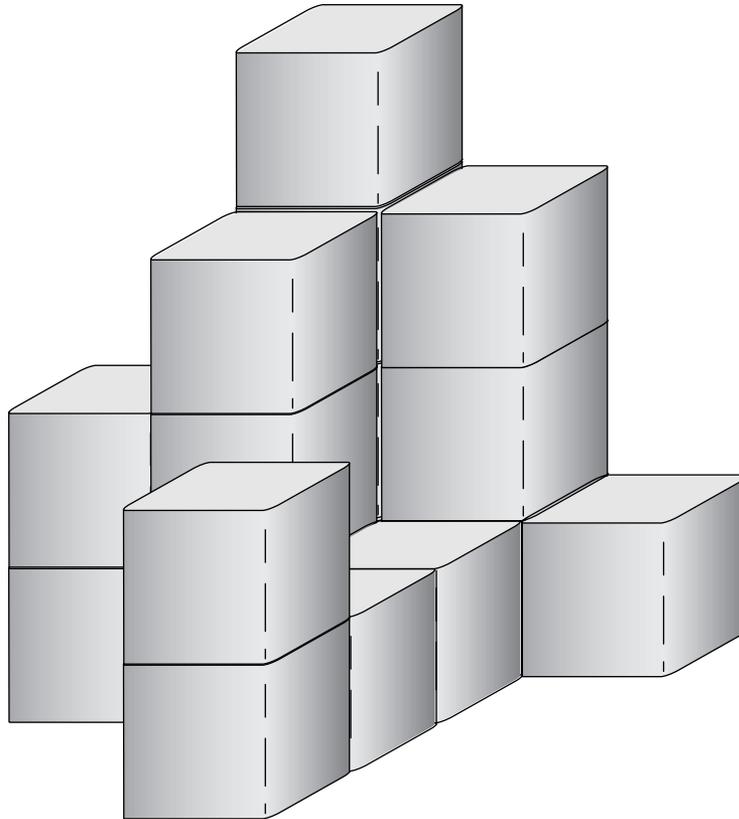


Figure A

- 61.** In Figure A, how many cubes have two of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 62.** In Figure A, how many cubes have three of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 63.** In Figure A, how many cubes have four of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes

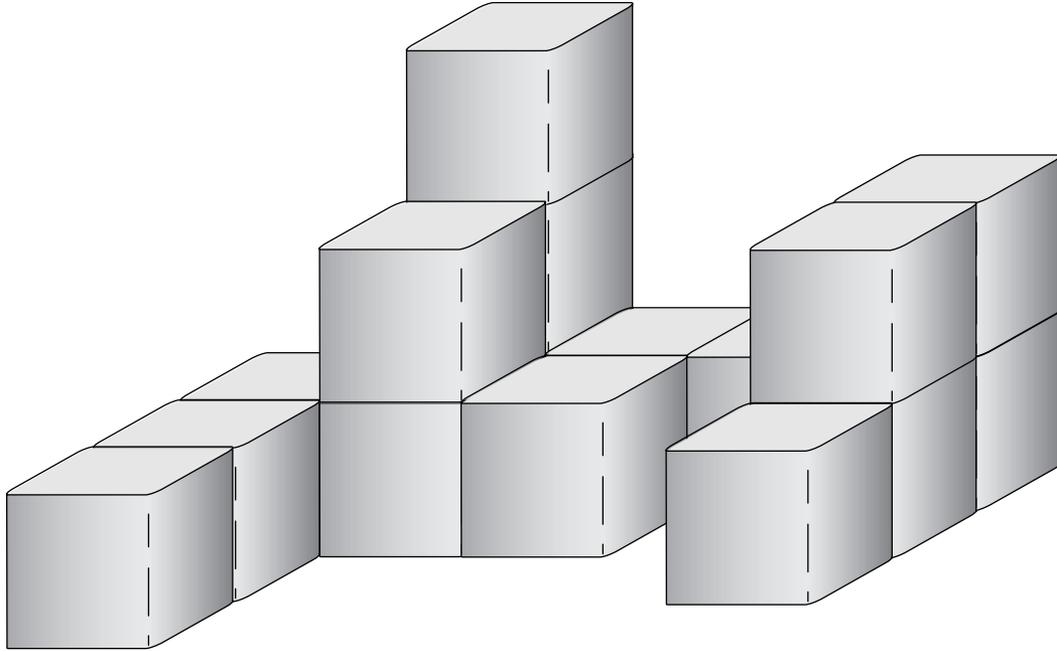


Figure B

- 64.** In Figure B, how many cubes have two of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 65.** In Figure B, how many cubes have three of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes

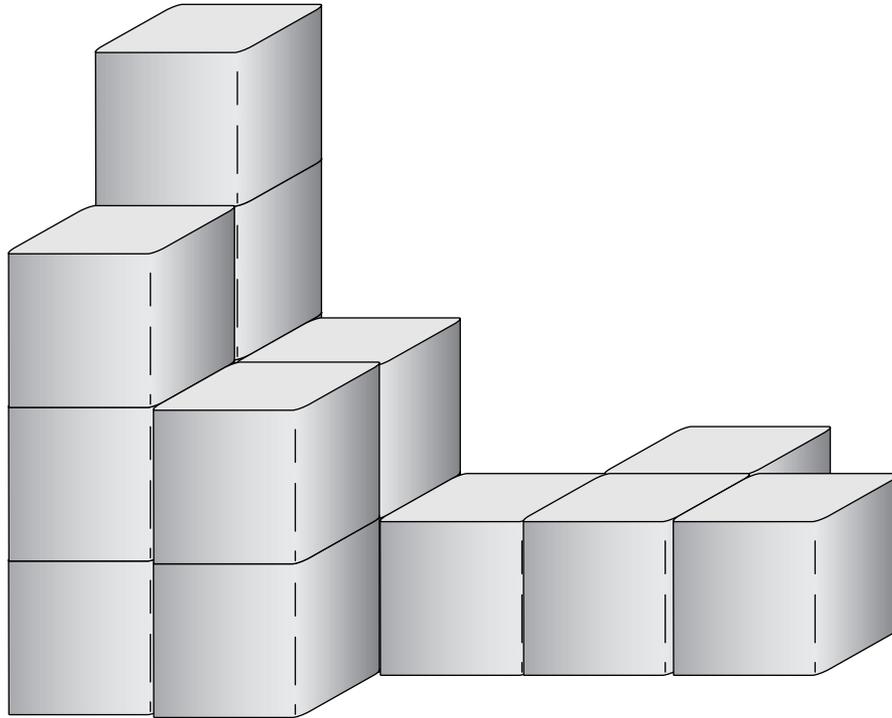


Figure C

- 66.** In Figure C, how many cubes have two of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 67.** In Figure C, how many cubes have three of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 68.** In Figure C, how many cubes have four of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes

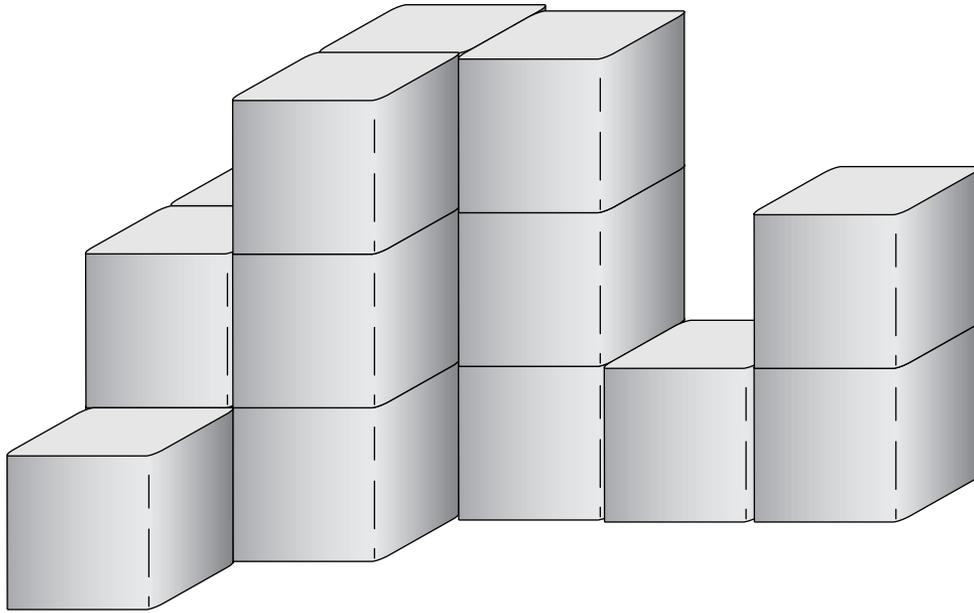


Figure D

- 69.** In Figure D, how many cubes have one of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 70.** In Figure D, how many cubes have two of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 71.** In Figure D, how many cubes have four of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes
- 72.** In Figure D, how many cubes have five of their exposed sides painted?
- A. 1 cube
 - B. 2 cubes
 - C. 3 cubes
 - D. 4 cubes
 - E. 5 cubes

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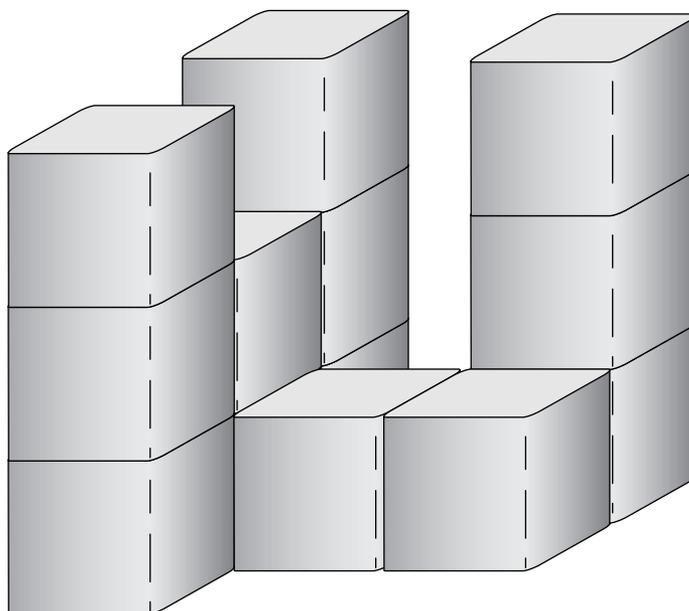


Figure E

73. In Figure E, how many cubes have one of their exposed sides painted?

- A. 1 cube
- B. 2 cubes
- C. 3 cubes
- D. 4 cubes
- E. 5 cubes

74. In Figure E, how many cubes have four of their exposed sides painted?

- A. 1 cube
- B. 2 cubes
- C. 3 cubes
- D. 4 cubes
- E. 5 cubes

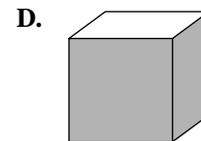
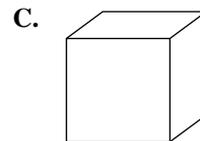
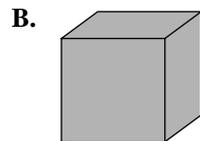
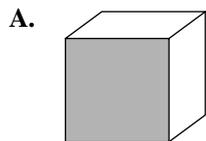
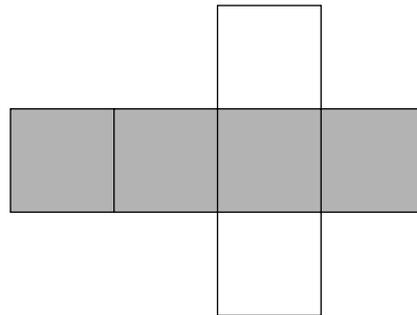
75. In Figure E, how many cubes have five of their exposed sides painted?

- A. 1 cube
- B. 2 cubes
- C. 3 cubes
- D. 4 cubes
- E. 5 cubes

Part 6

In Questions 76–90, a flat pattern is presented. Based on your perception of this pattern, you must visualize what it will look like when it is folded into a three-dimensional figure. You are given four choices but only one will be the correct answer. There is only one correct figure in each set. The outside of the pattern is what is seen in the center.

Example:

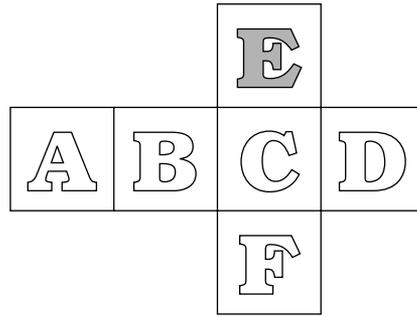


One of the preceding figures (A, B, C, or D) can be formed from the flat pattern in the center. The only figure that corresponds to the pattern is D. If the shaded surfaces are looked at as the sides of the box, then all four sides must be shaded, while the top and the bottom are white.

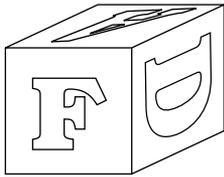
Proceed to Questions 76–90.

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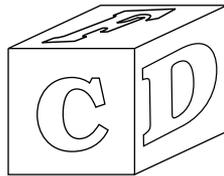
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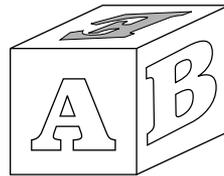
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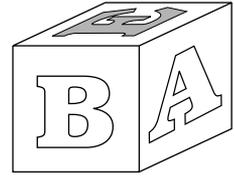
B.



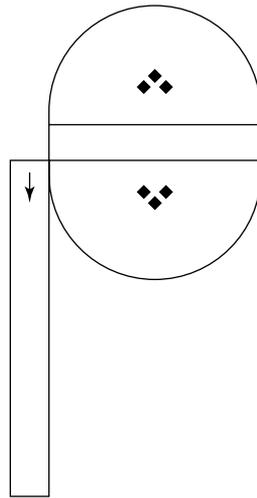
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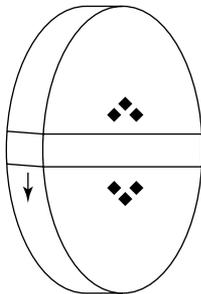
D.



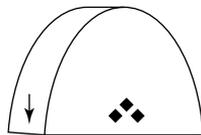
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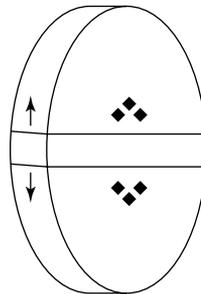
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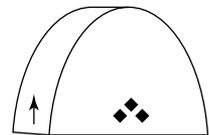
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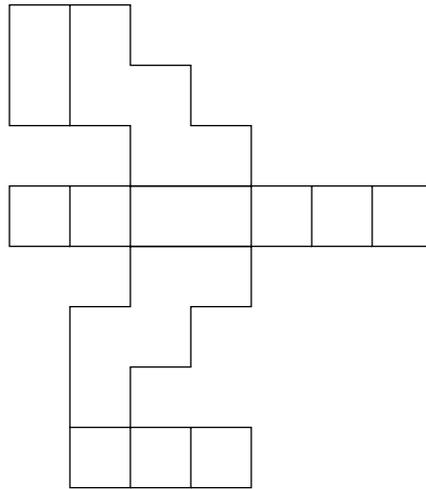
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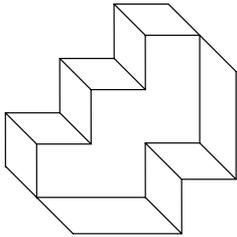
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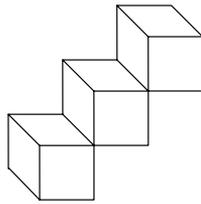
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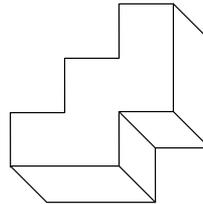
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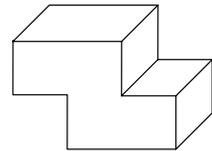
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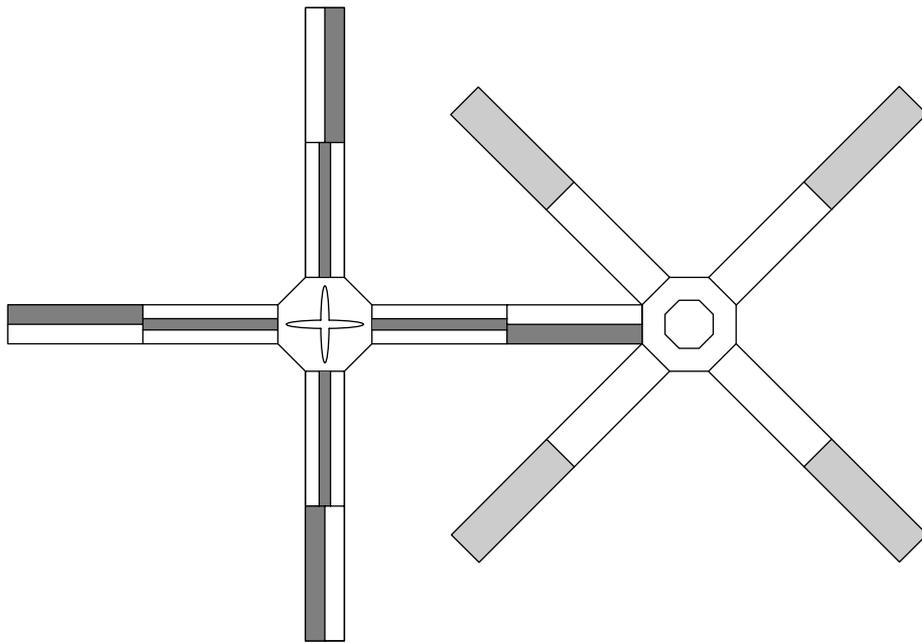


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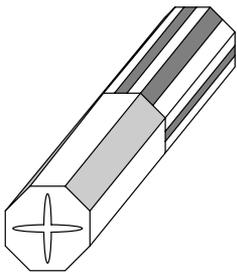


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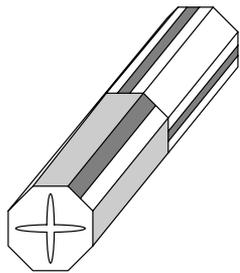
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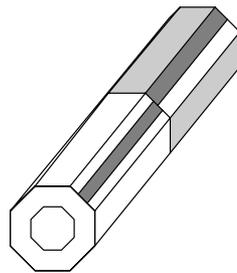
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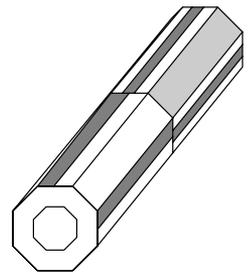
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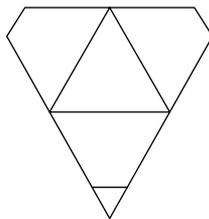
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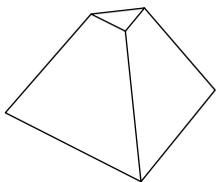
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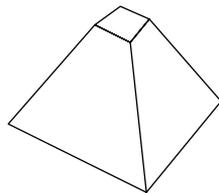
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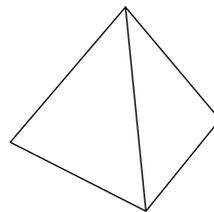
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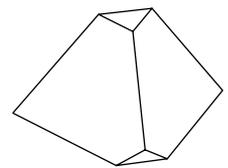
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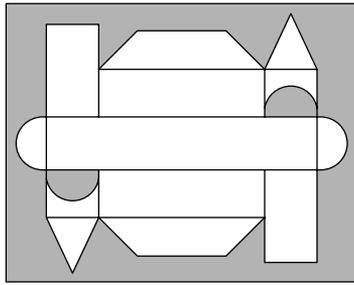
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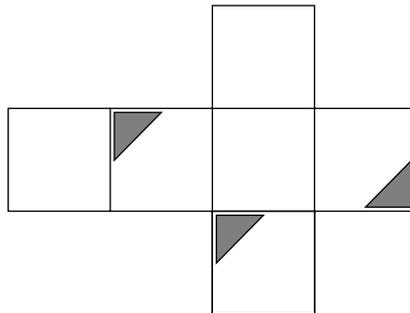


81.



- A. B. C. D.

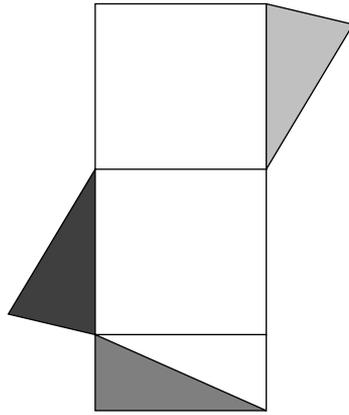
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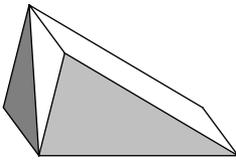
- A. B. C. D.

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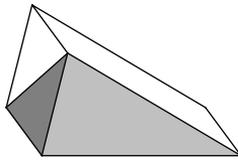
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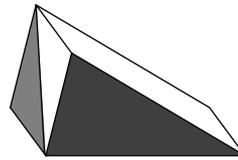
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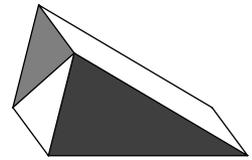
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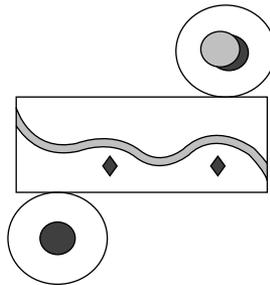
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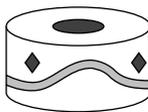
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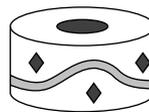
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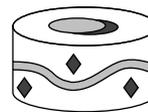
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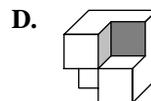
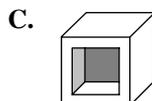
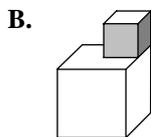
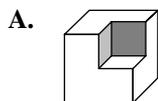
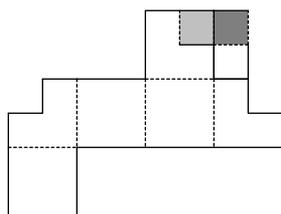
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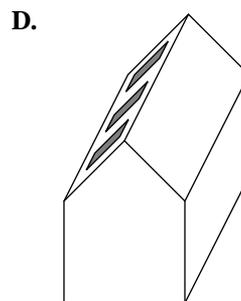
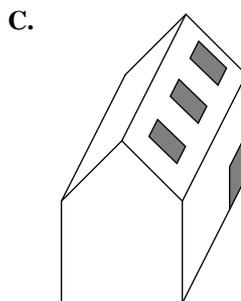
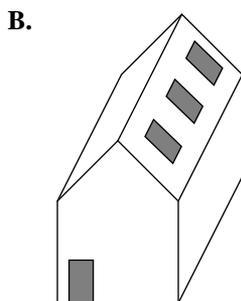
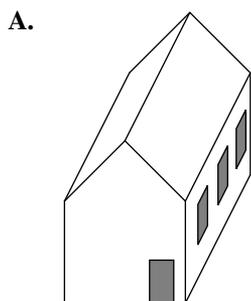
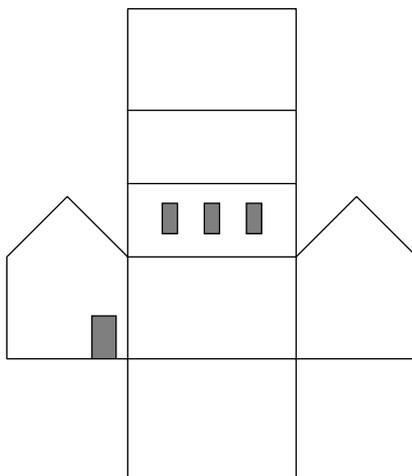
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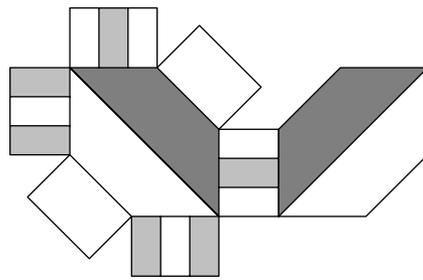


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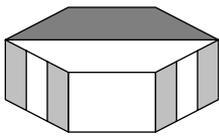


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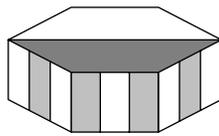
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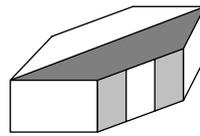
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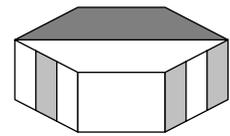
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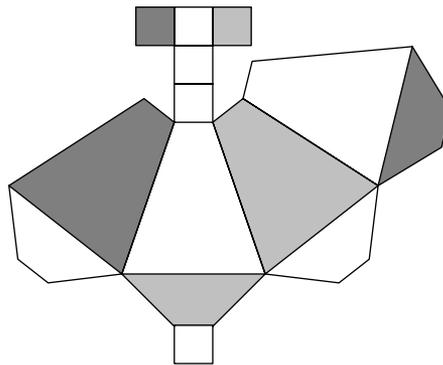
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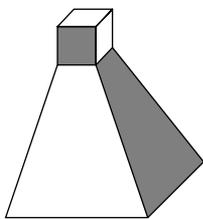
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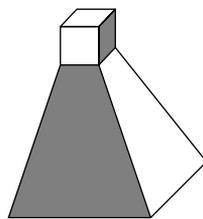
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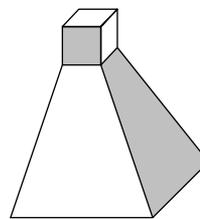
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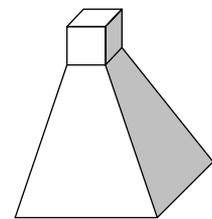
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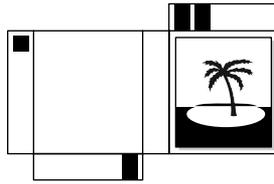
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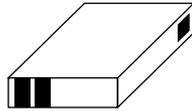
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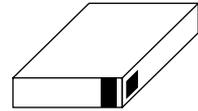
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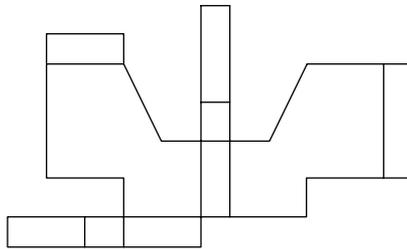
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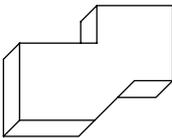
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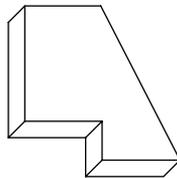
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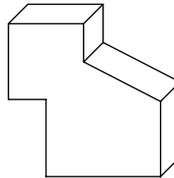
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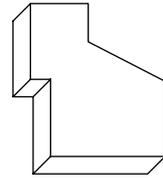
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C.



D.



IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



Reading Comprehension

Time: 60 Minutes

50 Questions

Directions: This section measures your ability to read and understand written English similar to what one may expect in a college or university setting. Read each passage and answer the questions based on what is stated or implied in the passage.

Passage 1

College students are known for pulling “all nighters” before exams. Business executives, preparing reports, might stay up all night before a crucial presentation. A truck driver might push through the night so that he can get his cargo to the destination on time. You might have a caffeine drink to keep you awake or loud music to help those eyelids from drooping. But you cannot stifle a yawn, and that is the first sign that your brain is checking out for the night!

The yawn is the body’s first external sign that you are losing your concentration. After 18 hours of no sleep, your reaction time begins to slow down from a quarter of a second to a half of a second and then longer. You begin to experience bouts of *microsleep*, moments when you zone out for 2 to 20 seconds. This is enough time for you to drift into another lane while driving or for you to have to reread a passage a second time. After 20 hours of sleep deprivation, you actually begin to nod off. Your reaction time is now equivalent to that of someone who has a blood alcohol level of 0.08, which is enough to get you arrested for driving under the influence in 49 states! Although you might feel that you get a second wind as the sun rises, your condition is continually deteriorating.

All through the animal kingdom, sleep ranks up there among the other necessities like food, water, shelter, and air for survival. Yet scientists still don’t know precisely what sleep is for. We immediately think of rejuvenation. However, except for the muscles, which need periodic relaxation not necessarily sleep, the rest of our internal organs continue to chug along regardless of whether we are awake or asleep. Most researchers will agree that the part of the body that benefits us the most from sleep is our brain. Yet, scientists do not agree on what these benefits are. Some feel that sleep is the time that the brain reviews and consolidates all the streams of information it has gathered while awake. Others suggest that it is a time which allows the brain to refuel and slush out wastes. A third theory suggests that in some mysterious way, sleep helps the brain master various skills, such as how to play the piano and ride a bike.

1. A yawn is
 - A. the way to indicate how much sleep you need.
 - B. a sign that you are bored with the lecture.
 - C. an indication that your brain needs rest.
 - D. a rude thing to do in public.
2. The research shows that
 - A. no two people need the same amount of sleep.
 - B. as you get tired, it takes your reflexes two seconds to respond to stimuli.
 - C. most people will be affected negatively after 18 hours of no sleep.
 - D. all nighters are not harmful if done only once a month.
3. The word *microsleep* in the third sentence of the second paragraph most closely means
 - A. that computer jargon is affecting medical words.
 - B. that automatically, your brain will zone out to rejuvenate itself.
 - C. that the word is the same as cat naps.
 - D. that you are not dreaming.
4. The comparison between sleep deprivation and drinking alcohol is done to show
 - A. that drinking and driving is dangerous.
 - B. that drinking will just speed up the need to sleep.
 - C. that both situations severely impair your judgment.
 - D. that there should be a law against sleepy people driving.

5. When you get your *second wind*, it means
- A. that you are now ready to continue work because you are awake again.
 - B. that your condition is still deteriorating, even though you don't know it.
 - C. that your body is able to work harder now because you have gotten over the tiredness.
 - D. that you can drive long distances now.
6. A contradictory fact to the concept of rejuvenation is
- A. that only your muscles sleep.
 - B. that sometimes you don't feel rested when you wake up.
 - C. that none of your organs rest when you sleep.
 - D. that all creatures, animals, and humans need sleep.
7. The article ends with three theories that
- A. all focus on sleep's affects on the brain.
 - B. indicate that sleep will help you perform better.
 - C. completely contradict each other in scope and depth.
 - D. are restatements of the basic tenet, sleep is necessary.

GO ON TO THE NEXT PAGE

Passage 2

A slimy lump of green is clumped at the bottom of a plastic bucket, the contents of which are hardly distinguishable. This jellied mass is actually a dozen bullfrogs, which have traveled thousands of miles to New York City's Chinatown to await their fate. Although they are native to North America, these particularly suspicious specimens have been raised in South America and imported to America. The trafficking of bullfrogs is big business. The U.S. Fish and Wildlife Service has reported that in 2002, nearly 49 million amphibians were imported for trade. Although most of the creatures were brought in to be pets, many found their place on people's dinner tables. Their skins are discarded in the trash and become vehicles for the communication of disease.

Chytridiomycosis, an amphibious fungal plague has cropped up throughout the world. These outbreaks have often led to the extinction of a species. Yet, not a single bullfrog or any other type of amphibian has been inspected at the U.S. border. Since September 11, our concern about biosecurity has been heightened. Tens of millions of dollars have been spent to try to protect the U.S., all the while, foreign pathogens sail into the country hidden in the bodies of exotic wildlife and their accompanying fleas and ticks. There is an estimated \$1.5 million dollars spent in the legal business of U.S. wildlife imports, but there is an equally large illegal pet trade. However, there are fewer than 100 inspectors to investigate over 32 points of entry into the United States.

The Wildlife Services' aim is to protect endangered species and to ensure humane transport of animals. The Department of Agriculture inspects only for diseases that threaten livestock and poultry. The Center for Disease Control mandates public health issues so the idea of wildlife diseases falls through the cracks.

The result is that diseases spread easily among animals and through feeding stations that breed infection. Two-thirds of known human pathogens are zoonotic, able to pass from animals to humans and vice versa. West Nile virus, the bird flu, and Hendra-Nipah are recent examples of human diseases that started out in animals and birds. The problem is compounded by the fact that scientists have discovered that many of these animals host bacteria which is resistant to antibiotics. Thus, the germs are not just cycling between wildlife, livestock, and humans, but they are becoming more dangerous with each pass. Salmonella enterica variant Typhimurium DT104, was a fairly common serotype first seen about 15 years ago. Now it is resistant to eight drugs. So even though there are fewer incidents of food-borne salmonella outbreaks, there are more instances of multi-drug resistant bacteria. For most pathogens, there are no boundaries between animals and people, so the globe-trotting frogs are literally drops in the bucket when it comes to the modern spread of disease.

8. Bullfrogs are imported because
 - A. they are not native to North America.
 - B. they are needed for laboratory tests.
 - C. they are part of the import trade business.
 - D. they are easy to transport.

9. These frogs are mostly used for
 - A. food.
 - B. experiments.
 - C. pets.
 - D. high school science labs.

10. In paragraph two, the word *chytridiomycosis* means
 - A. a disease of the frogs.
 - B. a chemical taken from the frogs.
 - C. a medicine used for the frogs.
 - D. a medicine made from the frogs.

11. The effect that September 11 had on our country has
 - A. effectively made the infiltration of foreign pathogens less.
 - B. has made inspectors look more closely at the import of frogs.
 - C. has increased the concern for biosecurity and, thus, uncovered numerous pathogens.
 - D. has had no effect on the import of amphibious creatures.

12. The purpose of the third paragraph is to show
 - A. how despite all the agencies, things still fall through the cracks.
 - B. that the United States has many agencies that overlap their responsibilities.
 - C. that the United States cares greatly for wildlife.
 - D. that terrorists cannot infiltrate our livestock.

13. In the second sentence of the fourth paragraph, the word *zoonotic* most closely means
 - A. able to pass from humans to animals.
 - B. able to pass from animals to humans.
 - C. able to pass back and forth between animals and humans.
 - D. able to only affect human or animals but not both.

- 14.** The inclusion of information about salmonella was to
- A.** tell people to be careful of what they eat.
 - B.** make people more comfortable to know that it is less frequently found.
 - C.** alert people to the fact that bacteria can become resistant to drugs.
 - D.** Compare it to West Nile virus and Hendrah-Nipah.

GO ON TO THE NEXT PAGE

Passage 3

The winter of 2005 in the Northern Hemisphere has provided much excitement to those who enjoy gazing at the heavens. Visible to the naked eye under a dark sky have been a string of comets. Comet c/2004 Q2, Machholz, can be seen during February in the northern sky as it slowly slides toward the North Star, Polaris. At the 5th magnitude, it is fainter than the Beehive star cluster, which at this time is beginning to rise in the east. If you are in the city, you will need binoculars to locate them. Like a pop fly in a baseball rounding the top of its arc, Machholz appears to slow this month. Thus, from the Earth's perspective, it lies almost straight up from the North Pole. This gives us a good sight line of its tail, which points away from the Sun. In fact, one can see two tails: one that is slightly bluish in color due to the ionized gas blowing straight out in the solar wind of charged particles and a yellow-white tail as ejected motes of dust begin tracing their own orbital paths. As these tails leave the brighter background of the Milky Way, they can become more distinguishable.

Another glorious sight is Saturn with its rings. It can easily be located because it is the steady, pale-yellow "star" that is halfway up in the east as the sky grows dark. If the Earth's atmosphere is not too turbulent, you can detect the shadow of the planet on its rings. A couple of months ago, the shadow would have been seen on the opposite side, and in the afternoon, it appears longer.

Jupiter has been seen the previous October and is always full of intrigue. As the planet rises before midnight, its view becomes very clear. Will the Great Red Spot begin a comeback? Are there any white ovals? Even though the Moon lies closer to the Earth than Jupiter, the perspective makes it seem much closer to Jupiter. Thus, at a time during the winter cycle, Jupiter will obscure the red super giant, Antares. In truth, what meets the eye in the sky can be deceiving but also exciting.

15. Machholz is

- A. a planet.
- B. a moon.
- C. a comet.
- D. a beehive cluster.

16. The Macholtz and the Beehive star cluster

- A. can be seen at the same time.
- B. are moving away from each other.
- C. can never be seen at the same time.
- D. are names for the same comet.

17. The use of the baseball metaphor is

- A. to pique the reader's attention.
- B. to illustrate the placement and movement of the comet.
- C. to talk about its brightness and speed.
- D. to appeal to American sport's fans.

18. The blue comet tail is due to

- A. the weather conditions.
- B. the type of binoculars you use.
- C. the time of night you see the comet.
- D. the amount of ions in the gas.

19. Jupiter's rings

- A. never change their placement to the viewer.
- B. never change their shape to the viewer.
- C. only change size in the afternoon.
- D. can only be seen at night.

20. The Red Spot and white ovals are

- A. part of cosmic mythology.
- B. characteristics of Mars.
- C. variable unexplained characteristics.
- D. traits of comets and stars.

21. Antares is

- A. a planet near Jupiter.
- B. a red superstar.
- C. a large comet.
- D. a Greek giant.

Passage 4

The spirit of adventure has always been basic to human nature both in the imagination and in reality. Jules Verne wrote about traveling the world in 180 days, a magical concept in a balloon. Captain Joshua Slocum, 100 years ago, sailed a vessel around the world alone. Now, a small ocean glider named Spray is the first autonomous underwater vehicle, or AUV, to cross the Gulf Stream underwater. This voyage has proven the viability of self-propelled gliders for long-distance scientific missions and providing new possibilities for the studies of the oceans.

The Spray was launched on Sept. 11, 2004, about 100 miles south of Nantucket Island, MA. Looking like a model airplane, it is six feet long with a four-foot wing span and no visible moving parts. It journeyed between Cape Cod and Bermuda, traveling at one-half a knot, or 12 miles a day. It would surface three times a day to measure various properties of the ocean and then submerge to 1,000 meters in depth. During its 15-minute surfacing, the position in the ocean and conditions such as temperature and salinity are relayed back to Woods Hole, MA, and California via satellite.

The journey was not without its setbacks. Two malfunctions brought the Spray back to Woods Hole before its third successful venture. Even then, there were challenges. When it began to cross the Gulf Stream, the surface currents exceeded six mph across the width of the glider, catapulting it on a fast ride north. In just two days, they lost two weeks' of progress. However, the excellent communication with the vehicle from the command post allowed the glider to get back on track. Since the Spray has a range of 6,000 miles, it could probably cross the entire Atlantic Ocean. The major concern is whether the Spray can stay at sea for months at a relatively low cost. If so, this would allow observations of large-scale changes under the ocean that usually go unobserved.

The potential for the wide-spread use of gliders in all bodies of water are astounding. Spray gliders can look at entire sections of ocean basins like the Atlantic or serve as moorings for a keeping station at a single point. Unlike humans who need to stop for breaks, gliders can carry out missions from several weeks to as long as six months. Oceanographic gliders are now at the stage similar to the start of aviation. Within a few years, they will be as commonplace as air travel is now.

22. AUV is
- A. a new type of military submarine.
 - B. a new type of four wheel drive car.
 - C. a new type of unmanned water vehicle.
 - D. a type of unexplained phenomenon.
23. Which statement is true?
- A. There are no moving parts.
 - B. The vehicle looks a bit like a plane.
 - C. It is about the size of a super jet.
 - D. It is considered a nuclear powered glider.
24. The purpose of this vehicle is to
- A. take sightseeing trips between Cape Cod and Bermuda.
 - B. examine fish underwater.
 - C. measure the saltiness of the water.
 - D. explore underwater places to moor submarine.
25. The reason why the Spray is successful
- A. is because it has excellent communication with the ground crew.
 - B. is because it can travel across the Atlantic Ocean.
 - C. is because it is easy to maneuver.
 - D. is because it can ride the waves easily.
26. The only drawback about this invention is
- A. keeping the cost down.
 - B. making enough vehicles so that they can be everywhere.
 - C. not competing against regular submarines.
 - D. convincing people of their worth.
27. The comparison to aviation is to
- A. choose that vehicle because it looks like a plane.
 - B. go along with the term *glider* because it travels that way.
 - C. show that although they are sparse now, they can become very common.
 - D. show they will soon be used instead of planes.
28. The tone in the article is
- A. skeptical about non-manned research.
 - B. excited about the global implications.
 - C. afraid that money will be wasted in this venture.
 - D. angry that it was not more commonly used.

GO ON TO THE NEXT PAGE

Passage 5

Cholera, a highly infectious disease, has resulted in millions of deaths time after time over centuries. It is caused by the bacterium *Vibrio cholerae*, first isolated by Robert Koch in 1883.

The organism enters the body through the digestive tract when contaminated food or water is ingested. The bacteria multiply in the digestive tract and establish infection. As they die, they release a potent toxin that leads to severe diarrhea and vomiting. This results in extreme dehydration, muscle cramps, kidney failure, collapse, and sometimes death. If the disease is treated promptly, death is less likely.

In many countries, a common source of the organism is raw or poorly cooked seafood taken from contaminated waters. The disease is especially prevalent after a natural disaster or other destruction that results in a lack of fresh water. Sewer systems fail, and waste travels into rivers or streams; piped water is not available, so people must take their drinking and cooking water from rivers or streams. Because people frequently develop communities along waterways, the disease can be spread easily from one community to the next community downstream, resulting in serious epidemics.

- 29.** The word *infectious* in the first sentence is closest in meaning to
- A. communicable.
 - B. severe.
 - C. isolated.
 - D. common.
- 30.** According to the passage, cholera is caused by
- A. a virus.
 - B. a bacterium.
 - C. kidney failure.
 - D. dehydration.
- 31.** All of the following are probable causes of infection except
- A. eating food cooked with contaminated water.
 - B. eating undercooked seafood.
 - C. eating overcooked pork.
 - D. eating raw oysters.
- 32.** What is the logical order of the events leading to the illness?
- A. Sanitary system fails, so fresh water is unavailable; disaster occurs; people drink the water; contaminated water flows into waterways.
 - B. Disaster occurs; sanitary system fails, so fresh water is unavailable; people drink the water; contaminated water flows into waterways.
 - C. Disaster occurs; contaminated water flows into waterways; sanitary system fails, so fresh water is unavailable; people drink the water.
 - D. Contaminated water flows into waterways; disaster occurs; sanitary system fails, so fresh water is unavailable; people drink the water.
- 33.** According to the passage, what is a symptom of the infection?
- A. release of a toxin by the bacteria
 - B. regurgitation
 - C. overeating
 - D. epidemics
- 34.** Which of the following would be an appropriate title for this passage?
- A. Dysentery and Its Effects
 - B. Water Purification Systems and Their Importance
 - C. Results of War and Natural Disasters
 - D. The Causes and Effects of Cholera
- 35.** The word *prevalent* in the third paragraph is closest in meaning to
- A. dangerous.
 - B. commonplace.
 - C. unusual.
 - D. organized.

- 36.** The word *lack* in the third paragraph is closest in meaning to
- A. contamination.
 - B. multitude.
 - C. shortage.
 - D. well.
- 37.** According to the passage, cholera
- A. is easily passed from one person to another.
 - B. is not a real threat.
 - C. is no more dangerous than the common cold.
 - D. cannot be passed from one to another by casual contact.
- 38.** What can you infer from the passage?
- A. Careful cooking and hygiene practices can reduce the chance of getting the disease.
 - B. Water mixed with other substances will not pass the disease.
 - C. The respiratory system is the most common area of entrance.
 - D. Kidney disease is the most common cause of the illness.
- 39.** The word *epidemics* at the end of the passage is closest in meaning to
- A. studies.
 - B. vaccines.
 - C. bacteria.
 - D. plagues.

GO ON TO THE NEXT PAGE

Passage 6

The ubiquitous bar code, developed more than 20 years ago, is not a stagnant product. On the contrary, the technology has been improved so that it can be used more efficiently. Much less expensive than a computer chip, the bar code can hold more information than it has in the past by adding a second dimension to the structure.

The bar code consists of a series of parallel vertical bars or lines of two different widths, although sometimes four widths are used, printed in black on a white background. Barcodes are used for entering data into a computer system. The bars represent the binary digits 0 and 1, just like basic computer language, and sequences of these digits can indicate the numbers from 0 to 9, which can then be read by an optical laser scanner and processed by a digital computer. Arabic numbers appear below the code.

The traditional bar code has been used to monitor skiers at ski lifts and to determine price and perform inventory control on groceries, drugs, medical supplies, manufactured parts, and library books to name a few. The bar code used on grocery products, introduced in the 1970s, is called a universal product code (or UPC) and assigns each type of food or grocery product a unique code. The five digits on the left are assigned to a particular manufacturer or maker, and the five digits on the right are used by that manufacturer to identify a specific type or make of product. Traditional single dimension bar codes are not readily customizable because there is little extra space.

The two-dimensional bar code, with an information density of 1,100 bytes, allows a considerably greater amount of information to be coded than does the traditional bar code, including customized information. It also has built-in redundancy, meaning that the identical information is duplicated on the same code. Therefore, if the code is damaged, it can still be read. The technology even allows pictures or text to be contained within the code, as well as barcode encryption. The new technology dramatically reduces the errors of the single dimensional bar code and reduces the enormous costs that some companies have reported in the past.

40. The word *ubiquitous* in the first sentence is closest in meaning to
- A. outdated.
 - B. ever-present.
 - C. new.
 - D. complicated.
41. The word *stagnant* in the first sentence is closest in meaning to
- A. ever-changing.
 - B. useful.
 - C. stale.
 - D. useless.
42. The author implies that the bar code
- A. has only recently become popular.
 - B. will never change.
 - C. is not useful.
 - D. has existed in one-dimensional form for years.
43. The author's main purpose is to describe
- A. the current technology and newest innovation of bar codes.
 - B. problems with the bar code.
 - C. the UPC used in grocery stores.
 - D. why the bar code is no longer viable.
44. Where in the final paragraph could the following sentence be logically placed?
- “Thus, the manufacturer is able to add additional information on the bar code that it finds useful for its own tracking purposes.”
- The two-dimensional bar code, with an information density of 1,100 bytes, allows a considerably greater amount of information to be coded than does the traditional bar code, including customized information. (A) It also has built-in redundancy, meaning that the identical information is duplicated on the same code. (B) Therefore, if the code is damaged, it can still be read. (C) The technology even allows pictures or text to be contained within the code, as well as bar code encryption. (D) The new technology dramatically reduces the errors of the single dimensional bar code and reduces the enormous costs that some companies have reported in the past.
- A. (A)
 - B. (B)
 - C. (C)
 - D. (D)

- 45.** Which of the following can be a UPC symbol?
- A.** A code with five digits on the left, five on the right, two different widths, and one number under each
 - B.** A code with six digits on the left, four on the right, two different widths, and one Roman numeral under each
 - C.** A code with five digits on the left, five digits on the right, five or six different widths, and one number under each
 - D.** A code with five digits on the left, five digits on the right, reverse form (white text on black background), and no numbers underneath
- 46.** A UPC is a type of
- A.** computer program.
 - B.** bar code.
 - C.** grocery item.
 - D.** scanner.
- 47.** The word *widths* in the second paragraph refers to
- A.** its size.
 - B.** its direction.
 - C.** its location.
 - D.** its content.
- 48.** The word *traditional* in the third paragraph is closest in meaning to
- A.** conventional.
 - B.** new.
 - C.** logical.
 - D.** technological.
- 49.** In the past, a common use of the bar code was
- A.** to encrypt pictures.
 - B.** to keep track of products stocked and sold.
 - C.** to act as a computer.
 - D.** to hide text.
- 50.** The word *considerably* in the final paragraph is closest in meaning to
- A.** slightly.
 - B.** technologically.
 - C.** interestingly.
 - D.** far.

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



Quantitative Reasoning

Time: 45 Minutes

40 Questions

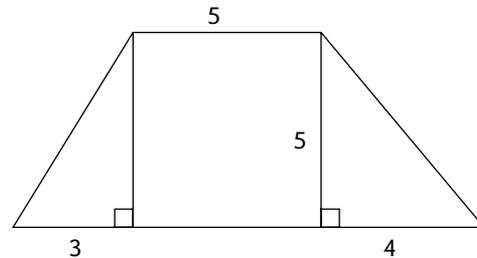
- An employee earns \$8.25 an hour. In 30 hours, what earnings are made?
 - 240.00
 - 247.50
 - 250.00
 - 255.75
 - 260.00
- $\frac{5}{16} + \frac{9}{24} =$
 - $\frac{1}{4}$.
 - $\frac{14}{48}$.
 - $\frac{14}{40}$.
 - $\frac{7}{20}$.
 - $\frac{11}{16}$.
- Seven more than 3 times a number is equal to 70. Find the number.
 - 10
 - 17
 - 21
 - 30
 - 63
- The area of one circle is 4 times as large as a smaller circle with a radius of 3 inches. The radius of the larger circle is
 - 12 inches.
 - 9 inches.
 - 8 inches.
 - 6 inches.
 - 4 inches.
- Which mathematical statement best represents the following?

Six less a number is four.

 - $4 < n + 6$
 - $6 = n - 4$
 - $6 < n + 4$
 - $6 - n = 4$
 - $n - 6 = 4$
- How much change would you get back from a \$20 bill if you purchased 8 CD covers costing \$1.59 each?
 - \$7.28
 - \$10.41
 - \$12.00
 - \$12.72
 - \$18.41
- If $a + b = 6$, what is the value of $3a + 3b$?
 - 9
 - 12
 - 18
 - 24
 - It cannot be determined.
- In a nut mixture, there are $1\frac{1}{8}$ pounds of almonds, $2\frac{3}{4}$ pounds of cashews, and $3\frac{1}{3}$ pounds of peanuts. The total weight of the mixture is
 - $6\frac{1}{3}$ pounds.
 - $6\frac{23}{24}$ pounds.
 - $7\frac{5}{24}$ pounds.
 - $7\frac{7}{12}$ pounds.
 - $7\frac{3}{4}$ pounds.
- Find the area of a triangle whose base is 3 inches less than its height, h .
 - $\frac{1}{2}h^2 - 3h$
 - $\frac{1}{2}h^2 - \frac{3}{2}h$
 - $\frac{1}{2}h - \frac{3}{2}$
 - $\frac{1}{2}h^2 - 3$
 - $\frac{1}{2}h^2 + 3h$

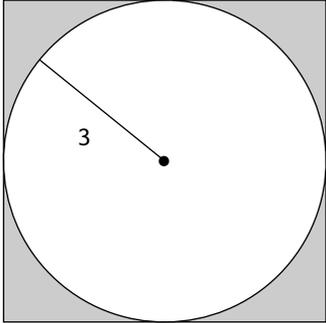
10. Round $(2.5)^4$ to the nearest tenth.
- A. 10.0
 - B. 25.4
 - C. 38.9
 - D. 39.0
 - E. 39.1
11. Find the diagonal of a square whose area is 36.
- A. 6
 - B. $6\sqrt{2}$
 - C. 9
 - D. $9\sqrt{2}$
 - E. 18
12. Simplify $(3x^2 + 2x - 5) - (2x^2 - 5) + (4x - 7)$.
- A. $x^2 + 6x - 17$
 - B. $x^2 + 4x - 7$
 - C. $x^2 + 6x - 2$
 - D. $x^2 + 6x - 7$
 - E. $5x^2 + 6x - 7$
13. Joann ate $\frac{1}{4}$ of a peach pie and divides the remainder of the pie among her four friends. What fraction of the pie does each of her friends receive?
- A. $\frac{1}{8}$
 - B. $\frac{3}{16}$
 - C. $\frac{1}{4}$
 - D. $\frac{1}{3}$
 - E. $\frac{7}{12}$
14. The line perpendicular to the line $y = -\frac{1}{8}x + 7$ has a slope equal to what number?
- A. -8
 - B. $-\frac{7}{8}$
 - C. $-\frac{1}{8}$
 - D. $\frac{1}{8}$
 - E. 8

15. Roxanne deposited \$300 into a savings account earning $5\frac{1}{4}\%$ annually. What is her balance after one year?
- A. \$15.75
 - B. \$315
 - C. \$315.25
 - D. \$315.75
 - E. \$316.25
16. If $2y + 6 = 3y - 2$, then $y =$
- A. -2.
 - B. 2.
 - C. 4.
 - D. 8.
 - E. 12.
17. Cards normally sell for \$3.00 each. How much was saved if 5 cards were purchased on sale for 2 for \$5.00?
- A. \$2.50
 - B. \$3.50
 - C. \$5.00
 - D. \$12.50
 - E. \$15.00
18. The area of the figure is



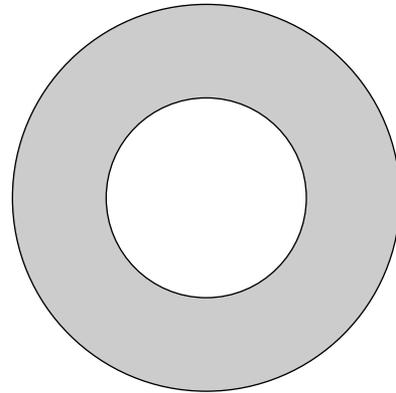
- A. 42.5
- B. 47
- C. 52.5
- D. 60
- E. 85

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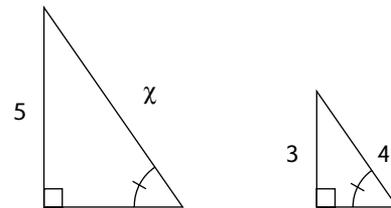
19. If $\cos y > 0$ and $\tan y < 0$, then $\angle y$ must lie in which quadrant?
- A. I
B. II
C. III
D. IV
E. I or IV
20. A winter coat is on sale for \$150. If the original price was \$200, what percent has the coat been discounted?
- A. 50%
B. 40%
C. 33%
D. 25%
E. 20%
21. How many minutes are there in one week?
- A. 10,080
B. 5,760
C. 1,440
D. 420
E. 168
22. What is the amplitude of the function $k(x) = 5 - 3\cos 8x$?
- A. 2
B. 3
C. 5
D. 8
E. 16
23. One-eighth of a bookstore's magazines are sold on a Friday. If $\frac{1}{4}$ of the remaining magazines are sold the next day, what fractional part of the magazines remains at the end of the second day?
- A. $\frac{1}{32}$
B. $\frac{1}{8}$
C. $\frac{7}{32}$
D. $\frac{7}{16}$
E. $\frac{21}{32}$
24. Standing by a pole, a boy $3\frac{1}{2}$ feet tall casts a 6-foot shadow. The pole casts a 24-foot shadow. How tall is the pole?
- A. 14 feet
B. 18 feet
C. 28 feet
D. 41 feet
E. 73.5 feet
25. The area of the shaded region is
- 
- A. $9 - 3\pi$.
B. $36 - 3\pi^2$.
C. $36 - 9\pi$.
D. $81 - 9\pi$.
E. 27π .
26. How many blocks with sides 4 inches in length can fit into a crate $3' \times 2' \times 2'$?
- A. 3
B. 32
C. 196
D. 324
E. 392
27. What is the probability of rolling 2 even numbers in a row with a fair pair of dice?
- A. $\frac{1}{12}$
B. $\frac{1}{8}$
C. $\frac{1}{6}$
D. $\frac{1}{4}$
E. $\frac{1}{2}$

- 28.** If x is a positive integer, solve $x^2 + 6x = 16$.
- A. 2
 - B. 4
 - C. 6
 - D. 8
 - E. 10
- 29.** What is the product of the median and the mode of the following set:
- {1, 2, 2, 5, 7, 7, 7}?
- A. 2
 - B. 4
 - C. 10
 - D. 35
 - E. 49
- 30.** A rope is made by linking beads that are $\frac{1}{2}$ " in diameter. How many feet long is a rope made from 60 beads?
- A. $2\frac{1}{2}$ ft
 - B. $3\frac{1}{2}$ ft
 - C. 10 ft
 - D. 30 ft
 - E. 120 ft
- 31.** If $7p + 5q = -3$, find q when $p = 1$.
- A. -2
 - B. $-\frac{8}{7}$
 - C. -1
 - D. $-\frac{2}{7}$
 - E. 2

- 32.** The radius of the smaller circle is $\frac{1}{4}$ as long as the larger circle. What percent of the figure shown is shaded?



- A. $6\frac{1}{4}\%$
 - B. 25%
 - C. 75%
 - D. 85%
 - E. $93\frac{3}{4}\%$
- 33.** Find the length of x in the figure.



- A. $\frac{15}{4}$
- B. $6\frac{2}{3}$
- C. $7\frac{1}{3}$
- D. $8\frac{1}{4}$
- E. $8\frac{3}{4}$

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34. Which of the following values of x is a solution to the equation $\tan x = 0$?
- A. $x = 0^\circ$
 - B. $x = 30^\circ$
 - C. $x = 45^\circ$
 - D. $x = 60^\circ$
 - E. 90°
35. What is the median of the set $\{1, 2, 2, 4, 4, 4\}$?
- A. 2
 - B. 2.83
 - C. 3
 - D. 3.17
 - E. 4
36. A Fahrenheit temperature can be changed to a Celsius temperature by using the formula $C = \frac{5}{9}(F - 32)$. If the temperature in Fahrenheit is 77° , what is the temperature in Celsius?
- A. 20°
 - B. 22°
 - C. 24°
 - D. 25°
 - E. 26°
37. Interest earned on an account totals \$100. If the interest rate is $7\frac{1}{4}\%$, what is the principle amount?
- A. \$725
 - B. \$1,333
 - C. \$1,379
 - D. \$1,428
 - E. \$1,456
38. What is the value of $8^{\frac{4}{3}}$?
- A. 4
 - B. 8
 - C. 16
 - D. 32
 - E. 64
39. The expression $1 - \cos^2 \theta$ is equivalent to
- A. $\tan^2 \theta$
 - B. $\cot^2 \theta$
 - C. $\sin^2 \theta$
 - D. $\csc^2 \theta$
 - E. $\sec^2 \theta$
40. If $b^{-\frac{1}{4}}$, then what is the value of b ?
- A. -16
 - B. $-\frac{1}{16}$
 - C. $\frac{1}{16}$
 - D. $\frac{1}{8}$
 - E. 16

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.



Answer Key for Practice Test 1

Natural Sciences

Biology

- | | | | |
|-------|-------|-------|-------|
| 1. D | 11. A | 21. E | 31. B |
| 2. A | 12. B | 22. A | 32. D |
| 3. B | 13. C | 23. D | 33. C |
| 4. C | 14. A | 24. C | 34. A |
| 5. D | 15. D | 25. E | 35. E |
| 6. B | 16. B | 26. A | 36. B |
| 7. C | 17. A | 27. D | 37. D |
| 8. E | 18. E | 28. B | 38. E |
| 9. D | 19. D | 29. E | 39. E |
| 10. C | 20. B | 30. D | 40. A |

Chemistry

- | | | | |
|-------|-------|-------|--------|
| 41. D | 56. D | 71. D | 86. C |
| 42. A | 57. B | 72. C | 87. C |
| 43. C | 58. E | 73. D | 88. B |
| 44. E | 59. C | 74. A | 89. A |
| 45. C | 60. D | 75. E | 90. E |
| 46. C | 61. E | 76. B | 91. C |
| 47. A | 62. B | 77. C | 92. A |
| 48. E | 63. A | 78. B | 93. B |
| 49. C | 64. D | 79. C | 94. C |
| 50. B | 65. A | 80. D | 95. B |
| 51. A | 66. C | 81. E | 96. A |
| 52. B | 67. A | 82. B | 97. B |
| 53. E | 68. C | 83. A | 98. C |
| 54. D | 69. D | 84. D | 99. E |
| 55. A | 70. B | 85. A | 100. B |

Perceptual Ability Test

Part 1

- | | | | |
|------|------|-------|-------|
| 1. E | 5. D | 9. A | 13. B |
| 2. B | 6. B | 10. B | 14. A |
| 3. B | 7. A | 11. A | 15. C |
| 4. E | 8. E | 12. D | |

Part 2

- | | | | |
|-------|-------|-------|-------|
| 16. B | 20. A | 24. B | 28. B |
| 17. C | 21. C | 25. A | 29. A |
| 18. A | 22. D | 26. D | 30. C |
| 19. D | 23. B | 27. A | |

Part 3

- | | | | |
|-------|-------|-------|-------|
| 31. A | 35. A | 39. B | 43. C |
| 32. C | 36. D | 40. D | 44. C |
| 33. B | 37. D | 41. A | 45. B |
| 34. B | 38. C | 42. C | |

Part 4

- | | | | |
|-------|-------|-------|-------|
| 46. B | 50. A | 54. E | 58. B |
| 47. B | 51. C | 55. D | 59. D |
| 48. C | 52. D | 56. B | 60. D |
| 49. D | 53. B | 57. D | |

Part 5

- | | | | |
|-------|-------|-------|-------|
| 61. A | 65. A | 69. D | 73. A |
| 62. C | 66. D | 70. C | 74. A |
| 63. A | 67. B | 71. C | 75. C |
| 64. D | 68. A | 72. A | |

Part 6

- | | | | |
|--------------|--------------|--------------|--------------|
| 76. C | 80. A | 84. B | 88. D |
| 77. D | 81. C | 85. A | 89. C |
| 78. C | 82. D | 86. D | 90. C |
| 79. D | 83. A | 87. A | |

Reading Comprehension

- | | | | |
|--------------|--------------|--------------|--------------|
| 1. C | 14. C | 27. C | 40. B |
| 2. C | 15. C | 28. B | 41. C |
| 3. B | 16. B | 29. A | 42. D |
| 4. C | 17. B | 30. B | 43. A |
| 5. B | 18. D | 31. C | 44. A |
| 6. C | 19. C | 32. C | 45. A |
| 7. A | 20. C | 33. B | 46. B |
| 8. C | 21. B | 34. D | 47. A |
| 9. C | 22. C | 35. B | 48. A |
| 10. A | 23. A | 36. C | 49. B |
| 11. D | 24. C | 37. A | 50. D |
| 12. A | 25. A | 38. A | |
| 13. C | 26. A | 39. D | |

Quantitative Reasoning

- | | | | |
|--------------|--------------|--------------|--------------|
| 1. B | 11. B | 21. A | 31. B |
| 2. E | 12. B | 22. B | 32. E |
| 3. C | 13. B | 23. E | 33. B |
| 4. D | 14. E | 24. A | 34. A |
| 5. E | 15. D | 25. C | 35. C |
| 6. A | 16. D | 26. D | 36. D |
| 7. C | 17. A | 27. D | 37. C |
| 8. C | 18. A | 28. A | 38. C |
| 9. B | 19. D | 29. D | 39. C |
| 10. E | 20. D | 30. A | 40. C |

Answers and Explanations for Practice Test 1

Natural Sciences

Biology

- 1. D.** Mitochondria are organelles found within eukaryotic cells that function to produce energy for cellular processes through the breakdown of glucose to form carbon dioxide, water, and ATP (energy) through a process known as cellular respiration. Protein synthesis (A) is carried by at the ribosomes of eukaryotic cells, and the physical (B) and biochemical (C) properties of eukaryotic cells are controlled by DNA contained in chromosomes found in the nucleus. Glucose is manufactured from carbon dioxide and water in the chloroplasts of plant cells through the process of photosynthesis.
- 2. A.** Cellular respiration involves the breakdown of glucose, in the presence of oxygen, to produce carbon dioxide, water, and ATP (energy), which can be used for cellular processes. It takes place in the mitochondria of eukaryotic cells. Fermentation takes place in the absence of oxygen and is sometimes referred to as anaerobic respiration. Fermentation is less efficient at energy production than cellular (aerobic) respiration, with fermentation resulting in the net production of 2 ATP molecules per glucose molecule broken down compared to a net of 36 ATP molecules for each glucose molecule broken down in cellular respiration. Alcoholic fermentation takes place in yeast and results in the production of ethanol from the anaerobic breakdown of glucose. Lactic acid fermentation takes place in human muscle cells when conditions become anaerobic, such as during heavy exercise. The result is the formation of lactic acid from the breakdown of glucose, which often leads to cramping in the muscle cells.
- 3. B.** Oxygen is not necessary for photosynthesis to take place. In fact, the first photosynthetic organisms evolved in an anaerobic environment. The process of photosynthesis involves the use of light energy, in the presence of chlorophyll, to produce glucose from a combination of carbon dioxide and water. Oxygen is given off as a by-product of the reactions.
- 4. C.** Enzymes are special types of proteins that speed up the rate of reactions by lowering the activation energy necessary for the reaction to take place. The enzymes themselves are not altered or consumed during the reaction. Cofactors (A) are nonprotein molecules or ions that are required for proper functioning of an enzyme. Substrates (B) are substances on which enzymes act to produce a product or products. Polypeptides (D) are chains of amino acids linked together by peptide bonds that serve as components of proteins. Promoters (E) are specific nucleotide sequences on DNA molecules in which RNA polymerase binds to initiate the transcription of mRNA from the DNA molecule.
- 5. D.** Substances can move across cell membranes by means of passive transport, which does not require energy expenditure, or active transport, which requires an input of energy for movement of a substance across the membrane. Passive forms of transport include diffusion, the movement of substances across a semi-permeable membrane from a region of higher concentration to a region of lower concentration; osmosis, the movement of water across a semi-permeable membrane from a region of higher concentration to a region of lower concentration; and facilitated diffusion, the diffusion of substances across a semi-permeable membrane with the assistance of a transport protein. Active transport across cell membranes involves the pumping of substances across a membrane against their concentration gradient (from a region of lower concentration to a region of higher concentration). Some active transport mechanisms involve embedded proteins, and others involve the use of ion pumps, which generate voltage across the membrane. Both chemical forces (the ion concentration gradient) and electrical forces (the effect of the membrane potential on the movement of ions) act on the diffusion of ions across a membrane by establishing an electrochemical gradient.
- 6. B.** Gametes are produced through a form of cell division referred to as meiosis, which results in the production of daughter cells with half the number of chromosomes as the parent cell. Thus, an organism with a somatic chromosome number of 24 would produce gametes containing 12 chromosomes. By halving the chromosome number in the gametes, the original somatic chromosome number of an organism is re-established at fertilization when two gametes unite to form a zygote.
- 7. C.** Yeast are single-celled members of the Kingdom Fungi.

- 8. E.** Angiosperms (flowering plants) are unique among the plant groups in that they produce a fruit that surrounds the seed(s). The production of fruit is considered an evolutionary advantage over the production of naked seeds (not enclosed in a fruit), as occurs in the gymnosperms. The fruit serves as both a protective structure for the seeds and a dispersal mechanism.
- 9. D.** Phylum Chordata includes two invertebrate groups, subphylum Urochordata (tunicates) and subphylum Cephalochordata (lancelets), as well as all vertebrate organisms.
- 10. C.** Vertebrate organisms, which are members of phylum Chordata, all possess a notochord, a dorsal, hollow nerve cord, pharyngeal slits, and a postanal tail at some point during development. In some cases, one or more features are present only during the embryo stage.
- 11. A.** In vertebrate organisms, the excretory system (which includes the ureters, urethra, kidneys, and bladder) is responsible for eliminating metabolic waste from the body, as well as maintaining the osmotic balance of the blood. The endocrine system (B) functions to regulate internal body systems, primarily through the production of various hormones. The digestive system (C) is responsible for the ingestion, digestion, and absorption of nutrients by the body. The circulatory system (D) is responsible for the distribution of oxygen, carbon dioxide, nutrients, and metabolic wastes throughout the body. The respiratory system (E) is responsible for gas exchange (uptake of oxygen and elimination of carbon dioxide) in the body.
- 12. B.** When food is ingested and begins to make its way down the human digestive system, it is first processed into small pieces in the mouth, and limited digestion of carbohydrates begins through the action of salivary amylase produced in saliva. With the aid of the tongue, the food is shaped into a ball, called a bolus, and pushed into the pharynx, which leads to both the esophagus and the trachea (windpipe). The act of swallowing pushes the trachea upward so that its opening, the glottis, is blocked by a cartilaginous flap called the epiglottis, thus ensuring that the bolus moves down into the esophagus instead of the windpipe. Muscular contractions, referred to as peristalsis, moves the bolus down the esophagus and into the stomach, where food is stored and preliminary digestion begins. As the bolus is mixed and processed by enzymes and acids produced in the stomach, it turns into a broth-like substance called chyme, which moves through the pyloric sphincter connecting the stomach to the small intestine. The small intestine is the site in which most digestion occurs and most nutrients are absorbed into the body. The pancreas, liver, and gall bladder participate in digestion by producing enzymes that are secreted into the top portion of the small intestine (the duodenum) that help break down the chyme. When digestion is complete, unabsorbed fluids and waste products pass into the large intestine and are eliminated as feces.
- 13. C.** Blood pressure is a measurement of how much force the blood is exerting against the walls of the blood vessels. Systolic blood pressure measures the force exerted during the contraction phase of the cardiac cycle, while diastolic blood pressure measures the force exerted during the relaxation phase of the cardiac cycle.
- 14. A.** The human dermal system (skin, hair, nails) serves as an outer covering for the body, protects the internal organs, helps protect the body against invading microorganisms, and serves as an important sensory organ. Although some organisms (for example, certain amphibians) carry out gas exchange at least partly through their skin; gas exchange in humans occurs through the respiratory system.
- 15. D.** In the human circulatory system, the primary function of the red blood cells is to transport oxygen and carbon dioxide throughout the body. The various types of white blood cells function in defense and immunity against invading microorganisms and other foreign cells. Platelets are fragments of cells that function in the process of blood clotting. Plasma is the liquid medium within which the various blood cells and platelets are suspended and is responsible for the movement of nutrients and metabolic wastes throughout the body. The plasma also helps to maintain the osmotic balance of the blood.
- 16. B.** Mucous membranes, phagocytic white blood cells, and the inflammatory response are all examples of nonspecific immune responses, meaning they act on any foreign invader. Conversely, the production of antibodies by exposure to various antigens is considered a specific immune response because each antigen encountered stimulates the production of antibodies specific to that antigen.
- 17. A.** The transfer of antibodies from a pregnant woman to her fetus is considered a type of passive immunity, which only lasts as long as the antibodies last (typically, a few weeks to a few months). Although passive immunity is temporary, it usually lasts long enough to protect the baby until its own immune system matures.

- 18. E.** Epinephrine is produced by the adrenal glands.
- 19. D.** Neurotransmitters are chemical messengers that are released by the terminal end of an axon at a synapse and diffuses across the synaptic cleft to stimulate a response in a postsynaptic neuron.
- 20. B.** The autonomic nervous system is responsible for conveying signals that regulate involuntary control of the cardiac muscles and the smooth muscles of the digestive, cardiovascular, excretory, and endocrine systems in humans. The autonomic nervous system is divided into two divisions: the parasympathetic division controls activities that conserve energy, such as digestion and a slowing of the heart rate; the sympathetic division controls activities that consume energy, such as increasing heart rate or metabolic function, preparing the body for action. The brain and spinal cord make up the central nervous system (A) of vertebrate organisms. The peripheral nervous system (C) is composed of the nerves and ganglia leading from the central nervous system to the rest of the body. The peripheral nervous system is divided into two divisions: the sensory division (E) conveys information to the central nervous system from sensory receptors; the motor division conveys signals from the central nervous system to effector cells. The somatic nervous system (D) carries signals to skeletal muscles, usually in response to an external stimulus.
- 21. E.** In human males, sperm are formed in the seminiferous tubules—a series of highly coiled tubes surrounded by connective tissue, which together make up the testes. From the seminiferous tubules, the sperm move into the epididymis (D), where they mature and become motile. During ejaculation, the sperm move from the epididymis through the vas deferens (C) into an ejaculatory duct that opens up into the urethra. The urethra runs through the penis (A) and opens to the outside at the tip of the penis. Several glands add secretions to the semen, with approximately 60 percent of the total volume of semen produced in the seminal vesicles (B).
- 22. A.** After fertilization, the uniting of an egg and a sperm to form a zygote, a special form of cell division referred to as cleavage takes place. Cleavage involves a rapid succession of cell divisions in which the cells undergo DNA synthesis and mitosis, but not the two growth stages of the cell cycle. The result is a partitioning of the zygote (a single large cell) into several smaller cells, called blastomeres, without an overall increase in the size of the developing embryo. This multicellular embryo is called a blastula. Different parts of the cytoplasm are partitioned into different blastomeres during cleavage, setting up the cells for future developmental events. Following cleavage, gastrulation occurs, resulting in the formation of a three-layered embryo called a gastrula. The next stage of development, organogenesis, results in the production of rudimentary organs in the embryo.
- 23. D.** The circulatory system arises from the mesoderm tissue layer in vertebrate organisms.
- 24. C.** The process of meiosis results in the production of gametes with one copy of each chromosome present in the parent cell. Assuming that no crossing over has occurred, the gametes produced by an individual with a genotype of AABbcc must each have one allele of each of the three genes. Because the parent is homozygous for the A and c alleles and heterozygous for the B allele, there are two possible combinations of alleles that could be present in the gametes: ABc and Abc. All gametes would get a dominant A allele and a recessive c allele, and half the gametes would receive a dominant B allele and half would receive a recessive b allele.
- 25. E.** A cross between a heterozygous individual and a homozygous recessive individual would produce offspring with a ratio of 1:1, with half having straight bodies and half having spiral bodies. The heterozygous individual would produce two types of gametes with approximately equal frequency, with half the gametes containing the dominant allele coding for straight body type (B) and half having the recessive allele for spiral body type (b). The homozygous recessive parent would produce gametes carrying only the recessive allele (b). Thus, two combinations of gametes are possible from a cross between these two individuals: B + b (Bb) and b + b (bb), resulting in half the offspring (the heterozygous individuals, Bb) having a straight body type and half the offspring (the homozygous recessive individuals, bb) having a spiral body type.
- 26. A.** Sex-linked traits refer to those traits that are carried on the sex chromosomes. In humans, most sex-linked traits are carried on the X chromosome; very few traits are carried on the Y chromosome.
- 27. D.** If a diploid gamete, formed by nondisjunction during meiosis, unites with a normal haploid gamete, the resulting zygote would have three copies of each chromosome and, therefore, be triploid—which is a form of polyploidy.

- 28. B.** Each gene on a molecule of DNA codes for one polypeptide, a component of proteins. DNA in the nucleus is read and copied onto a complementary mRNA (messenger RNA) molecule through the process of transcription. Following transcription, the noncoding regions of the mRNA molecule (introns), which lie between the coding regions (exons), are excised, and the exons are spliced together through RNA processing. The processed mRNA molecule moves out of the nucleus and into the cytoplasm and attaches to a ribosome, where the synthesis of polypeptides takes place through the process of translation.
- 29. E.** DNA (deoxyribonucleic acid) is a polynucleotide composed of a chain of nucleotide units. Each nucleotide unit consists of the sugar deoxyribose, a phosphate group, and one of four nitrogenous bases (adenine, thymine, cytosine, guanine). The phosphate group of one nucleotide is attached to the sugar of the next nucleotide, forming a double backbone of alternating sugar and phosphate molecules with the nitrogenous bases projecting inward and held together by hydrogen bonds. The entire structure is twisted upon itself into the form of a double helix.
- 30. D.** The polymerase chain reaction (PCR) allows for the amplification (making of hundreds or thousands of copies or “clones”) of a DNA segment without using plasmids and bacterial cells. This technique is especially useful when small quantities of DNA are available to work with, such as the case with evidence (blood or semen) found at a crime scene. The amplification of the DNA allows for the production of a large quantity of DNA from a small sample relatively quickly. Transformation (A) refers to the uptake of DNA from the surrounding environment. Transduction (E) refers to the uptake of DNA by bacterial cells through infection of the cells with a bacteriophage (bacterial virus). DNA fingerprinting (C) involves the use of restriction fragment length polymorphism (RFLP) technology to characterize the DNA of an individual. Genetic engineering (B) refers to any direct manipulation of genes for research or practical purposes.
- 31. B.** An organism that contains segments of DNA from another organism, inserted into it through genetic engineering technology, is referred to as being *transgenic*.
- 32. D.** The differential success in reproduction among individuals in a population, in which the most fit or best adapted individuals are most likely to survive and reproduce, is, by definition, the process of natural selection. The process of natural selection is influenced by an interaction between the genetic make-up of an individual and environmental conditions and is based in part on the presence of heritable variation. Natural selection allows for the adaptation (C) of populations of organisms to their environment (E). The process of evolution (A) is often defined as *descent with modification* (B).
- 33. C.** If a population is very small, its gene pool might not reflect the gene pool represented in the entire species. In addition, the existing gene pool of a small population may not be accurately represented in the next generation, due to random chance or sampling error, if all of the alleles are not passed on. This force of microevolution is referred to as genetic drift—changes to the gene pool of a small population due to random chance.
- 34. A.** Classification of organisms follows a hierarchical approach, with the highest level being the domain and the lowest level being the species. The hierarchical classification proceeds as follows: domain, kingdom, phylum (or division, for plants), subphylum, class, order, family, genus, species.
- 35. E.** A population (D) refers to a group of individuals of the same species that share a common geographic area. A community (E) refers to all of the populations of different species that share a common geographic area and have the potential to interact with each other. An ecosystem (C) refers to a community of organisms along with all of the abiotic factors with which the organisms in the community may interact. A gene pool (B) refers to the total complement of genes in a population at any given time.
- 36. B.** Mutualism (B) describes an interspecific interaction in which both species benefit from the relationship. An example of mutualism can be found in lichens, which are composed of a fungal organism and a green alga or cyanobacteria living symbiotically, in which the green alga or cyanobacteria provides energy (carbohydrates) to both organisms through photosynthesis, while the fungus provides shelter from the elements, as well as a source of water and dissolved nutrients through absorption of broken down organic matter from the soil. Commensalism (A) refers to an interspecific relationship in which one species benefits from the relationship while the other species neither benefits nor is harmed by the relationship. An example of commensalism would be the presence of an epiphytic orchid living on a tree. This relationship benefits the orchid because the tree branches provide a place for the orchid to rest while absorbing water and nutrients from the atmosphere, whereas, the tree is neither helped nor harmed by the orchid. Predation (C) involves one organism (the predator) benefiting by capturing and

eating another organism (prey), for example a mountain lion catching and consuming a deer. Competition (D) involves two (or more) species competing for limited resources (food, water, shelter, space) and usually results in detrimental effects on the populations of both species. Parasitism (E) involves one organism (the parasite) living on or in another organism (the host). While the parasite usually doesn't kill its host outright, it usually weakens it, leading to a reduction in fitness and reproductive potential of the host. An example would be mistletoe living on a tree host. Unlike epiphytic plants (such as the orchid in the preceding example), mistletoe puts down root-like projections into the living tissue of its host tree, absorbing water and nutrients at the expense of the host.

- 37. D.** Primary consumers are those organisms that feed on the producers in a food chain. Because the producers are plants, algae, or photosynthetic bacteria, the primary consumers are considered herbivores—organisms that feed on plant material.
- 38. E.** Water, nutrients, and carbon are cycled through an ecosystem, moving from nonliving (abiotic) components to living (biotic) components, and back to nonliving components. Conversely, energy moves through an ecosystem in one direction, with a loss of energy at each trophic level.
- 39. E.** The processes of photosynthesis and cellular respiration account for the majority of transformations and movement of carbon through an ecosystem. Theoretically, on a global scale, the return of carbon dioxide to the atmosphere through cellular respiration should be approximately balanced by the removal of carbon dioxide from the atmosphere through photosynthesis. Globally, the amount of atmospheric carbon dioxide is steadily increasing due to the burning of wood and fossil fuels, which adds more carbon dioxide to the atmosphere than can be taken back out of the atmosphere through photosynthesis, disrupting the balance of the carbon cycle.
- 40. A.** There are still common myths being perpetuated in society that behavior is controlled either entirely by the genetic make-up of the individual (nature) or entirely by environmental influences (nurture). Today, most geneticists, behavioral scientists, and social scientists agree that behavior is controlled by both the genetic make-up of an individual and by environmental influences. The degree of genetic versus environmental influence varies among individuals for different behaviors.

Chemistry

- 41. D.** Arsenic is a metalloid. It is in Group 5A.
- 42. A.** Copper and chlorine are a metal and nonmetal, respectively. Normally this type of combination will form an ionic substance. The other combinations all have pairs of nonmetals.
- 43. C.** The nitrate ion, NO_3^- , is derived from nitric acid, HNO_3 .
- 44. E.** The complete combustion always yields $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{g})$. The coefficients must be “2” for $\text{CO}_2(\text{g})$ to balance the carbons and a “4” for water to balance the 8 hydrogen atoms.
- 45. C.** The mols of ammonia are determined by Avogadro's number and the count of ammonia molecules. Convert the molecules to mols # mols = $(1 \text{ mol} / 6.02 \times 10^{23} \text{ molecules}) (1.0 \times 10^{22} \text{ molecules})$.
- 46. C.** The carbon-14 isotope will emit a beta particle to form a nitrogen-14 daughter.
- 47. A.** The 16.2 days equals two half-life periods. The amount left after time t can be determined this way.
- $$A = A_0[1/2]^{t/t_{1/2}} = A_0[1/2]^{16.2 \text{ days}/8.1 \text{ days}} = A_0[1/2]^2 = A_0/4 =$$
- 48. E.** *Sublimation* is the name for the conversion of a solid to a gas.
- 49. C.** The stoichiometric ratio of 3/2 gives the ratio for the reaction rates.
- 50. B.** The first order rate law for concentration versus time has the form, $\ln [A] = -kt + C$.
- 51. A.** Temperature increases normally increase reaction rates because there are more effective collisions between reactants. This is partially due to the fact that “hotter” molecules have more energy on average.

52. B. The conjugate base of weak acid has a K_b defined by $K_b = K_w / K_a = 1 \times 10^{-14} / 7.2 \times 10^{-4} = 1.4 \times 10^{-11}$.
53. E. The strongest acid is the oxyacid, HClO_4 , which contain the most oxygen atoms on the central atom.
54. D. The decrease in container size will shift the mixture toward the side with fewer gas molecules.
55. A. Acetic acid is a weak acid. The acid neutralized with NaOH will give a basic solution with a pH near 9.
56. D. The solubility equilibrium expression has only the products in the expression. Iron (III) sulfide dissolves to form Fe^{3+} and S^{2-} ions.
57. B. The smallest mass molecule will have the highest effusion rate.
58. E. The density of a gas at STP is controlled by the molar mass. The lowest molar mass will have the lowest density.
59. C. Metallic solids consist of cations held together by a mobile sea of electrons.
60. D. Methane has four single bonds between the central C atom and the four hydrogen atoms. The carbon atom in carbon dioxide has two double bonds to the oxygen atoms.
61. E. There are two pi bonds and one sigma bond in $-\text{C}::\text{N}$: group. There are four pi electrons in these pi bonds.
62. B. The 2p atomic orbital has $n = 2$, $\ell = 1$ (true for all p orbitals) and allowed values for $m_\ell = 1, 0, -1$.
63. A. The halogens, Group 7A, are non-metals.
64. D. Hess' Law tells us that the heat of reaction is independent of pathway. Reversing the first two reactions changes the sign for the enthalpy changes. The third reaction is added to the sum of the reversed first two.
65. A. We have to reverse the iodine reaction, which will change the sign. We have to multiply the iodine half reaction by $\frac{1}{2}$, but we do not change the potential. $E^\circ = 0.7994 - 0.535 = 0.2644 \text{ V}$.
66. C. A reaction runs until one of the reactants is exhausted. This is the limiting reagent.
67. A. The reaction quotient is smaller than the equilibrium constant when the reactant concentrations are higher than equilibrium values. The reaction mixture has not reached equilibrium concentrations. Remember Q depends on products/reactants.
68. C. The phosphorus central atom has sp^3d hybridization. There are five single bonds between the central atom and the five fluorine atoms. These single bonds are formed between the five sp^3d orbitals on the phosphorus atom and the fluorine atomic orbitals.
69. D. $\Delta E = \Sigma \text{BE Bonds broken} - \Sigma \text{BE Bonds formed} = \text{BEH-H} + \text{BECl-Cl} - \text{BEC-Cl} - \text{BEH-Cl}$; $\Delta E = 414 \text{ kJ/mol} + 244 \text{ kJ/mol} - 326 \text{ kJ/mol} - 432 \text{ kJ/mol} = +658 \text{ kJ/mol} - 758 \text{ kJ/mol} = -100 \text{ kJ/mol}$
70. B. Amphoteric substances can act as both acids and bases.
71. D. Bromine adds symmetrically to the double bond in this alkene. The bromine atoms add to the number 2 and 3 carbon atoms in the butene.
72. C. Benzene substituents on adjacent carbon atoms in benzene are in the ortho positions.
73. D. The Diels-Alder reaction is an excellent synthetic tool for producing ring structures.
74. A. The chair form is the lowest energy conformer.
75. E. This is an ester: RCOOR .
76. B. The numbering of carbon is always such that the pi bond starts at the lowest number carbon as possible. The higher priority elements are on the same side (hence Z).
77. C. Tertiary alcohols form the most stable carbocation intermediate. The order is $3^\circ > 2^\circ > 1^\circ$.
78. B. The E1 mechanism requires the reactant undergo a unimolecular elimination to form a cation.

- 79. C.** The first step in polymerization is initiation. This is done by using an initiator that can easily dissociate into free radicals, such as benzoyl peroxide. The propagation step is the chain lengthening step, where monomer units are added. The termination step occurs when the polymer meets with something that can absorb the free radical without forming a new one (such as another strand of the polymer, radical, or oxygen).
- 80. D.** A Grignard reagent reacting with CO_2 produces a carboxylate salt, $\text{RCOO}^-(\text{MgX})^+$. The hydrolysis of this salt will produce a carboxylic acid, RCOOH .
- 81. E.** The larger more polarizable species are soft bases (I^- , Br^-) and are more reactive than the less polarizable hard bases (F^-).
- 82. B.** This is an $\text{E}2$ β -elimination via an alkyl magnesium iodide.
- 83. A.** The reactivity for the $\text{S}_{\text{N}}1$ mechanism is $3^\circ > 2^\circ > 1^\circ$.
- 84. D.** Symmetric ketones have the same carbon chains bonded to a carbonyl group, $\text{C}=\text{O}$.
- 85. A.** Aromatic compounds have a lot of electrons and are subject to attack by electrophilic reagents.
- 86. C.** Amine is R-NH_2 . Amine compounds often display physiological activity and are used in pharmaceuticals.
- 87. C.** The adjacent carbon has two hydrogen atoms that will generate $n + 1$ magnetic fields on the “a” hydrogen. This will produce a triplet peak pattern.
- 88. B.** The decoupled spectrum will not show the spin-spin coupling with protons. Only the aldehyde has two types of carbon atoms. All the other compounds have only one type of carbon atom.
- 89. A.** The m/e ratio for the cation is the molecular weight. Only C_3H_7^+ has a mass of 43.
- 90. E.** The carbonyl $\text{C}=\text{O}$ stretching frequency is in the range $1600\text{--}1750\text{ cm}^{-1}$.
- 91. C.** Stretching frequencies parallel bond strengths. Bond strengths increase with the number of bonds. Absorption frequencies increase with bond order for two given atoms.
- 92. A.** Benzene has the most delocalization. The six π electrons in benzene are delocalized around the six carbon ring. There is less and less delocalization with more isolation of the double bonds.
- 93. B.** London forces are the weakest intermolecular forces, which is why alkanes have very high vapor pressure, low melting point, and boiling point.
- 94. C.** Elimination reactions will produce π bonds, which cannot be present in chiral compounds. In $\text{S}_{\text{N}}1$ reactions, the chiral center is destroyed in the intermediate.
- 95. B.** The nitrogen in amines has a partial negative charge and has a lone pair of electrons; this makes amines nucleophilic. Carbon 2 will have the largest partial positive charge. The π bond between this carbon and oxygen will make this carbon more reactive as well.
- 96. A.** There are no chiral carbon atoms. The two sides of the ring $-\text{CH}_2\text{CH}_2-$ joining the carbon atoms to the Cl atoms are the same.
- 97. B.** There are no carbon-carbon double bonds in a carboxylic acid group.
- 98. C.** Reduction of aldehydes and ketones is a two-step process. A hydride is used first, and then acid is used to hydrolyze the initial reduction product.
- 99. E.** Aldehydes are oxidized in the Tollen’s test.
- 100. B.** Dehydration of alcohols produces the most branched or substituted alkene.

Reading Comprehension

- 1. C.** This is stated in the last sentence of the first paragraph.
- 2. C.** (A) There is no comparison between people. (B) The reflexes slow down at a quarter of a second. (D) There is no support for this idea.

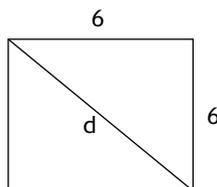
3. B. This is stated in the third sentence of the second paragraph.
4. C. Although you might agree with (A) and (D), the article is not about this. There is no evidence of (B).
5. B. This is stated in the last sentence of the second paragraph.
6. C. Contradictory means opposite of what you expect. When you sleep, your organs don't sleep!
7. A. There is no contradiction (C), and the information goes beyond the fact that sleep is necessary (D). All statements include the affect of sleep on the brain.
8. C. This is stated in the first paragraph.
9. C. This is stated in the second to the last sentence of the first paragraph.
10. A. The first sentence of the second paragraph defines it as an amphibious fungal plague.
11. D. (A) This is contradicted by the information in the text. (B) The point of the articles is that there is no inspection. (C) The first part is true, but the second part of the statement is false.
12. A. The third paragraph explains the duties of various departments, but none deal with the examination of imported creatures.
13. C. The second sentence of the last paragraph defines the word.
14. C. There is the statement that this disease is resistant to eight drugs in the last paragraph.
15. C. It is defined in the third sentence of the first paragraph.
16. B. In the first paragraph, there is the description of one comet moving north and the other one moving east.
17. B. The description of a fly ball allows us to think about the comet's motion.
18. D. At the end of the first paragraph, they state that the bluish color is from ionized gas.
19. C. The second paragraph discusses the movement and shape of the rings.
20. C. The third paragraph raises these questions about changes in the planet Jupiter.
21. B. The last sentence of the last paragraph defines Antares as a red super giant.
22. C. The definition is given in the first paragraph, and the name is the abbreviation of autonomous underwater vehicle.
23. A. This is stated in the second sentence of the second paragraph.
24. C. The last sentence of the second paragraph states that it measure salinity, which means the amount of salt in the water.
25. A. This is stated in the middle of the third paragraph.
26. A. This is stated at the end of the fourth paragraph.
27. C. The last sentence mentions that it will become commonplace like the airplane did, but it takes time.
28. B. The use of the word astounding in the first sentence of the last paragraph indicates excitement.
29. A. Infectious means communicable, or easy to pass along to others. The passage makes it clear that one person can pass the disease on to another. Notice the word "infect," which means to transmit an illness, and the suffix indicates this is an adjective.
30. B. The second sentence of the first paragraph specifically states that cholera is caused by a *Vibrio cholerae* bacterium.
31. C. The second paragraph indicates that contaminated food and water carry the organism and that certain raw or poorly cooked foods cause infection. However, nothing indicates that food cooked too much (overcooked) causes cholera.

32. C. The order of events leading to the illness is: Disaster occurs; contaminated water flows into waterways; sanitary system fails, and fresh water becomes unavailable; and people drink the water.
33. B. Regurgitation, which means the same as vomiting.
34. D. "The Causes and Effects of Cholera" is the most general description of the passage. The entire passage is about cholera. Dysentery, in the first answer choice, is another illness that causes some of the same symptoms. Contaminated water is a cause of the disease, but the second choice is not a good title for the passage. The third answer choice relates to only a portion of the topic. Although war and natural disaster may cause cholera, the passage is about the disease, not the cause.
35. B. The context of the sentence leads you to understand that prevalent means very common.
36. C. Shortage is nearest in meaning to lack. Both words mean "to be without."
37. A. Cholera is easily passed from one person to another.
38. A. Careful cooking and hygiene practices can reduce the chance of getting the disease.
39. D. The sentence states that the epidemics have resulted in millions of deaths, so it's clear that epidemic is not a positive thing, which helps you eliminate the first two answer choices. Bacteria makes no sense because it means that cholera "has been responsible for" bacteria.
40. B. Ubiquitous means "omni-present" or "existing everywhere."
41. C. The word stagnant means stale, "out-of-date," or "not changing." This passage states that the bar code concept is still being changed.
42. D. The passage indicates that the bar code has been used in various ways since the 1970s.
43. A. The passage covers both a review of existing technology and the new two-dimensional code.
44. A. The two-dimensional bar code, with an information density of 1,100 bytes, allows a considerably greater amount of information to be coded than the traditional bar code, including customized information. Thus, the manufacturer is able to add additional information on the bar code that it finds useful for its own tracking purposes. It also has built-in redundancy, meaning that the identical information is duplicated on the same code. Therefore, if the code is damaged, it can still be read. The technology even allows pictures or text to be contained within the code, as well as bar code encryption. The new technology dramatically reduces the errors of the single dimensional bar code and reduces the enormous costs that some companies have reported in the past.
45. A. The reading states that the code consists of horizontal lines, black print on a white background, with two and sometimes four different widths, and Arabic numerals underneath.
46. B. The passage states: The bar code used on grocery products, introduced in the 1970s, is called a universal product code (or UPC), and assigns each type of food or grocery product a unique code.
47. A. Width is a noun related to the noun wide. It describes the size from left to right.
48. A. Traditional refers to a long-standing tradition or convention.
49. B. Keeping track of products stocked and sold means the same thing as inventory control. The other uses mentioned are potential uses of the new two-dimensional bar code.
50. D. In this context, considerably means "far" or "much."

Quantitative Reasoning

1. B. The earnings for 30 hours are $\$8.25 \times 30 = \247.50 .
2. E. The least common multiple of the divisors 16 and 24 is 48. $\frac{5}{16} + \frac{9}{24} = \frac{15}{48} + \frac{18}{48} = \frac{33}{48} = \frac{11}{16}$.
3. C. Translate to a mathematical expression and solve. $3x + 7 = 70$ so $3x + 7 - 7 = 70 - 7$ and $3x = 63$. Divide both sides by 3. Therefore, $x = 21$.

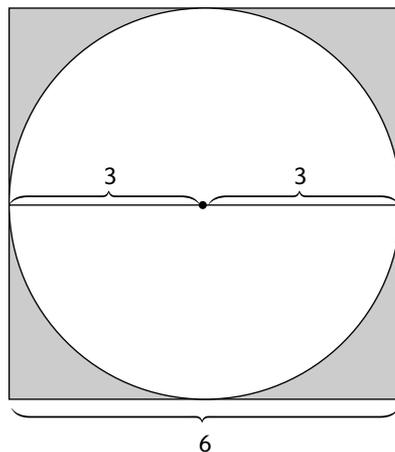
4. **D.** The area of the circle with a radius of 3 is $\pi r^2 = \pi \cdot 3^2 = 9\pi$. The area of the larger circle is $4 \times 9\pi = 36\pi$. Therefore, $r^2 = 36$ so $r = \sqrt{36} = 6$. The radius of the larger circle is 6.
5. **E.** Six less a number is shown by $n - 6$. So six less a number is four is represented by $n - 6 = 4$.
6. **A.** The cost of the 8 CD covers is $8 \times \$1.59 = \12.72 . The change received back is $\$20.00 - \$12.72 = \$7.28$.
7. **C.** $3a + 3b = 3(a + b)$. Since $a + b = 6$, $3a + 3b = 3(6) = 18$.
8. **C.** $1\frac{1}{8} + 2\frac{3}{4} + 3\frac{1}{3} = \frac{9}{8} + \frac{11}{4} + \frac{10}{3} = \frac{27}{24} + \frac{66}{24} + \frac{80}{24} = \frac{173}{24} = 7\frac{5}{24}$ pounds.
9. **B.** The area of a triangle is $A = \frac{1}{2}bh$. If the base is 3 inches less than the height, then $b = h - 3$. Substituting this value in for b gives $A = \frac{1}{2}(h - 3)h = \frac{1}{2}h^2 - \frac{3}{2}h$.
10. **E.** $(2.5)^4 = 2.5 \times 2.5 \times 2.5 \times 2.5 = 39.0625$. Rounded to the nearest tenth is 39.1.
11. **B.** The area of a square is s^2 where s is a side of the square. If $s^2 = 36$, then $s = 6$. The diagonal of a square forms two right triangles; d is the hypotenuse, and the two legs are 6 units long.



Using the Pythagorean Theorem, $d^2 = 6^2 + 6^2 = 36 + 36 = 72$. Therefore, $d = \sqrt{72} = 6\sqrt{2}$.

12. **B.** $(3x^2 + 2x - 5) - (2x^2 - 5) + (4x - 7) = 3x^2 + 2x - 5 - 2x^2 + 5 + 4x - 7 = 3x^2 - 2x^2 + 2x + 4x - 5 + 5 - 7 = x^2 + 6x - 7$.
13. **B.** After eating $\frac{1}{4}$ of a pie, what remains is $1 - \frac{1}{4} = \frac{3}{4}$. If 4 friends share the remainder, then each received $\frac{3}{4} \div 4 = \frac{3}{4} \times \frac{1}{4} = \frac{3}{16}$.
14. **E.** The line $y = -\frac{1}{8}x + 7$ has a slope of $-\frac{1}{8}$. A line perpendicular would have a slope equal to the negative reciprocal of $-\frac{1}{8}$, which is 8.
15. **D.** Interest earned in one year is $\$300 \times 5\frac{1}{4}\% = \15.75 . The total amount of the account after one year is $\$300 + \$15.75 = \$315.75$.
16. **B.** Subtracting $2y$ from both sides leads to the equation $6 = y - 2$. Next, add 2 to both sides to get $y = 8$.
17. **A.** Five cards at \$3.00 each cost $5 \times \$3.00 = \15.00 . If cards are 2 for \$5.00, the cost per cards is $\frac{\$5.00}{2} = \2.50 so 5 cards would cost $\$2.50 \times 5 = \12.50 . The amount saved is $\$15.00 - \$12.50 = \$2.50$.
18. **A.** Add the areas of the two triangles and the square to find the total area. The area of the square is $5^2 = 25$. Both triangles have a height of 5. The area of one triangle is $\frac{1}{2}bh = \frac{1}{2} \cdot 3 \cdot 5 = \frac{15}{2} = 7.5$. The area of the other triangle is $\frac{1}{2}bh = \frac{1}{2} \cdot 4 \cdot 5 = \frac{20}{2} = 10$. The total area is $25 + 7.5 + 10 = 42.5$.
19. **D.** The cosine function is positive in the first and fourth quadrants. The tangent function is negative in the second and fourth quadrants. Thus, $\angle y$ must lie in the fourth quadrant.
20. **D.** The percent discounted is the amount discounted divided by the original price. The amount discounted is $\$200 - \$150 = \$50$. The percent discounted is $\frac{50}{200} = 0.25 = 25\%$.
21. **A.** There are 60 minutes in an hour, 24 hours in one day, and 7 days in one week. So 1 week = $\frac{7 \text{ days}}{1 \text{ week}} \times \frac{24 \text{ hours}}{1 \text{ day}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = 7 \times 24 \times 60 = 10,080$ minutes.

- 22. B.** The amplitude of the function is the absolute value of the coefficient of the cosine term, that is, 3.
- 23. E.** At the end of the first day, there are $1 - \frac{1}{8} = \frac{7}{8}$ of the magazines remaining. $\frac{7}{8} \times \frac{1}{4} = \frac{7}{32}$ sold the next day. So at the end of the second day, there are $\frac{7}{8} - \frac{7}{32} = \frac{28}{32} - \frac{7}{32} = \frac{21}{32}$ of the magazines remaining.
- 24. A.** Using the ratio $\frac{\text{height}}{\text{shadow}}$, the proportion $\frac{3\frac{1}{2}}{6} = \frac{x}{24}$ models this situation, where x represents the height of the pole. Cross multiply. $3\frac{1}{2} \times 24 = 6x$ so $84 = 6x$ and $x = \text{feet } \frac{84}{6} = 14$.
- 25. C.**



The area of the shaded region equals the area of the square minus the area of the circle. Since the radius of the circle is 3, the square has a side length of 6. The area of the square is 6^2 or 36. The area of the circle is $\pi r^2 = \pi \cdot 3^2 = 9\pi$. The shaded region, therefore, is $36 - 9\pi$.

- 26. D.** The volume of each cube is $4 \times 4 \times 4 = 64 \text{ in}^3$. The volume of the crate, in inches, is $(3 \times 12) \times (2 \times 12) \times (2 \times 12) = 20,736 \text{ in}^3$. The number of blocks that can fit in the crate is $\frac{20736}{64} = 324$.
- 27. D.** If a pair of dice are rolled one time, the probability of getting an even number is $\frac{18}{36} = \frac{1}{2}$. Thus, if rolled twice, the probability is $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$.
- 28. A.** Set the equation equal to 0 and factor. $x^2 + 6x - 16 = 0$ and $(x + 8)(x - 2) = 0$. Then, either $x + 8 = 0$ or $x - 2 = 0$, so $x = -8$ or $x = 2$. Since x is positive, $x = 2$ only.
- 29. D.** The mode is the most frequently occurring number, which is 7. The median is the number in the middle, which is 5. The product is $5 \times 7 = 35$.
- 30. A.** $60 \text{ beads} \times \text{feet } \frac{1}{2} = 30 \text{ inches}$. Converting this to feet gives $30 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = \text{feet } \frac{30}{12} = 2\frac{1}{2}$.
- 31. B.** Substitute 1 for p and solve for q . $7(1) + 5q = -3$ and $7 + 5q = -3$.
 $7 + 5q - 7 = -3 - 7$ and $5q = -10$. Dividing both sides by 5 results in $q = -2$.
- 32. E.** Let the radius of the smaller circle = 1. Then the radius of the larger circle is 4. The shaded region is found by subtracting the area of the smaller circle from the area of the larger circle. The area of the smaller circle is $\pi(1)^2$ or π . The area of the larger circle is $\pi(4)^2$ or 16π . The shaded region is $16\pi - \pi$ or 15π . The percent of the whole figure that is shaded is $\frac{15\pi}{16\pi} = 0.9375 = 93\frac{3}{4}\%$.
- 33. B.** The proportion $\frac{5}{3} = \frac{x}{4}$ can be used to find x . Cross multiply. $5 \times 4 = 3x$ so $20 = 3x$ and $x = \frac{20}{3} = 6\frac{2}{3}$.
- 34. A.** Since $\tan x = \frac{\sin x}{\cos x}$, $\tan x = 0$ whenever $\sin x = 0$. Of the choices, $\sin x = 0$ only at 0° .

- 35. C.** The set contains an even number of numbers, so the median of the numbers is the arithmetic mean of the two numbers in the middle. The numbers in the middle are 2 and 4, and the arithmetic mean of these numbers is 3.
- 36. D.** Substituting $F = 77$ into the conversion formula yields $C = \frac{5}{9}(F - 32) = \frac{5}{9}(77 - 32) = \frac{5}{9}(45) = 5(5) = 25$.
- 37. C.** Interest = principle \times rate. Let p represent the principle. Then $\$100 = p \times 7\frac{1}{4}\%$ so $p = \frac{\$100}{7\frac{1}{4}\%} = \frac{\$100}{0.0725} = \$1,379$.
- 38. C.** $8^{\frac{4}{3}} = (\sqrt[3]{8})^4 = 2^4 = 16$.
- 39. C.** One of the Pythagorean identities is $\sin^2\theta + \cos^2\theta = 1$, so $1 - \cos^2\theta = \sin^2\theta$.
- 40. C.** To solve this equation, raise both sides to the power of -4 . Thus, $(b^{-\frac{1}{4}})^{-4} = 2^{-4}$ or $b = 2^{-4} = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$.