Answer Sheets for Practice Test 2

Remove these sheets and use to mark your answers.

Natural Sciences

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Perceptual Ability Test

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Reading Comprehension

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Quantitative Reasoning

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PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** 1.0079																	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.179
11 **Na** 22.99	12 **Mg** 24.30											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.974	16 **S** 32.06	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	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	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	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.91	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	81 **Ti** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	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 2

Natural Sciences

Time: 90 Minutes

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

1. Which of the following is NOT a characteristic of all living cells?

   A. All cells are self-contained (surrounded by a plasma membrane).
   B. All cells contain DNA.
   C. All cells contain cytoplasm.
   D. All cells contain genes.
   E. All cells contain a nucleus.

2. The process of diffusion involves

   A. the passive movement of substances from a region of higher concentration to a region of lower concentration.
   B. the passive movement of substances from a region of lower concentration to a region of higher concentration.
   C. the passive movement of water from a region of lower concentration to a region of higher concentration.
   D. the input of energy to move substances from a region of higher concentration to a region of lower concentration.
   E. the input of energy to move substances from a region of lower concentration to a region of higher concentration.

3. During growth and tissue repair in humans, new cells are produced through the process of

   A. meiosis.
   B. mitosis.
   C. fission.
   D. budding.
   E. both mitosis and meiosis.

4. The process of cellular respiration involves

   A. the inhaling of oxygen and the exhaling of carbon dioxide through the lungs.
   B. the inhaling of carbon dioxide and the exhaling of oxygen through the lungs.
   C. the uptake of oxygen and the release of carbon dioxide through the skin.
   D. the breakdown of glucose molecules to produce energy in the form of ATP
   E. the formation of glucose molecules through the breakdown of ATP.

5. Which of the following statements best describes the energy conversion that occurs during photosynthesis?

   A. Chemical energy in the form of ATP is converted to light energy.
   B. Chemical energy in the form of glucose is converted to light energy.
   C. Chemical energy in the form of glucose is converted to energy in the form of ATP.
   D. Light energy is converted to chemical energy in the form of glucose.
   E. Light energy is converted into energy in the form of ATP.

6. Enzymes are

   A. a type of protein capable of raising the activation energy of chemical reactions.
   B. a type of protein capable of lowering the activation energy of chemical reactions.
   C. a type of lipid capable of raising the activation energy of chemical reactions.
   D. a type of lipid capable of lowering the activation energy of chemical reactions.
   E. a type of carbohydrate capable of raising the activation energy of chemical reactions.

7. The endosymbiont theory is used to explain

   A. the presence of chloroplasts and mitochondria in eukaryotic cells.
   B. the association between green algae and fungi in lichens.
   C. the association between mistletoe and its host tree.
   D. the association between epiphytic orchids and their host tree.
   E. the presence of a membrane-bound nucleus in eukaryotic cells, but not in prokaryotic cells.

8. Which of the following groups of plants is MISmatched with its description?

   A. mosses   nonvascular; reproduce by spores
   B. ferns   nonvascular; reproduce by spores
   C. pines   vascular; reproduce by seeds
   D. lilies   vascular; reproduce by seeds
   E. apples   vascular; reproduce by seeds

9. Which of the following features is NOT considered a characteristic of primates?

   A. opposable thumb
   B. well-developed cerebral cortex
   C. continuously-growing incisors
   D. forward-facing eyes
   E. omnivorous

10. *Homo sapiens* are a member of

    A. class Hominida.
    B. class Vertebrata.
    C. class Erectus.
    D. class Chordata.
    E. class Mammalia.

11. Which of the following hormones is NOT produced by the pituitary gland?

    A. calcitonin
    B. oxytocin
    C. growth hormone
    D. prolactin
    E. antidiuretic hormone

12. The amount of force exerted by blood against the walls of the blood vessels is referred to as

    A. pulse rate.
    B. heart rate.
    C. blood pressure.
    D. systole.
    E. diastole.

13. In humans, organic molecules taken into the body must be converted to a form that is usable by the body through the process of

    A. respiration.
    B. circulation.
    C. excretion.
    D. digestion.
    E. thermoregulation.

14. Which of the following macromolecules provides the most direct form of usable energy by humans?

    A. lipids
    B. proteins
    C. carbohydrates
    D. nucleic acids
    E. fats

15. The primary functional unit of the human excretory system is the

    A. ureter.
    B. urethra.
    C. bladder.
    D. small intestine.
    E. kidney.

16. Chemical coordination of the human body is controlled by hormones produced in a series of glands referred to as the

    A. excretory system.
    B. endocrine system.
    C. hormonal system.
    D. nervous system.
    E. circulatory system.

17. In the human reproductive system, fertilization takes place in the

- **A.** vagina.
- **B.** cervix.
- **C.** uterus.
- **D.** ovary.
- **E.** Fallopian tube.

18. The human central nervous system consists of

- **A.** the brain and the spinal cord.
- **B.** the spinal cord and the peripheral nerves.
- **C.** the brain and the peripheral nerves.
- **D.** the spinal cord and the parasympathetic nerves.
- **E.** the brain and the parasympathetic nerves.

19. Which of the following represents the correct flow of air in the human respiratory system?

- **A.** nose → trachea → larynx → bronchi → alveoli
- **B.** nose → trachea → larynx → alveoli → bronchi
- **C.** nose → larynx → trachea → bronchi → alveoli
- **D.** nose → larynx → trachea → alveoli → bronchi
- **E.** nose → larynx → bronchi → trachea → alveoli

20. The organ in the human body that is composed primarily of lymph node tissue and is the site where red blood cells are destroyed is the

- **A.** pancreas.
- **B.** gall bladder.
- **C.** appendix.
- **D.** liver.
- **E.** spleen.

21. Which of the following statements regarding antibiotics is INCORRECT?

- **A.** Antibiotics interfere with the growth and development of bacteria.
- **B.** Many bacterial strains have developed resistance to commonly used antibiotics.
- **C.** Antibiotics are currently added to many soaps and other cleaning agents.
- **D.** Antibiotics are effective against bacteria, viruses, and other infectious agents.
- **E.** Different antibiotics may need to be used depending on whether the bacterial agent is Gram-positive or Gram-negative.

22. Which of the following organs or tissues is NOT derived from the ectoderm during human embryo development?

- **A.** skeletal system
- **B.** epidermis
- **C.** cornea
- **D.** tooth enamel
- **E.** nervous system

23. In human embryo development, the first series of cell divisions following fertilization results in the partitioning of the zygote into many smaller cells. This series of divisions is referred to as

- **A.** gastrulation.
- **B.** blastulation.
- **C.** cleavage.
- **D.** organogenesis.
- **E.** morulation.

24. Which of the following must occur for an individual to express a particular trait (for example, blue eye color)?

- **A.** Genes must be transcribed directly into proteins.
- **B.** Genes must be translated directly into proteins.
- **C.** Genes must be transcribed onto transfer RNA (tRNA) from which they can be translated into proteins.
- **D.** Genes must be transcribed onto messenger RNA (mRNA) from which they can be translated into proteins.
- **E.** Genes must be translated onto messenger RNA (mRNA) from which they can be transcribed into proteins.

DAT Practice Test 2

25. The genetic make-up of an individual is referred to as his or her

A. genome.
B. genotype.
C. phenotype.
D. gene pool.
E. genetic code.

26. If an individual has one allele coding for attached earlobes and one allele coding for free earlobes, that individual is said to be

A. homozygous for earlobe type.
B. recessive for earlobe type.
C. dominant for earlobe type.
D. heterozygous for earlobe type.
E. heterogeneous for earlobe type.

27. The existence of the M, N, and MN blood groups in humans is an example of

A. complete dominance.
B. complete recessiveness.
C. codominance.
D. incomplete dominance.
E. heterozygosity.

28. Which of the following combinations of children could be produced by a woman with type-AB blood and a man with type-O blood?

A. AB only
B. O only
C. AB or O
D. A, B, AB, or O
E. A or B

29. The characterization of an individual's DNA by restriction analysis and gel electrophoresis is referred to as a

A. DNA fingerprint.
B. PCR product.
C. DNA probe.
D. restriction blot.
E. transgenic blot.

30. What proportion of offspring resulting from a cross between a squirrel that was homozygous dominant for round ears and a squirrel that is heterozygous for round and pointed ears would have pointed ears?

A. 0%
B. 25%
C. 50%
D. 75%
E. 100%

31. Which of the following statements regarding sex-linked traits is INCORRECT?

A. Daughters will always show dominant sex-linked traits if their father has the trait.
B. Sons will always show the sex-linked trait if their mother is homozygous for the trait.
C. Sons cannot inherit a sex-linked trait from their father.
D. Daughters cannot inherit a sex-linked trait; only sons can inherit sex-linked traits.
E. Sex-linked traits are carried primarily on the X chromosome; few traits are carried on the Y chromosome.

32. Which of the following statements best describes the process of evolution?

A. changes in the genetic composition of a population over time
B. natural selection among individuals in a population
C. failure of a population to change in genetic composition over time
D. genetic drift within a population
E. survival of the fittest

33. A group of related individuals that can interbreed and produce fertile offspring is referred to as a

A. community.
B. population.
C. species.
D. gene pool.
E. family.

34. The difference between a community and an ecosystem is that

    A. an ecosystem does not include any abiotic factors.

    B. a community does not include any abiotic factors.

    C. a community only includes a single species type.

    D. an ecosystem does not include interactions among species.

    E. a community does not include interactions among species.

35. The base of every food chain consists of

    A. carnivores.

    B. primary consumers.

    C. herbivores.

    D. decomposers.

    E. producers.

36. Which of the following factors affecting population density would be considered density-independent?

    A. availability of food

    B. availability of water

    C. accumulation of toxins in the ecosystem

    D. prolonged period of drought

    E. availability of shelter

37. When a toxin enters the food chain, it usually

    A. does not move up the food chain.

    B. becomes less and less concentrated as it moves up through the food chain.

    C. becomes more and more concentrated as it moves up through the food chain.

    D. is broken down immediately by the decomposers.

    E. is absorbed and neutralized by the producers.

38. A tapeworm living inside a human intestine would be an example of which type of interspecific relationship?

    A. mutualism

    B. commensalism

    C. predation

    D. parasitism

    E. symbiosis

39. If a mutation occurs in a population resulting in a favorable trait, that trait is likely to increase in frequency in the population due to which of the following forces?

    A. genetic drift

    B. migration

    C. genetic bottlenecking

    D. evolution

    E. natural selection

40. The study of the evolution of social behavior is referred to as

    A. sociobiology.

    B. socialism.

    C. ecology.

    D. microbiology.

    E. mycology.

41. Which of the following categories best classifies silver?

    A. alkali metal

    B. nonmetal

    C. noble gas

    D. metalloid

    E. transition metal

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42. Which of the following liquids has the highest vapor pressure?

A.
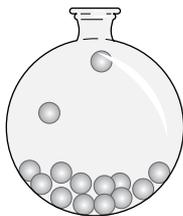
B.
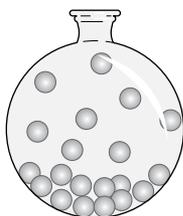
C.
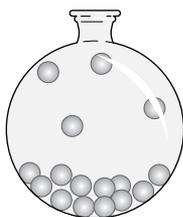
D.
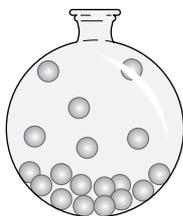
E.
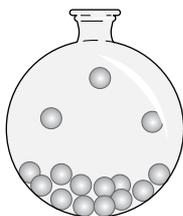
43. What is the total number of valence electrons in sulfur trioxide, SO_3?

   A. 8
   B. 6
   C. 24
   D. 22
   E. 18

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

$$CH_3OH(l) + O_2(g) \rightarrow$$
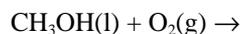
   A. $CO(g) + H_2O(g)$
   B. $2\ CO(g) + 3\ H_2O(g)$
   C. $CO_2(g) + 4\ H_2O(g)$
   D. $2\ C(s) + O_2(g) + 4\ H_2(g)$
   E. $CO(g) + 2\ H_2O(g)$

45. How many mols of NH_3 equal 3.0×10^{24} molecules of ammonia?

   A. 17
   B. 0.50
   C. 5.0
   D. 1.0×10^{22}
   E. 6.0×10^{45}

46. Which of the following is the nuclear decay equation for alpha emission by polonium-210?

   A. $^{210}_{15} P \rightarrow\ ^{0}_{-1}e + ^{210}_{16}S$
   B. $^{210}_{84} Po \rightarrow\ ^{4}_{2}\alpha + ^{206}_{82}Pb$
   C. $^{210}_{84} Po \rightarrow\ ^{0}_{-1}e + ^{210}_{85}At$
   D. $^{210}_{82} Pb \rightarrow\ ^{4}_{2}\alpha + ^{206}_{80}Hg$
   E. $^{210}_{80} Pt \rightarrow\ ^{4}_{2}\alpha + ^{206}_{78}Os$

47. Which of the following is NOT a physical property?

   A. odor
   B. melting point
   C. compressibility
   D. color
   E. flash point

48. Which of the following acids is the strongest?

   A. C_2H_2 p$K_a = 25$
   B. CF_3CO_2H p$K_a = 0.18$
   C. H_2CO_3 p$K_a = 3.7$
   D. CH_3CO_2H p$K_a = 4.8$
   E. HCO_2H p$K_a = 3.8$

49. Which of the following acids is the weakest?

   A. HF
   B. HCl
   C. HBr
   D. HI
   E. $HClO_4$

50. Which of the arrows in the figure indicates the energy for the transition state along the reaction coordinate?
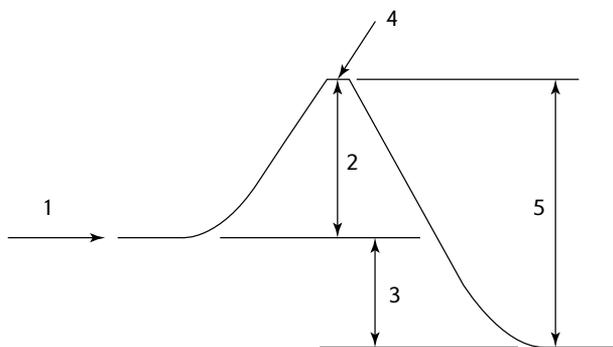
A. 1
B. 2
C. 3
D. 4
E. 5

51. Which of the following pairs of solutes and van't Hoff Factors is NOT correct?

A. CH_3OH (methanol), i = 1
B. NaCl (sodium chloride), i = 2
C. $FeCl_3$ (iron III chloride), i = 4
D. CH_3CH_2OH (ethanol), i = 1
E. $CaCl_2$ (calcium chloride), i = 2

52. What name is used to describe the Group A elements?

A. halogens
B. rare gases
C. representative elements
D. transition elements
E. coinage metals

53. Metallic gold crystallizes in the face-centered cubic lattice. How may gold atoms are "inside" a unit cell?

A. 1
B. 2
C. 3
D. 4
E. 6

54. The angular momentum quantum number ℓ can have values from 0 to n – 1. Which of the following values is correct for a 2s atomic orbital?

A. 0
B. 1
C. 2
D. –1
E. 1/2

55. Which of the following covalent bonds is the shortest and strongest?

A. H-I
B. H-F
C. H-Cl
D. H-Br
E. H-At

56. How many tons of $KClO_3$ are needed to produce 96 tons of O_2? The reaction is $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$. The molar masses are 1 mol $KClO_3$ = 123 g/mol; 1 mol KCl = 75 g/mol; 1 mol O_2 = 32 g/mol.

A. 369 tons
B. 123 tons
C. 492 tons
D. 750 tons
E. 246 tons

57. The trans→cis isomerization of 1, 2-dichloroethylene has an energy of activation of 232. kJ/mol. The ΔH for the reaction is 4.18 kJ/mol. What do you predict for the activation energy for the reverse cis→trans isomerization?

E_a forward – $\triangle H$ = E_a reverse

A. +232 kJ/mol
B. –232 kJ/mol
C. 4.18 kJ/mol
D. +227 kJ/mol
E. –227 kJ/mol

58. Which of the following exists as a ferromagnetic solid?

A. lithium, Li
B. iron, Fe
C. calcium, Ca
D. potassium, K
E. silver, Ag

GO ON TO THE NEXT PAGE

59. Which of the following atoms has exactly one outer electron?

   A. Br
   B. Ca
   C. Li
   D. Mg
   E. Sn

60. Which of the following pairs of atoms, molecules, and hybridization is NOT CORRECT?

   A. carbon in carbon monoxide, sp
   B. oxygen in water, sp^3
   C. sulfur in sulfur dioxide, sp^2
   D. nitrogen in ammonia, sp^3
   E. carbon in methane, sp

61. The density of helium is 0.1786 kg/m^3 at STP. The gas is allowed to expand to 1.500 times the initial volume by adjusting temperature and pressure. What is the new density for the helium sample?

   A. 0.2656 kg/m^3
   B. 0.1191 kg/m^3
   C. 0.1786 kg/m^3
   D. 1.6786 kg/m^3
   E. 1.1910 kg/m^3

**62.** Which of the following combinations of orbital quantum numbers do not go together? $n = 2$, $\ell = 0$, $m_\ell = -1$?

   A. 1s, $n = 1$, $\ell = 0$, $m_\ell = 0$?
   B. 2p, $n = 2$, $\ell = 1$, $m_\ell = -1$?
   C. 2s, $n = 2$, $\ell = 0$, $m_\ell = -1$?
   D. 3s, $n = 3$, $\ell = 0$, $m_\ell = 0$?
   E. 3p, $n = 3$, $\ell = 1$, $m_\ell = -1$?

63. One mol of electrons is usually associated with which of the following terms?

   A. 1 Ohm
   B. 1 Faraday
   C. 1 Coulomb
   D. 1 Ampere
   E. 1 Volt

64. Which set of conditions makes a real gas behave like an ideal gas?

   A. high temperature / low pressure
   B. high temperature / high pressure
   C. low temperature / low pressure
   D. low temperature / high pressure
   E. high density / low temperature

65. In order to balance the half-reaction $MnO_4^- \rightarrow MnO_2$ in acidic solution, how many electrons need to be added and to which side?

   A. 1 to the product side
   B. 2 to the reactant side
   C. 3 to the reactant side
   D. 2 to the product side
   E. 4 to the reactant side

66. Which of the following nuclear processes decreases the atomic number in the daughter?

   A. α, alpha decay
   B. γ, gamma decay
   C. $n°$ decay
   D. β, beta decay
   E. K capture

67. In a reversible chemical reaction, which of the following will "remain after the reaction stops?"

   A. only the products
   B. only the excess reagent
   C. both reactants and products
   D. the percent yield
   E. the limiting reagent

68. Based on the following standard electrode potentials for the two half reactions, what is the standard electrode potential for the reaction $I^-|I_2||$ $Sn^{2+}|$ Sn?

$I_2 + 2\,e^- \rightarrow 2\,I^-$ $E^0 = 0.53$ V
$Sn^{2+} + 2\,e^- \rightarrow$ Sn $E^0 = -0.14$ V

   A. $+ 0.2644$ V
   B. $+ 0.39$ V
   C. $- 0.39$ V
   D. -0.67 V
   E. $+ 0.67$ V

69. What does the term "Q" represent in the Nernst equation, $E = E^0 - (RT/nF) \ln Q$?

   A. standard potential
   B. non-standard concentrations
   C. temperature effects
   D. electrons per mol
   E. Universal gas constant

70. Which of the following is an amphoteric compound that can act as either an acid or a base?

   A. $NaOH(aq)$
   B. $Ca(OH)_2(aq)$
   C. $Al(OH)_3(aq)$
   D. $HCl(aq)$
   E. $NH_3(aq)$

71. What is the addition product from the reaction of $Br_2(g)$ with 2-butene?

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

72. What is the name for the molecule shown here?
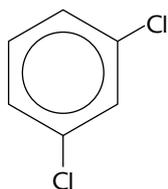
   A. m-dichlorobenzene
   B. p-dichlorobenzene
   C. o-dichlorobenzene
   D. o-chlorotoluene
   E. 1,4-dichlorocyclohexane

73. According to Markonikov's rule, which carbon will the hydroxide go on in the formation of alcohol from the following hydration reaction?
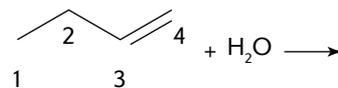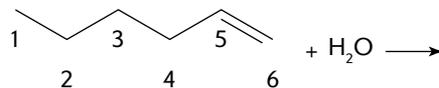
   A. 6
   B. 2
   C. 3
   D. 4
   E. 5

74. Which of the following functional groups is NOT an ortho-para director?

   A. $-OR$
   B. $-CH_3$
   C. $-OH$
   D. $-NH_2$
   E. $-C:::N:$

75. Which form of spectroscopy would be the best for detecting the types of differently bonded hydrogen atoms?

   A. FT-IR
   B. MS
   C. UV-Vis
   D. NMR
   E. Raman

76. In the following figure, which carbon atom is most likely to be the site for the formation of a carbanion?
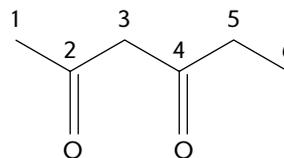
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

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77. What type of amine is formed from the reaction of an alkyl halide and a tertiary amine?

    A. primary
    B. secondary
    C. tertiary
    D. quaternary
    E. cyclic

78. Which of the following molecules has a hydrogen atom in an allylic position?

    A. $H_2C::CH_2$
    B. $HC:::CH$
    C. $H_2C::CHCH_3$
    D. $C_6H_5C:::CH$
    E. CH_3CH_2OH

79. The hydrogen atoms in the molecule are labeled A through E. Which of these hydrogen atoms is NOT labeled correctly?
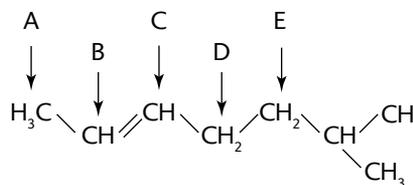
    A. 1°, allylic
    B. 2°, vinylic
    C. 2°, vinylic
    D. 2°, allylic
    E. 2°, vinylic

80. Which of the following alkenes will yield only one product on ozonolysis?

    A. $H_2C::CHCH_2CH_3$
    B. $H_2C::CHCH::CH_2$
    C. $H_2C::CHCHC::CH_2$
    D. $CH_3CH::CHCH_3$
    E. $H_2C::CHCH_3$

81. The Cahn-Ingold-Prelog rules are used to assign the configuration of each chiral atom in terms of the symbols R and S. Based on these rules, which of the following is NOT labeled correctly?
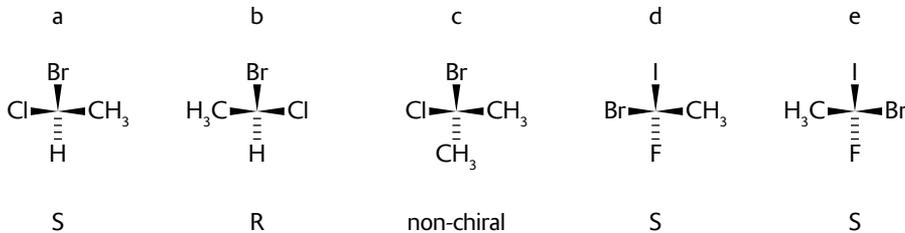
82. Which of the following statements is FALSE?

    A. There are two broad classes of stereoisomers, enantiomers, and diastereomers.
    B. Achiral molecules cannot possess chiral centers.
    C. Racemization of an enantiomer must result in the breaking of at least one bond to the chiral center.
    D. An attempted resolution can distinguish between a racemate and a *meso* compound.
    E. A meso compound cannot be resolved because it does not consist of enantiomers.

83. Which of the following will form 2-butene when treated with concentrated H_2SO_4?

    A. $CH_3CHOHCH_2CH_3$
    B. $CH_3CHBrCH_2CH_3$
    C. $CH_3C:::CCH_3$
    D. $CH_3CHBrCHBrCH_3$
    E. $CH_3CH_2CH_2CH_2OH$

84. Which of the following pairs of general formulas and hydrocarbon classes is INCORRECT?

    A. C_nH_{2n}, cycloalkanes
    B. C_nH_{2n+2}, open chain alkanes
    C. C_nH_{2n-2}, alkynes
    D. C_nH_{2n}, alkenes
    E. C_nH_{2n+2}, alkynes

85. Which of the following is an isomer of 2-methylpropane?

    A. 2-methylbutane
    B. butane
    C. cyclopentane
    D. cyclobutane
    E. cyclopropane

86. Which of the following is the I.U.P.A.C. name for the following compound?

$$CH_3$$
$$|$$
$$CH_3CH_2CH_2CHCHCHCH_3$$
$$|$$
$$OH$$
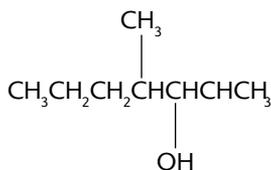
    A. 2-methyl-3-hexanol
    B. 5-methyl-4-hexanol
    C. 3-methyl-2-hexanol
    D. 2-methyl-3-pentanol
    E. 2,2-dimethyl-3-pentanol

87. Which of the following is the product when CH_3CHO reacts with $KMnO_4$?

    A. CO_2 and H_2O
    B. CH_3COOH
    C. CH_3CH_2OH
    D. CH_3COCH_3
    E. CH_3CH_2COOH

88. What is the product of the reaction of phenylacetaldehyde with $LiAlH_4$?

    A. $C_6H_5CH_2CH_2OH$
    B. $C_6H_5CH_3$
    C. $C_6H_{11}CH_2CH_2OH$
    D. $C_6H_5CHOHCH_2OH$
    E. $C_6H_5CH_2CH_3$

89. Which of the following reactions will NOT produce a carboxylic acid?

    A. $CH_3CH_2CHO + KMnO_4 \rightarrow$
    B. $CH_3CH_2C:::CCH_2CH_3 + HNO_3 \rightarrow$
    C. $CH_3CH_2CHO + LiAlH_4 \rightarrow$
    D. $CH_3CH_2C:::N + H_3O^+ \rightarrow$
    E. $C_6H_5CH_2CH_2\,MgCl + CO_2 \rightarrow C_6H_5CH_2CH_2$ $CO_2MgCl + H_3O^+ \rightarrow$

90. What are the products of the reaction of an ester, $C_6H_5COOCH_2CH_3$, with lithium aluminum hydride?

    A. $C_6H_5CH_2OHCH_2CH_3$
    B. $C_6H_5CH_2CH_2CH_3$
    C. $C_6H_{11}CH_2CH_2CH_3$
    D. $C_6H_5CH_2OH$ and CH_3CH_2OH
    E. $C_6H_5CH_3$ and CH_3CH_3

91. Short of being oxidized to carbon dioxide, which of the following functional groups CANNOT be oxidized further?

    A. aldehydes
    B. alkenes
    C. alcohols
    D. ketones
    E. alkanes

92. How many π electrons are in a triple bond?

    A. 6
    B. 4
    C. 2
    D. 1
    E. 0

GO ON TO THE NEXT PAGE

93. Which of the following can react with CH_3CH_2OH to diethylether?

    A. H_2SO_4 and heat

    B.   NaOH

    C.   Na metal

    D.   HCl and heat

    E.   basic aqueous $KMnO_4$

94. Which of the following reactants will convert acetic acid to acetic anhydride?

    A. H_2 with Pd

    B.   NaOH aqueous

    C.   hot concentrated H_2SO_4

    D. $CH_3COO^-Na^+$

    E. CH_3COOH

95. Which of the following compounds is an ether?

    A. $C_6H_5CH_2COOH$

    B. $C_6H_5CH_2CHO$

    C. CH_3COCH_3

    D. $CH_3CH_2OCH_2CH_3$

    E. $C_6H_5CH_2COOCH_2CH_3$

96. What product is expected for the reaction

$C_6H_5CH_2OH + MnO_4^{1-} \rightarrow$

    A. C_6H_5CHO

    B. C_6H_5COOH

    C. $C_6H_5CH_2OCH_2C_6H_5$

    D. $C_6H_5COC_6H_5$

    E. $C_6H_5CH_2OCH_2C_6H_5$

97. Which of the following reagents will convert $CH_3CH_2CHCH_2$ to an epoxide?

    A. CH_3COCl

    B. CH_3CH_2COOH

    C.   basic MnO_4^{1-}

    D. $CH_3CH_2COCH_3CH_2$

    E. CH_3CH_2COOOH

98. Which of the following compounds and the Grignard reagent, C_2H_5MgCl, can be used to produce a carboxylic acid?

    A. CH_3CHO

    B. CH_3COCH_3

    C. H_2CO

    D. CO_2

    E. CH_3CH_2COOH

99. Formaldehyde has the formula H_2CO. There are 12 valence electrons in formaldehyde. How many electrons are in each of the following classes σ (sigma), π (pi), and n (nonbonding)?

    A. $8\ \sigma$, $2\ \pi$ and $2\ n$

    B. $4\ \sigma$, $4\ \pi$ and $4\ n$

    C. $2\ \sigma$, $4\ \pi$ and $6\ n$

    D. $6\ \sigma$, $2\ \pi$ and $4\ n$

    E. $6\ \sigma$, $4\ \pi$ and $2\ n$

100. Which of the following structures is expected to be aromatic based on Huckel's $4n + 2$ rule for planar species?
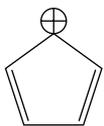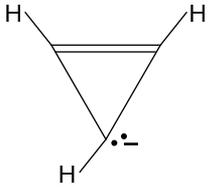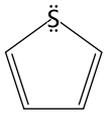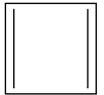
    A.

    B.

    C.

    D.

    E.

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

STOP

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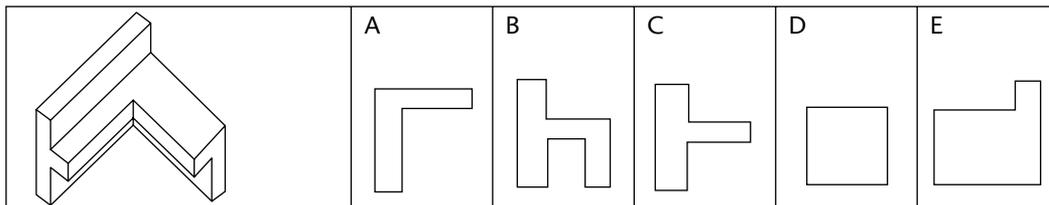
The correct answer is E since the object would pass through this aperture if the side at the left were introduced first.

Proceed to Questions 1–15.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

GO ON TO THE NEXT PAGE
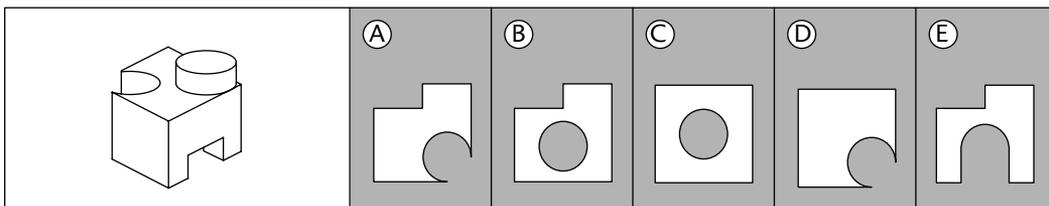
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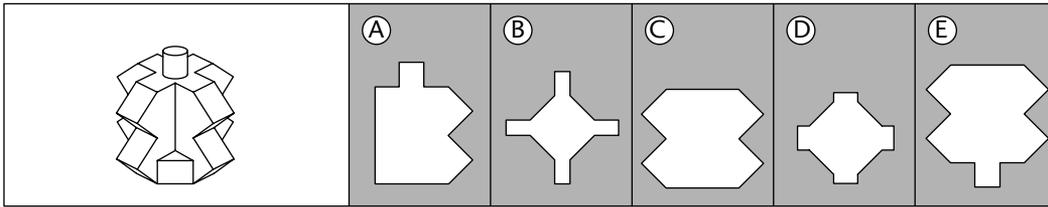
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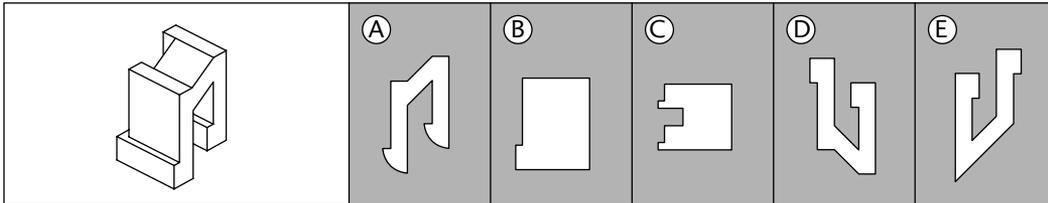
13.
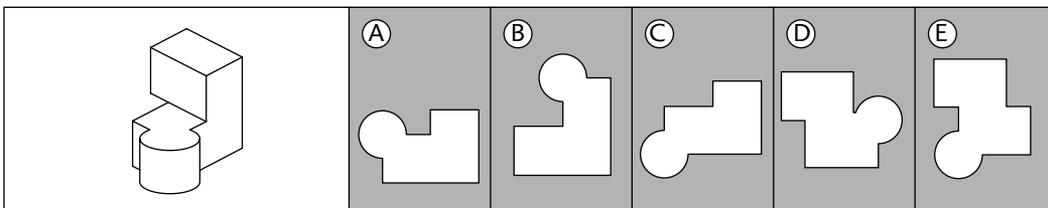
14.
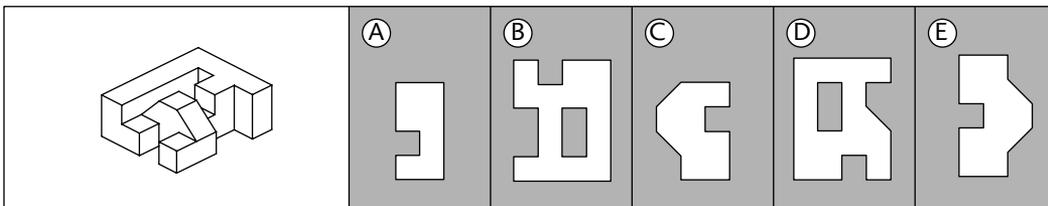
15.
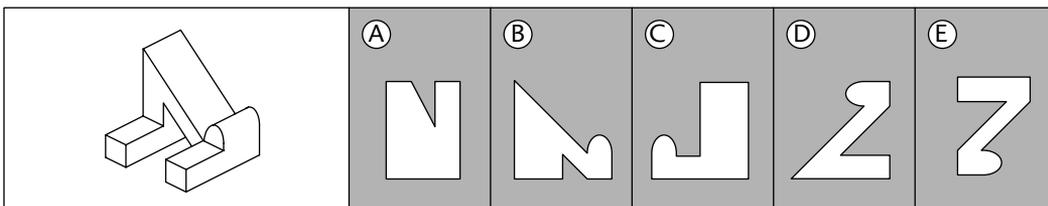
Part 2

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.

TOP VIEW

TOP VIEW

END VIEW

FRONT VIEW

FRONT VIEW

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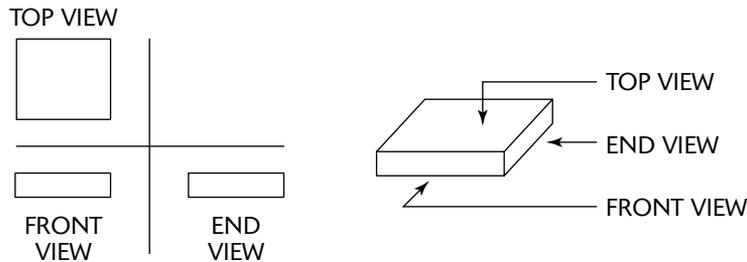
If there were a hole in the block, the views would look like this:

TOP VIEW

FRONT VIEW

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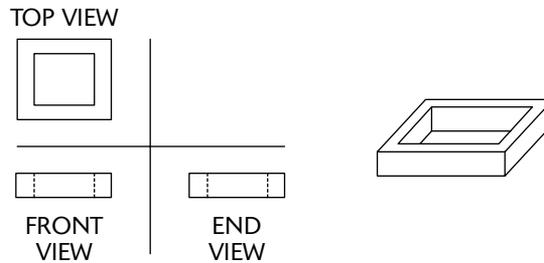
Note that lines that cannot be seen on the surface in some particular view are dotted in that view.

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.

TOP VIEW

FRONT VIEW   END VIEW

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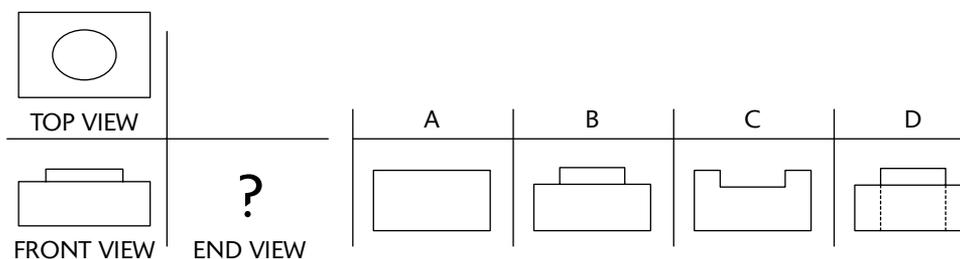
The front view shows that there is a smaller block on the base and that there is no hole. The top view shows that the block is round and in the center of the base. The answer, therefore, must be B.

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.

16. Choose the correct TOP VIEW.
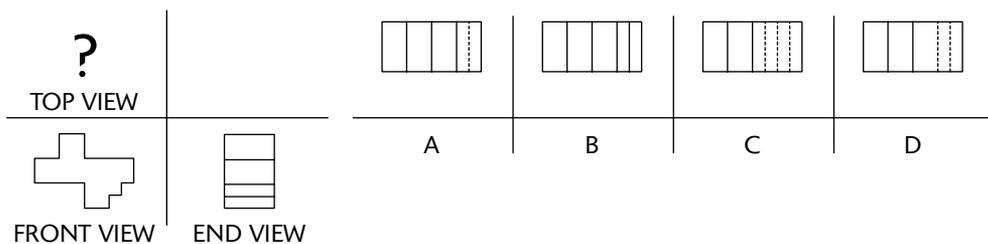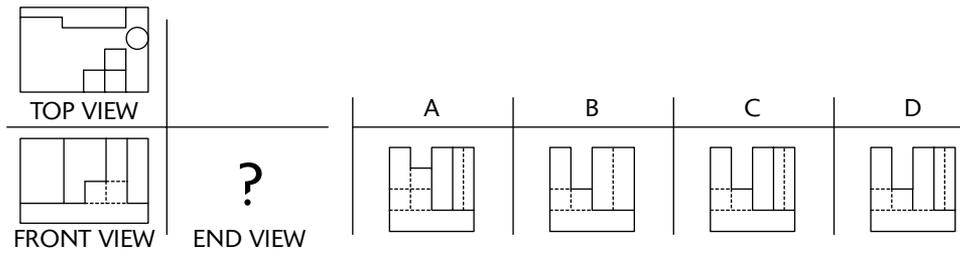

17. Choose the correct TOP VIEW.
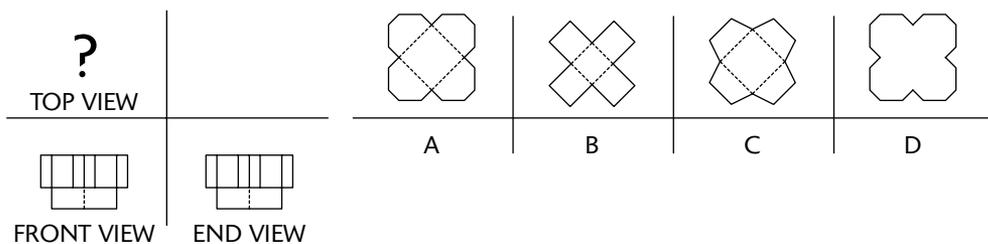
18. Choose the correct TOP VIEW.
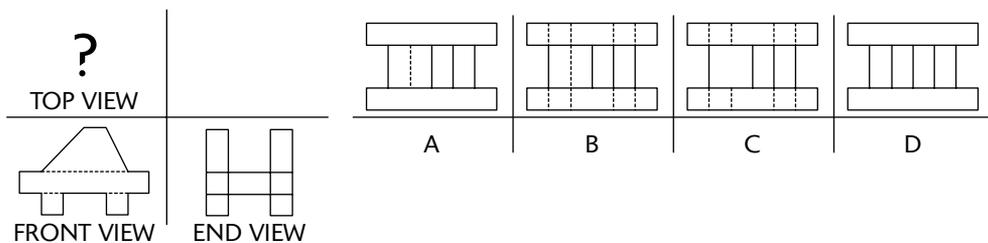
19. Choose the correct END VIEW.
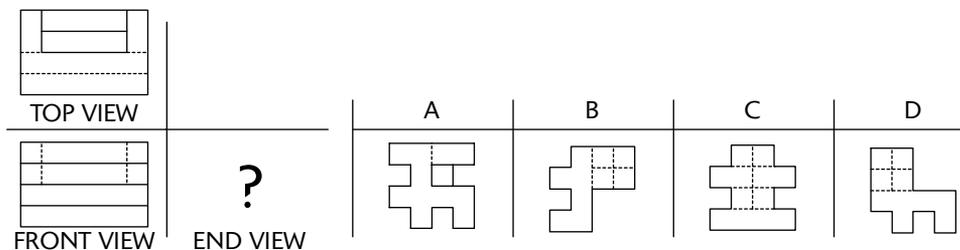
20. Choose the correct FRONT VIEW.
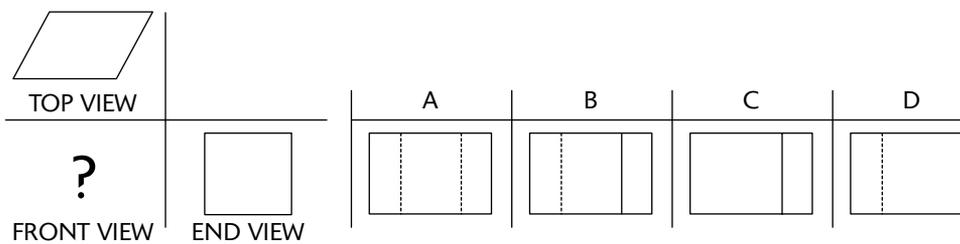
312

21. Choose the correct END VIEW.
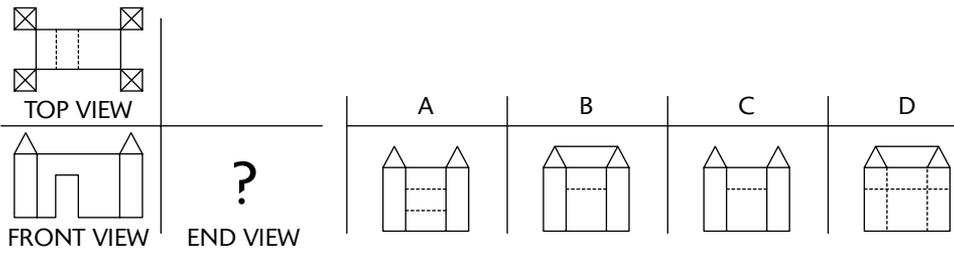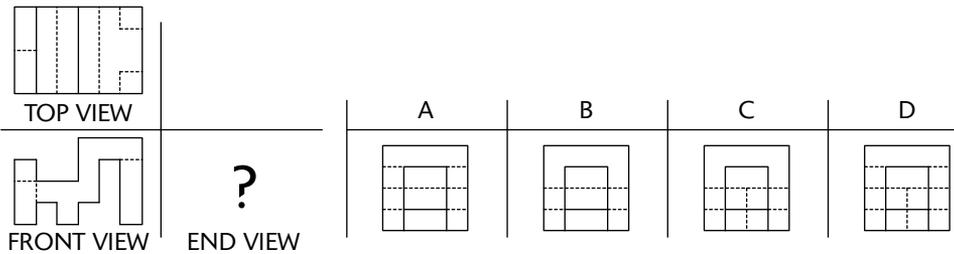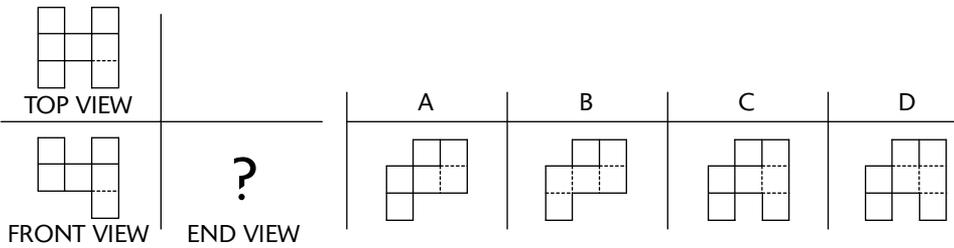
TOP VIEW

FRONT VIEW   END VIEW

A   B   C   D

22. Choose the correct END VIEW.

TOP VIEW

FRONT VIEW   END VIEW

A   B   C   D

23. Choose the correct END VIEW.

TOP VIEW

FRONT VIEW   END VIEW

A   B   C   D

24. Choose the correct TOP VIEW.

TOP VIEW

FRONT VIEW   END VIEW

A   B   C   D

25. Choose the correct END VIEW.

TOP VIEW

FRONT VIEW   END VIEW

?

A   B   C   D

26. Choose the correct END VIEW.

TOP VIEW

FRONT VIEW   END VIEW

?

A   B   C   D

27. Choose the correct END VIEW.

TOP VIEW

FRONT VIEW   END VIEW

?

A   B   C   D

28. Choose the correct TOP VIEW.

?

TOP VIEW

FRONT VIEW   END VIEW

A   B   C   D

29. Choose the correct FRONT VIEW.

TOP VIEW

FRONT VIEW | END VIEW

A | B | C | D
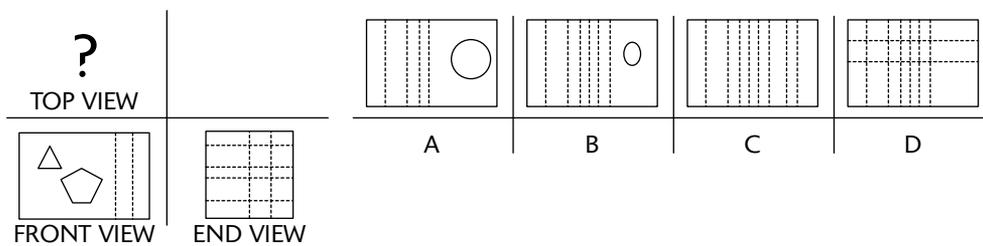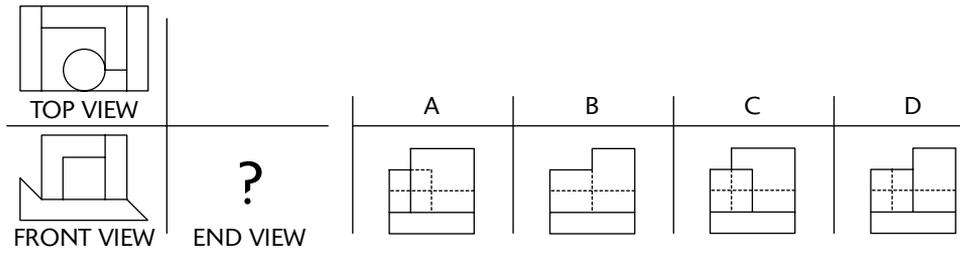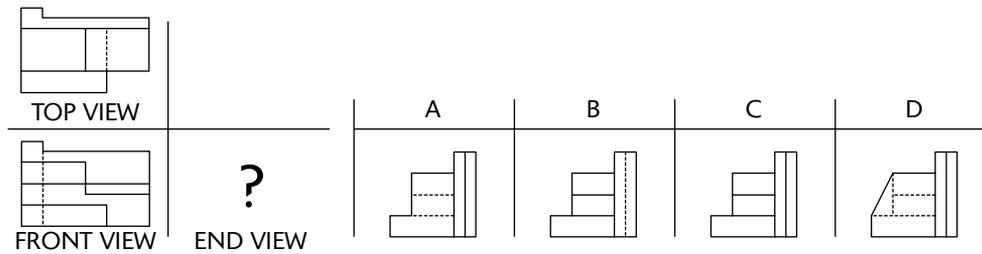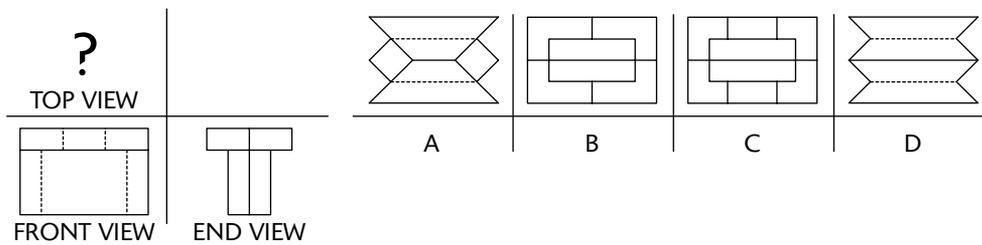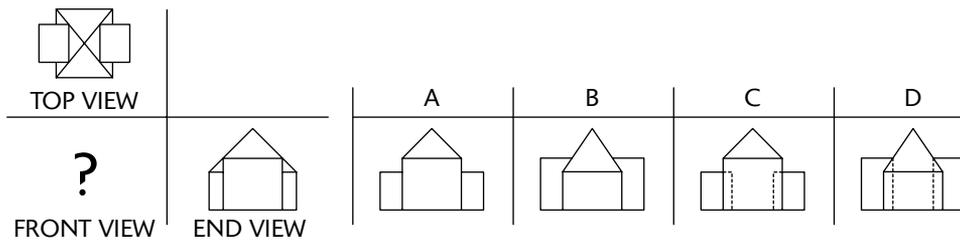
30. Choose the correct TOP VIEW.

TOP VIEW

FRONT VIEW | END VIEW

A | B | C | D
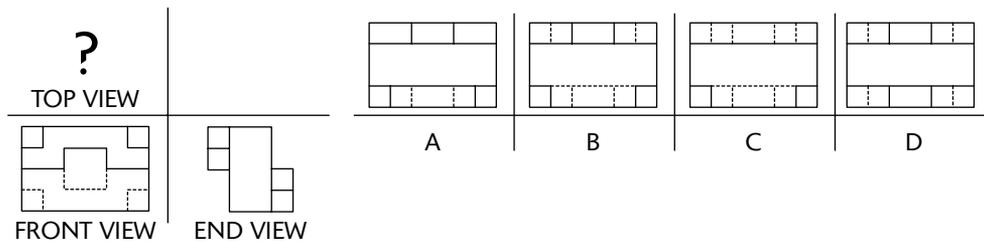
Part 3

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:
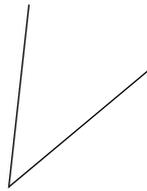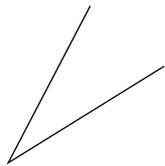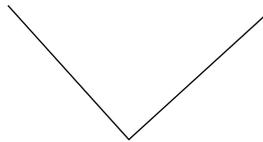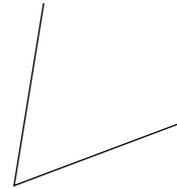
| 1 | 2 | 3 | 4 |

    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.
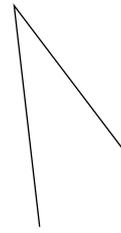
Proceed to Questions 31–45.

31.

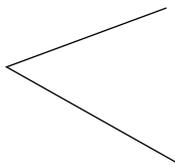1   2   3   4
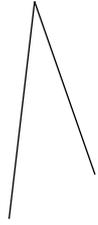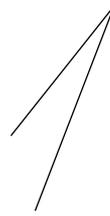
- **A.** 3 – 1 – 2 – 4
- **B.** 3 – 1 – 4 – 2
- **C.** 1 – 3 – 2 – 4
- **D.** 1 – 2 – 3 – 4

32.
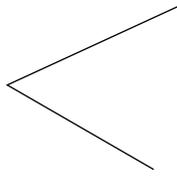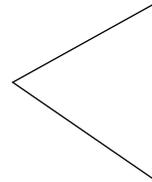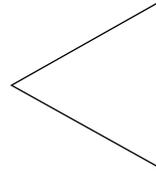
1   2   3   4

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

33.
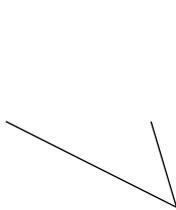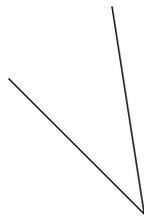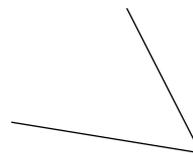
1   2   3   4

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

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34.
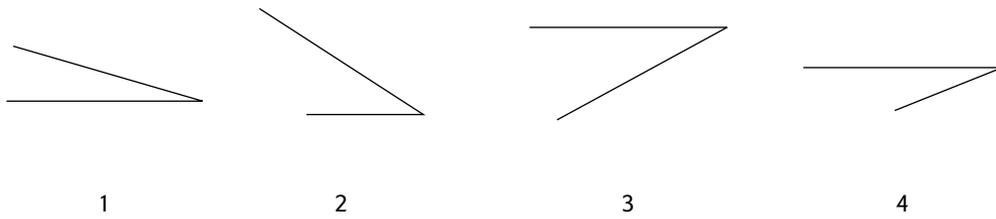
1   2   3   4

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

35.
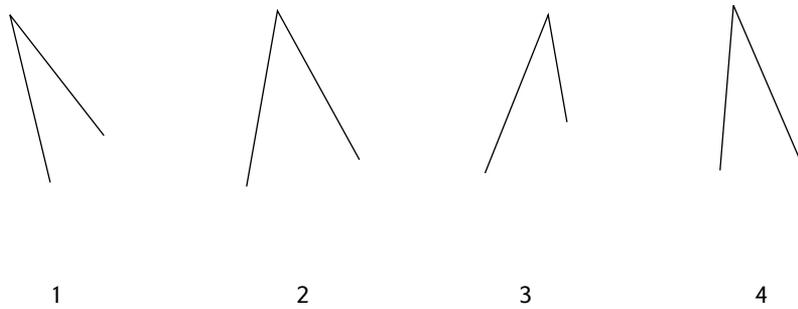
1   2   3   4

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

36.
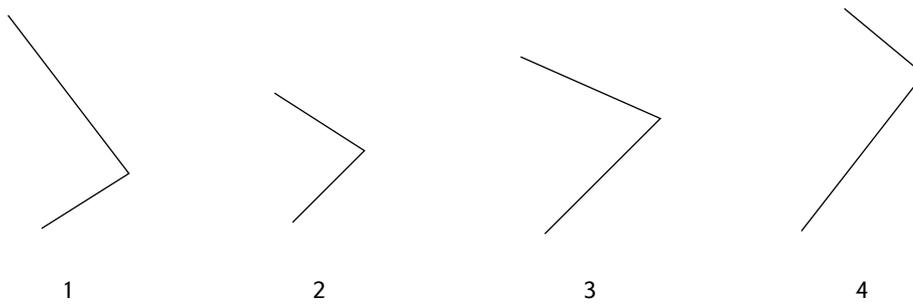
1   2   3   4

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

37.
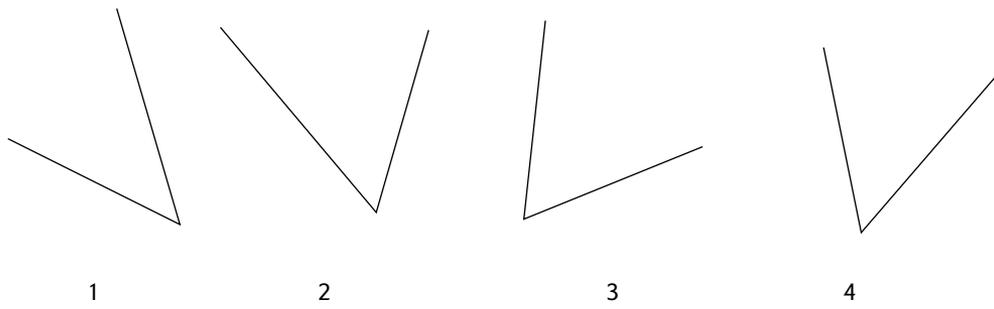
1   2   3   4

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

38.
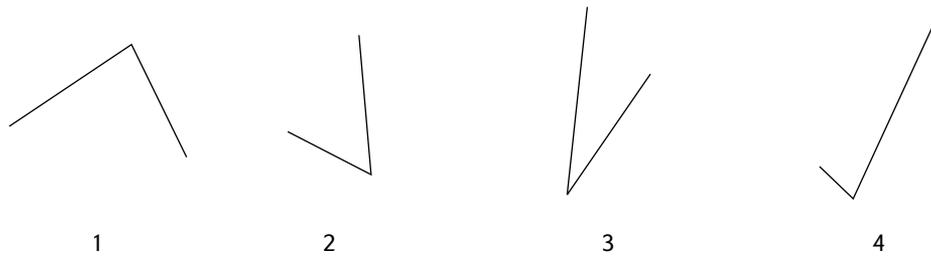
1   2   3   4

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

39.
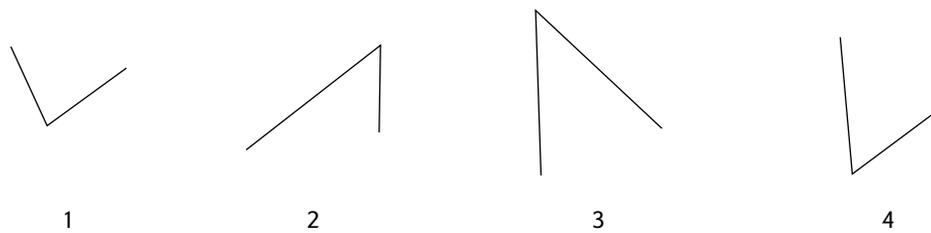
1   2   3   4

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

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40.
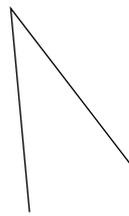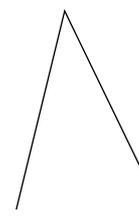
1   2   3   4

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

41.
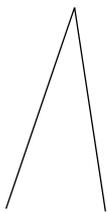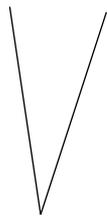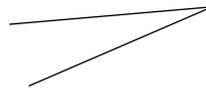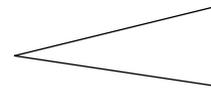
1   2   3   4

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

42.
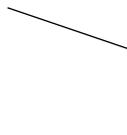
1   2   3   4

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

43.
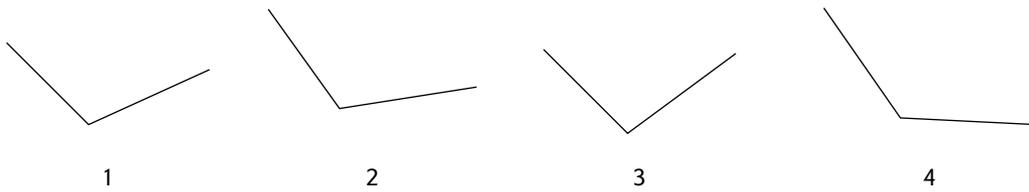
1   2   3   4

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

44.
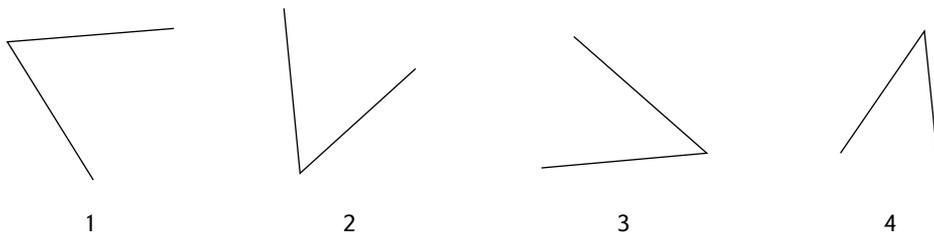
1   2   3   4

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

45.
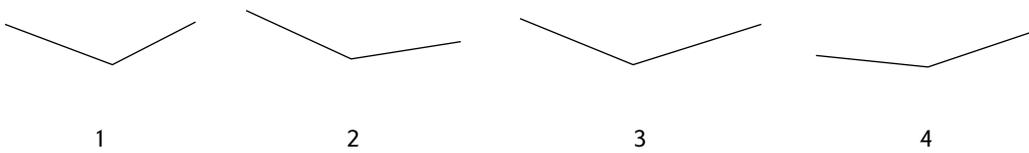
1   2   3   4

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

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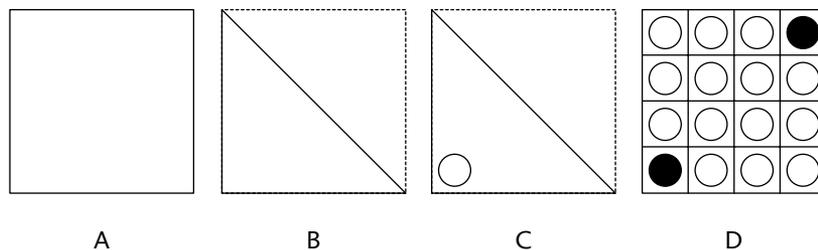
In Example 1, Figure A represents the original paper, unfolded. The second choice, B, represents the first fold. The third illustration shows where the hole is punched. After the paper is unfolded, there will be two holes represented by the dark circles in the last illustration (D).

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

Example 2:
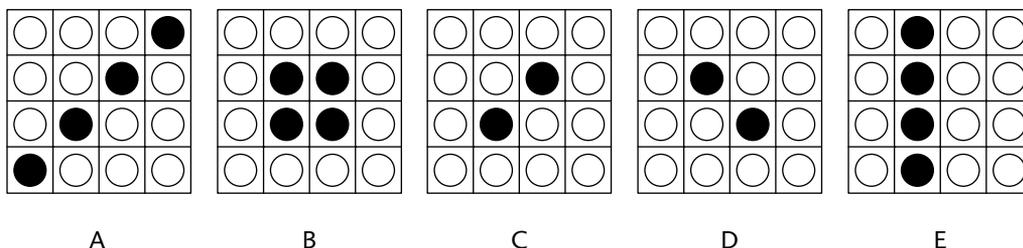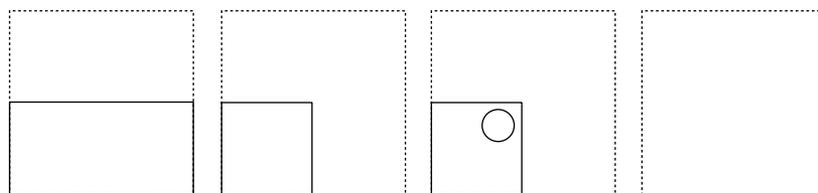
The correct answer to this example is B. With one fold, you would have two holes punched. With two folds, you will have four holes punched.

Proceed to Questions 46–60.

46.

A   B   C   D   E

47.
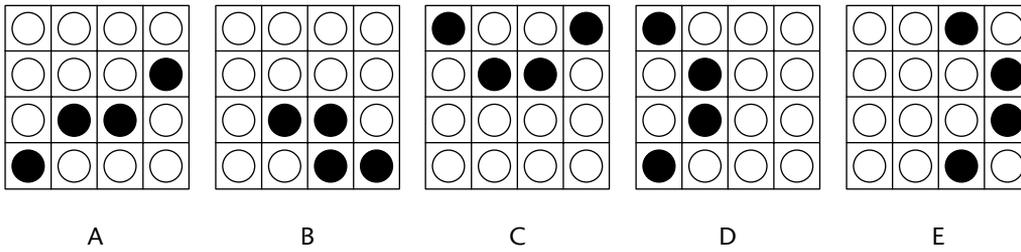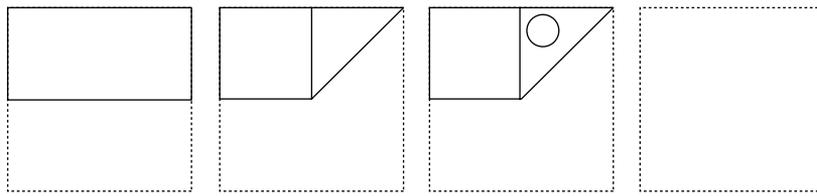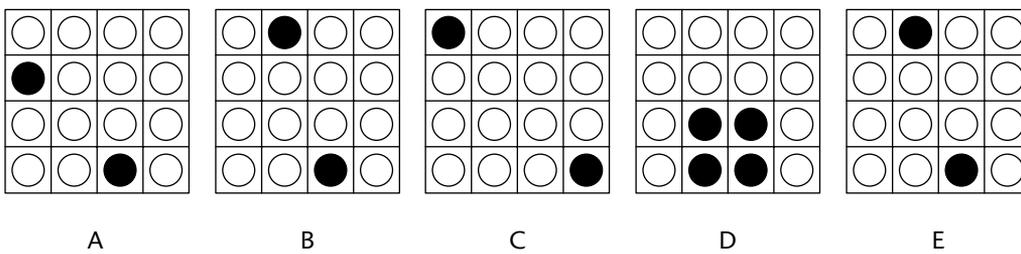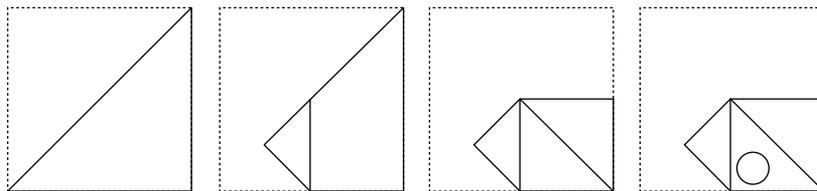
A   B   C   D   E

GO ON TO THE NEXT PAGE

48.
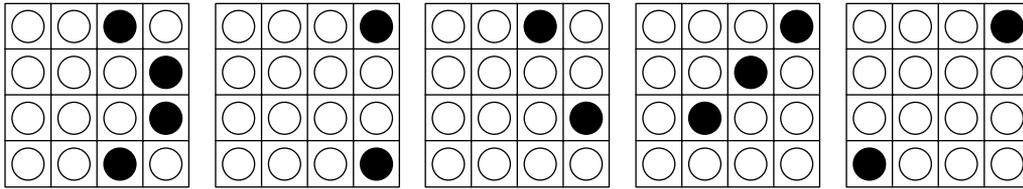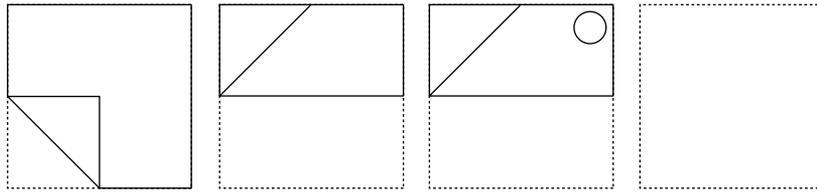
      A   B   C   D   E

49.
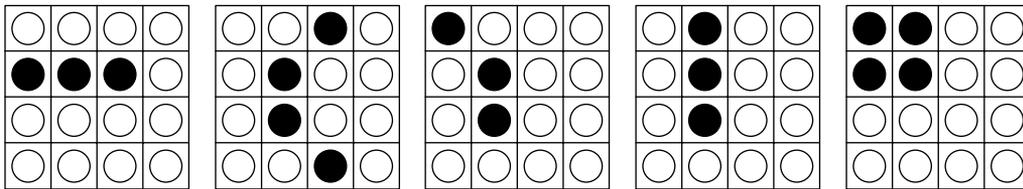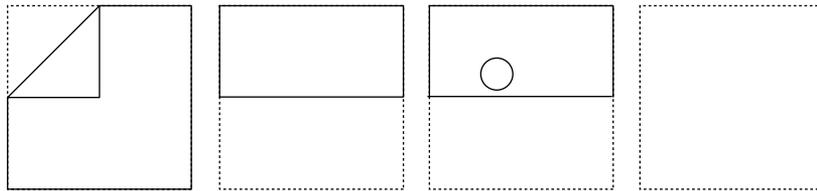
      A   B   C   D   E

50.
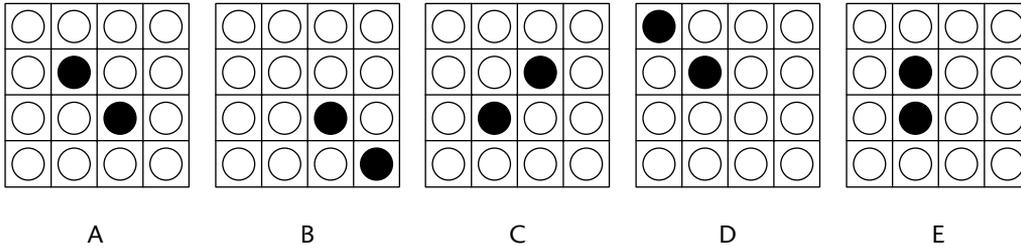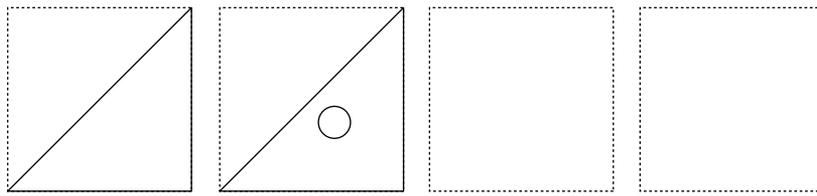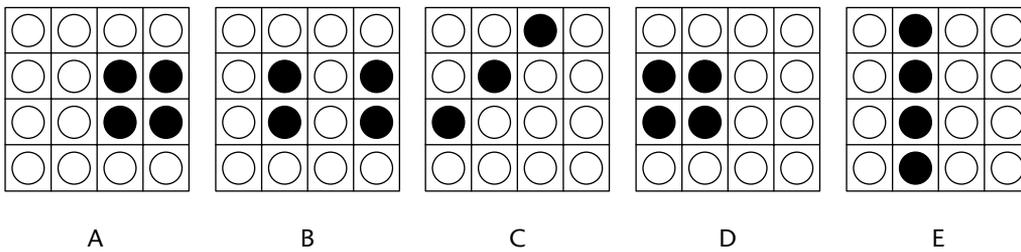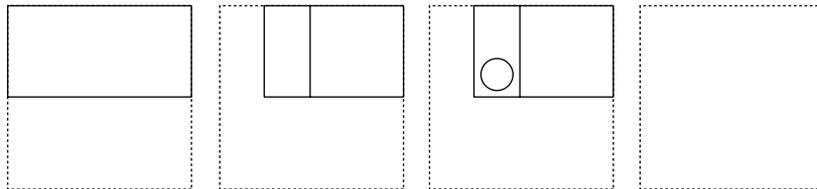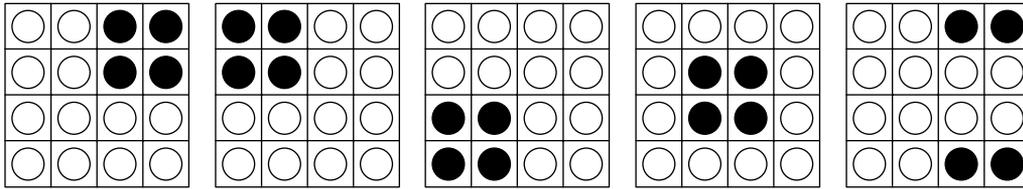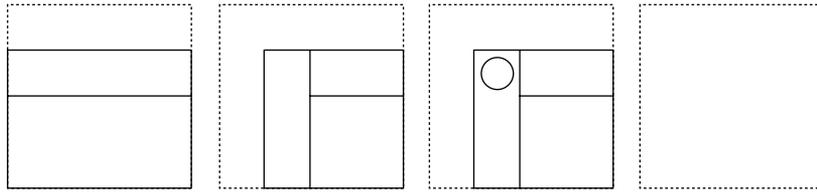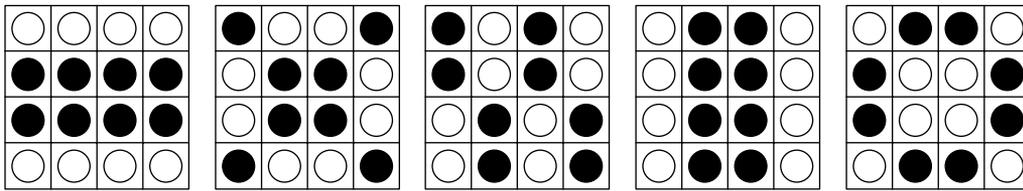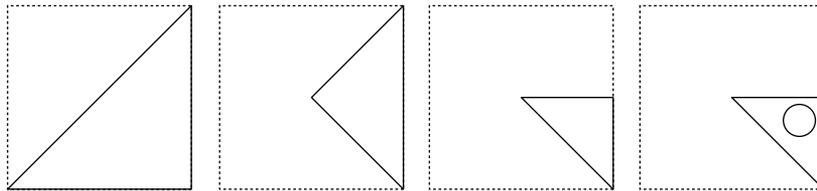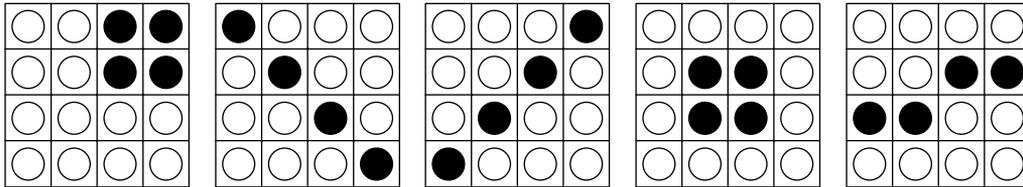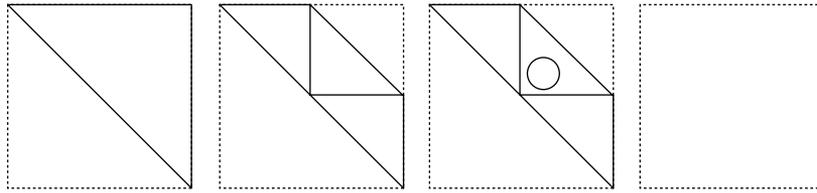
A B C D E

51.

A B C D E

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52.

A   B   C   D   E

53.

A   B   C   D   E

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A B C D E

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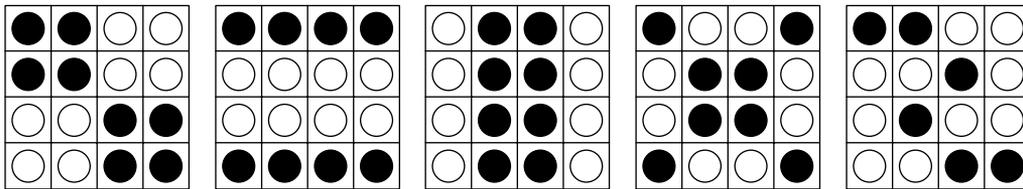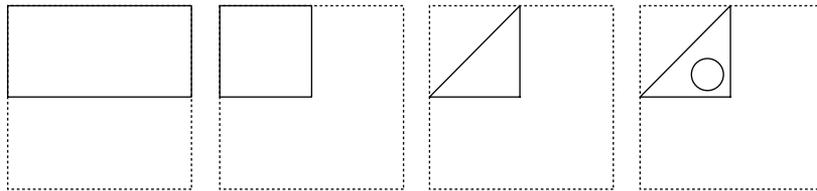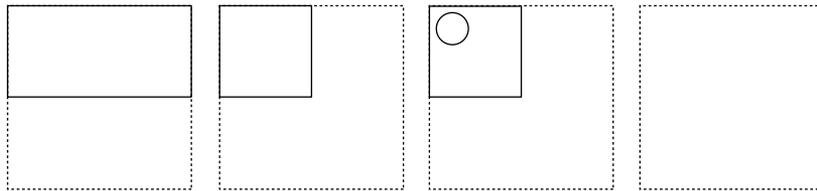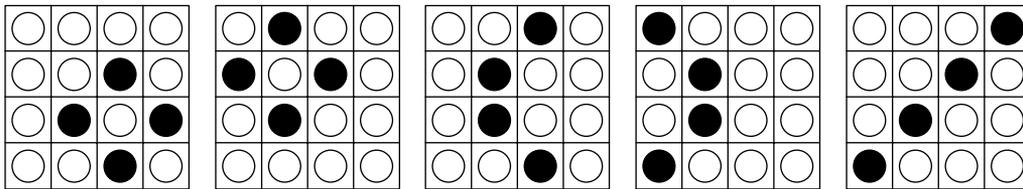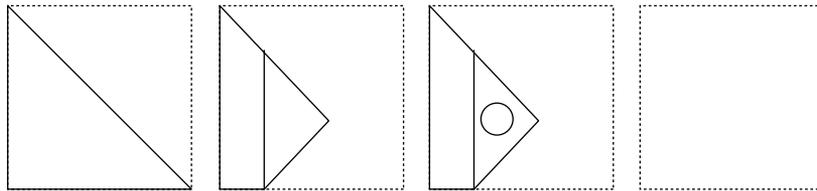
A B C D E

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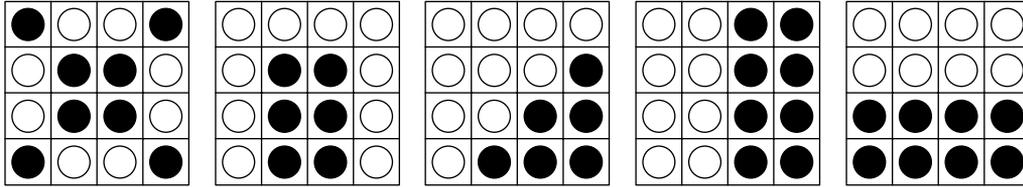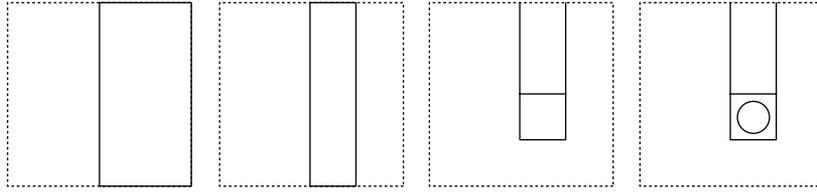
A   B   C   D   E

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 there 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?
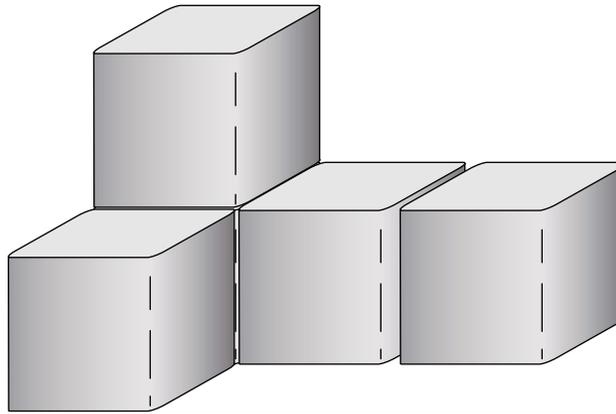
Figure 1

    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.
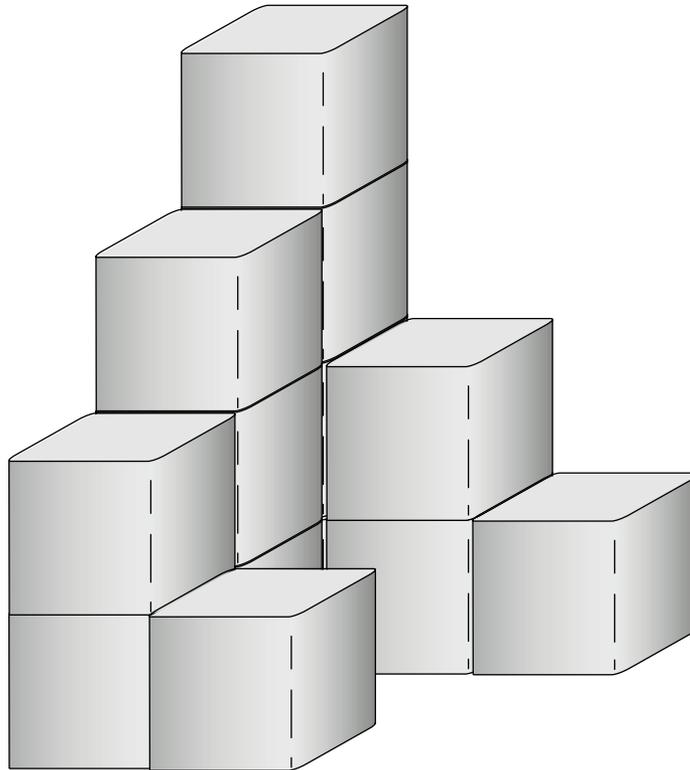
Figure A

61. 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

62. 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

63. In Figure A, 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
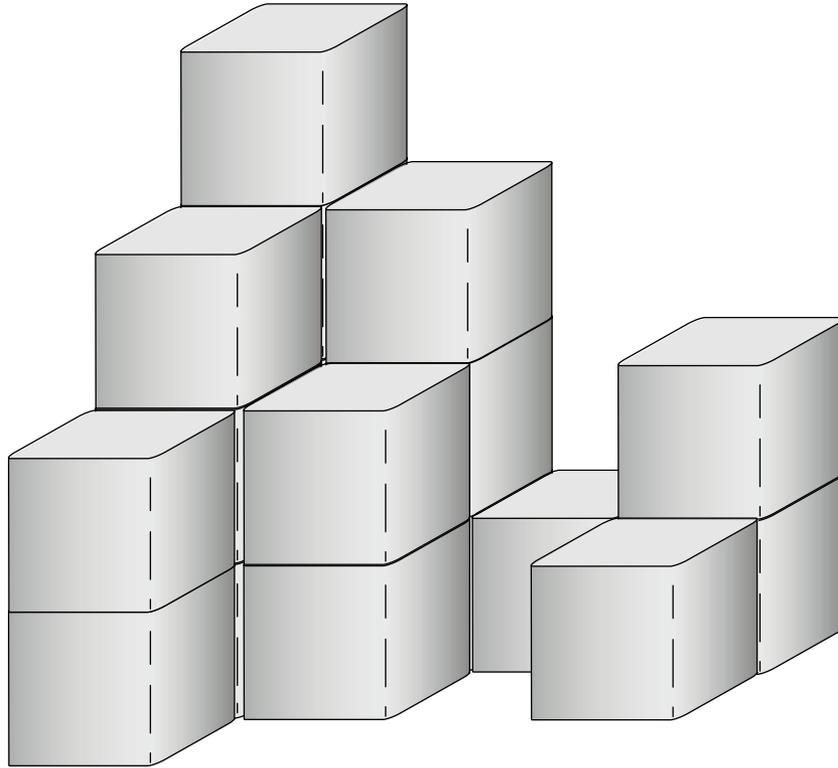
Figure B

64 In Figure B, 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

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

66. In Figure B, 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

67. In Figure B, 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
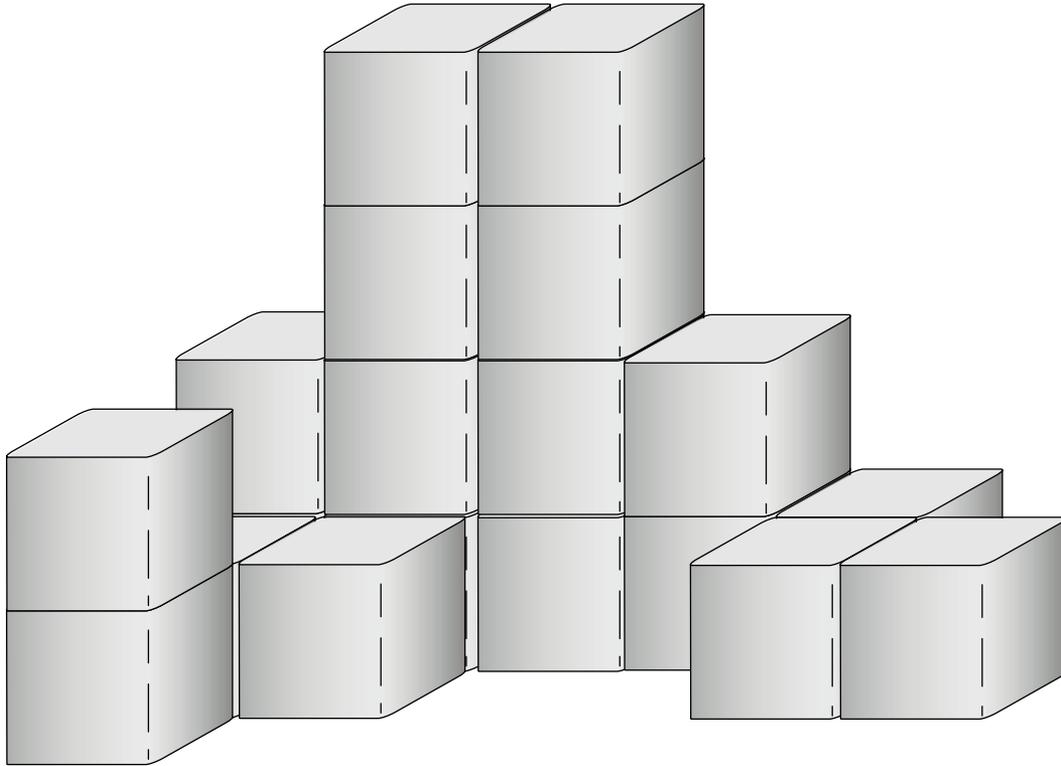
Figure C

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

69. In Figure C, 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
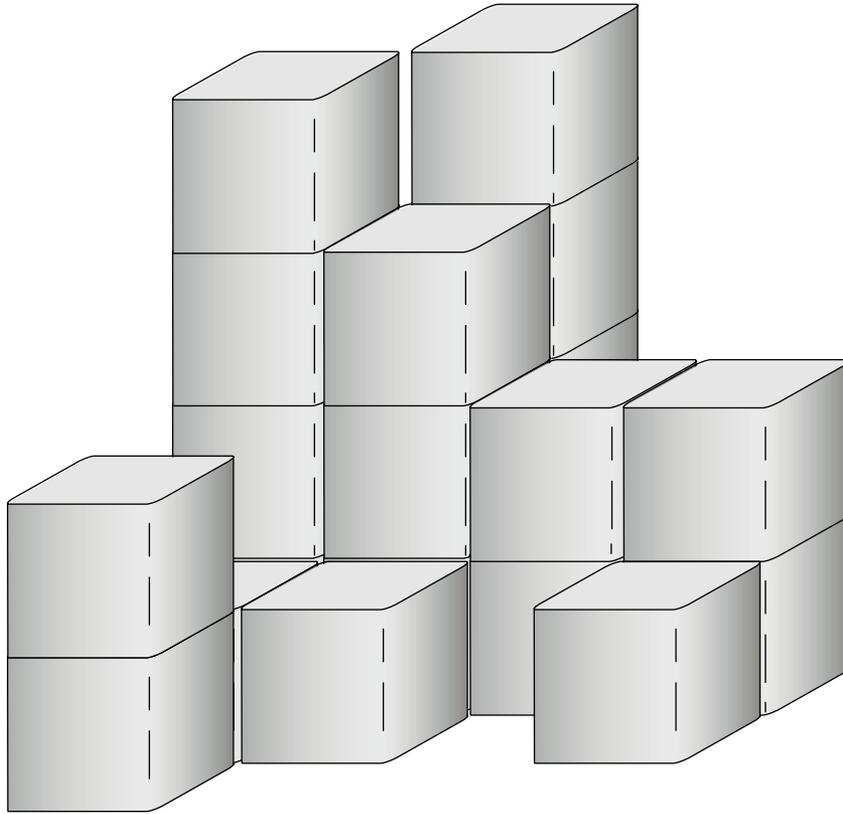
Figure D

70. 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

71. 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

72. 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

GO ON TO THE NEXT PAGE

73. 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
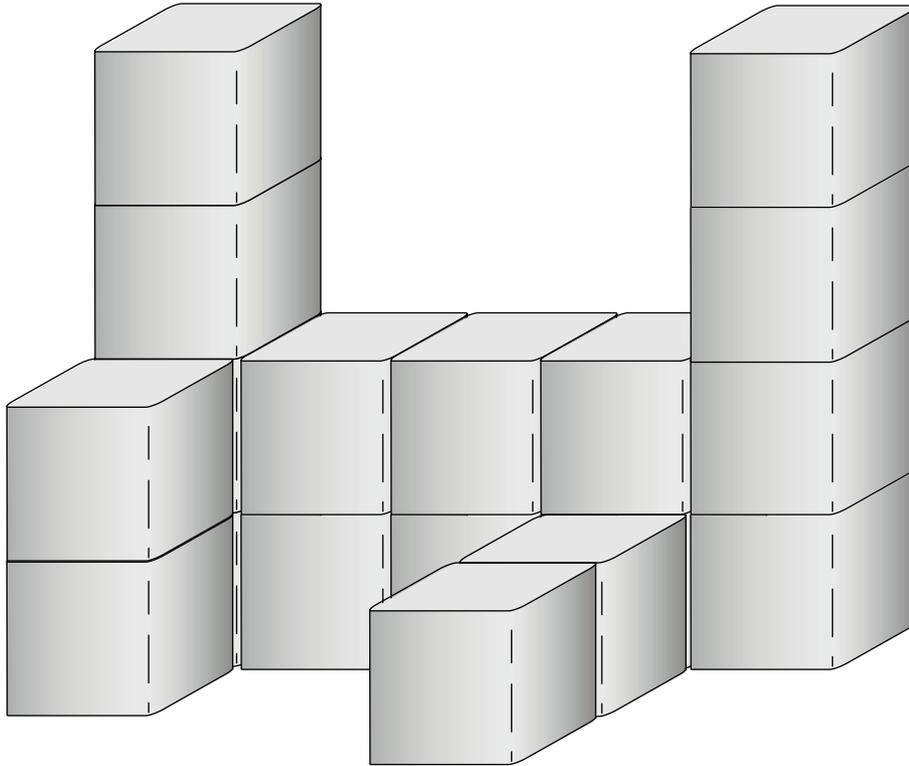
Figure E

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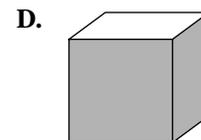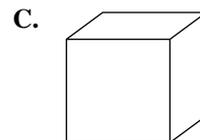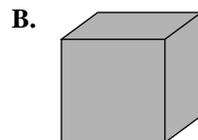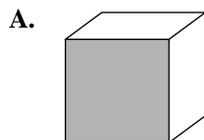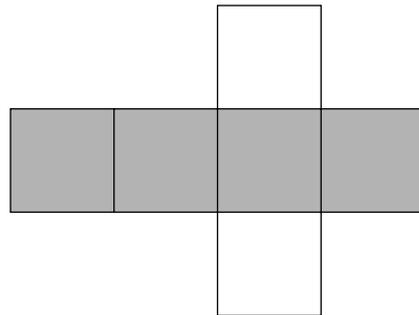
One of the preceding figures (A, B, C, or D) can be formed from the flat pattern in the center. The only figure that corresponds to the pattern is D. If the shaded surfaces are looked at as the sides of the box, then all four sides must be shaded, while the top and the bottom are white.

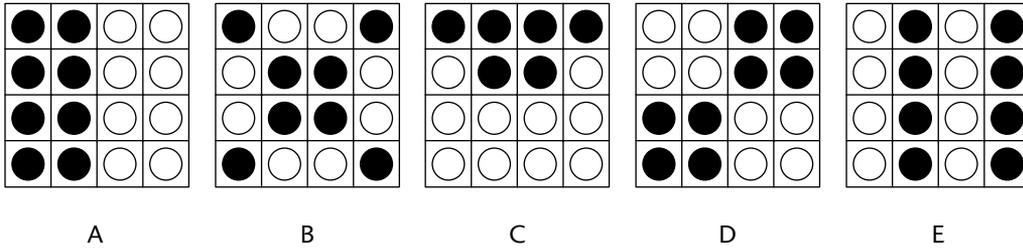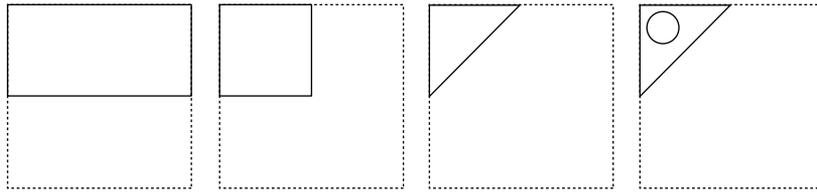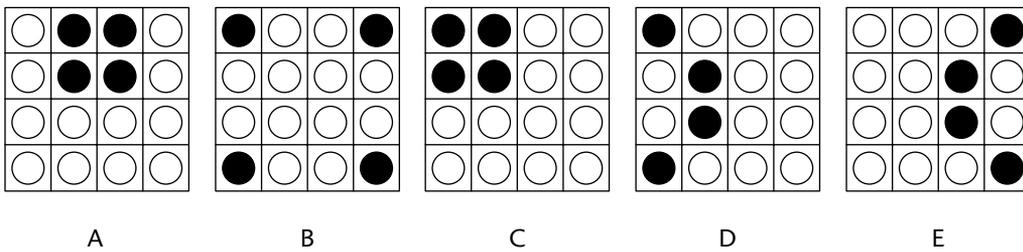Proceed to Questions 76–90.

76.
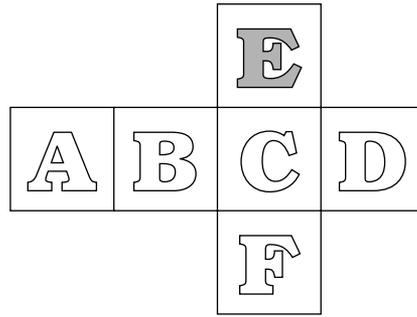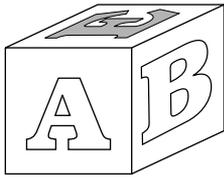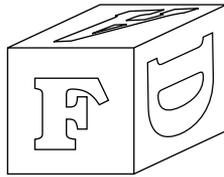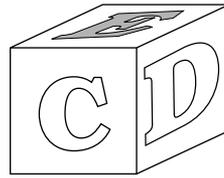
A.   B.   C.   D.
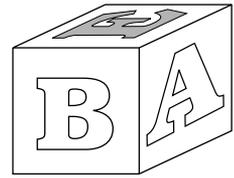
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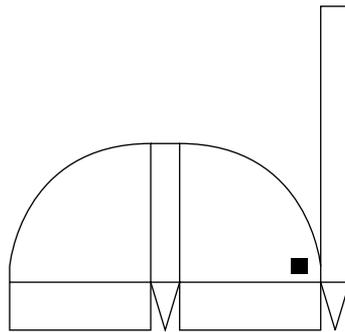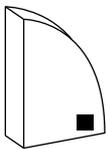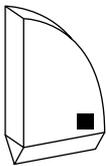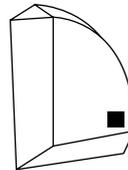
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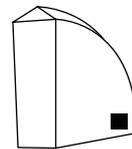
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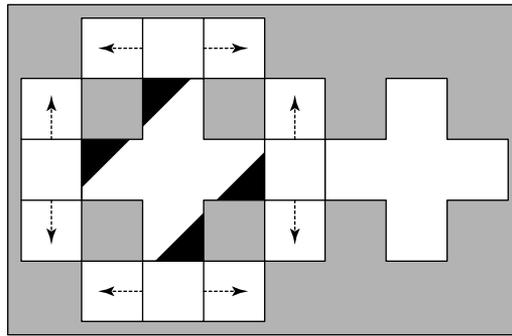
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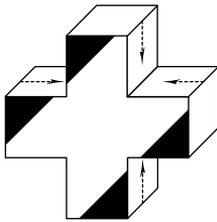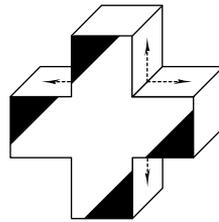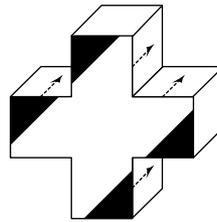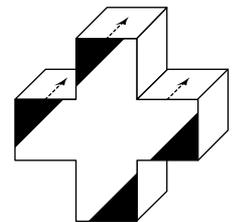
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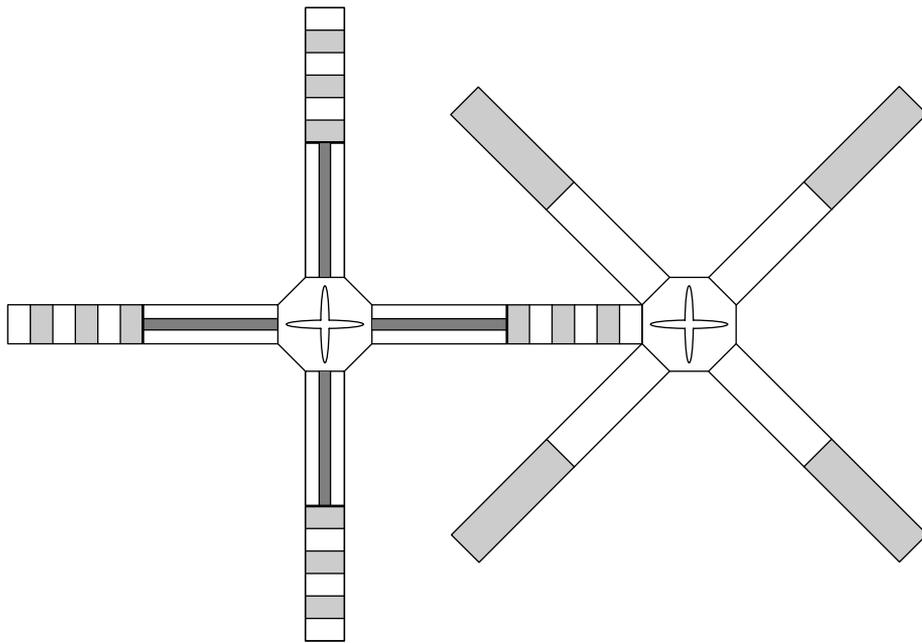
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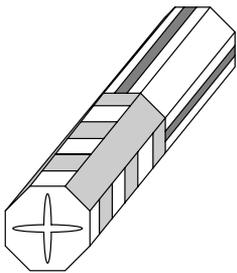
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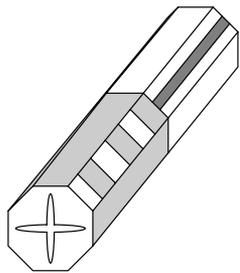
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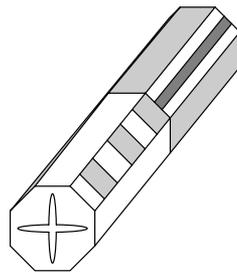
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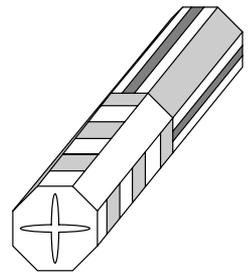
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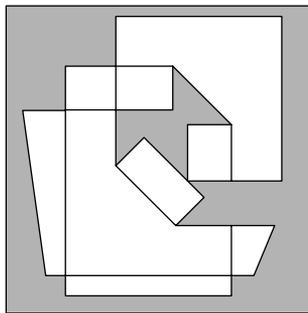
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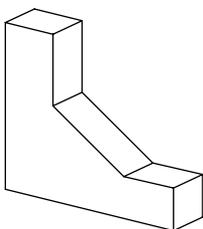
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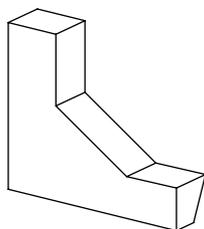
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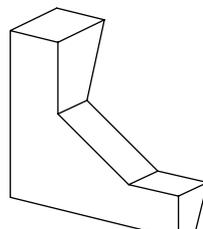
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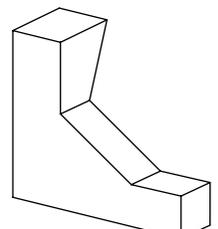
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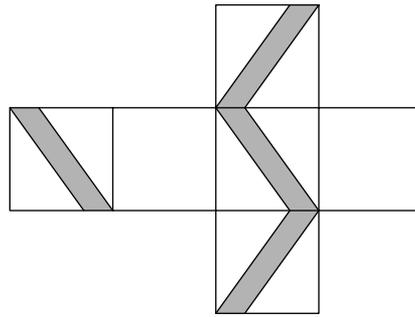
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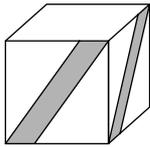
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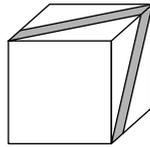
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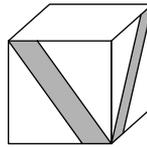
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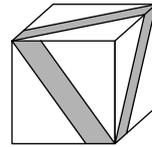
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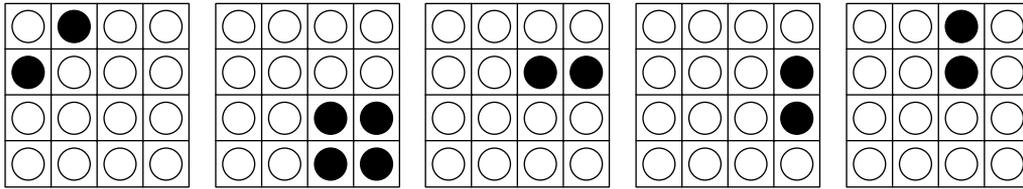
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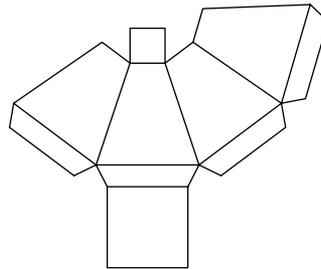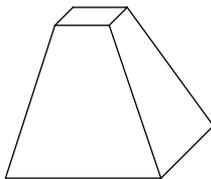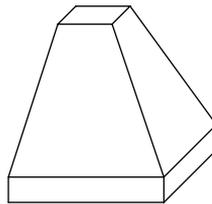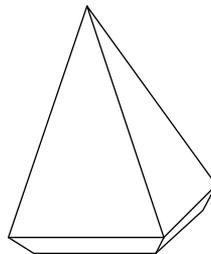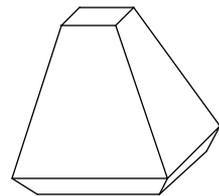
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83.

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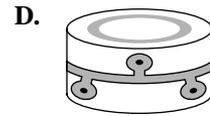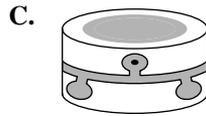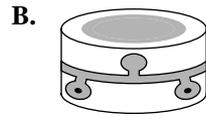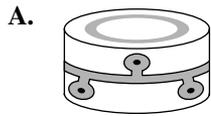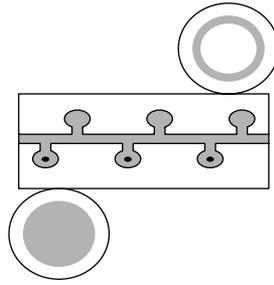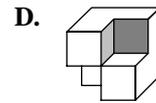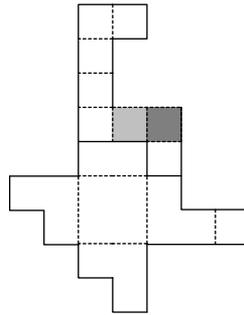
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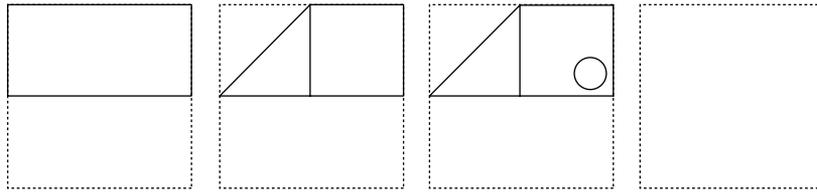
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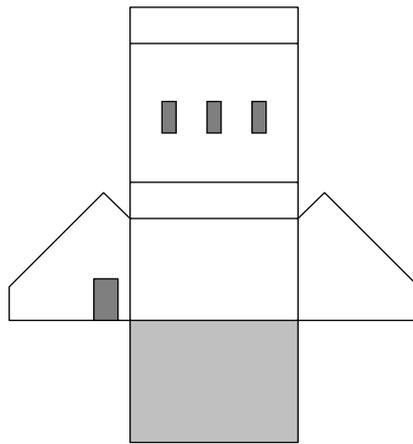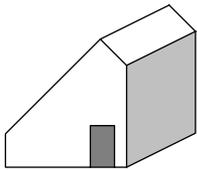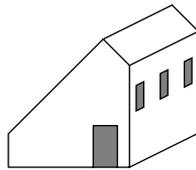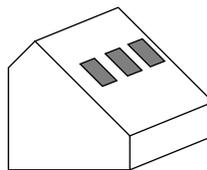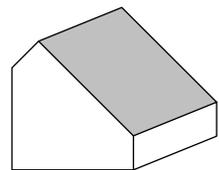
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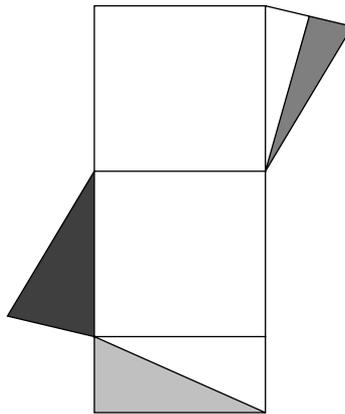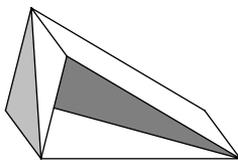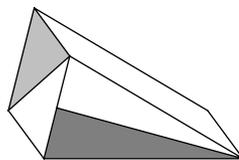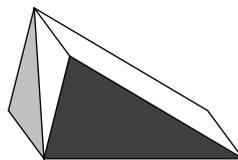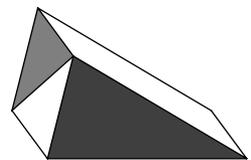
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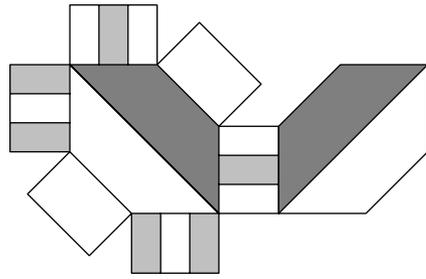
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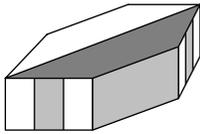
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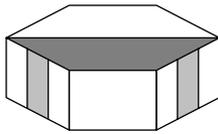
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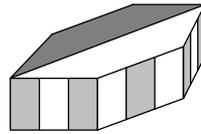
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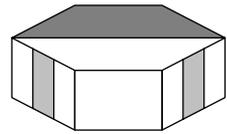
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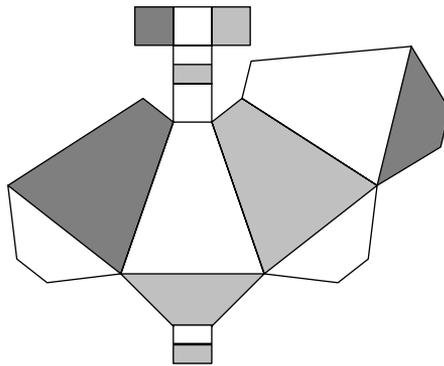
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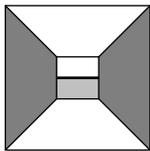
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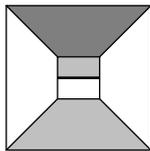
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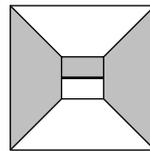
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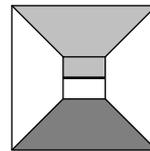
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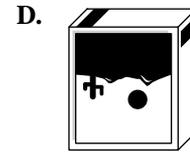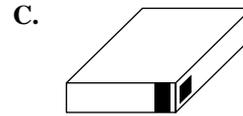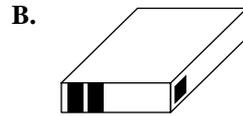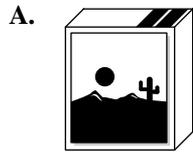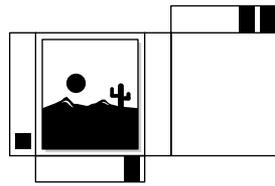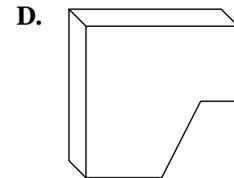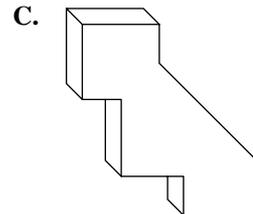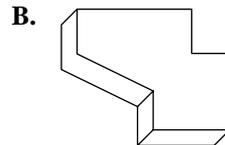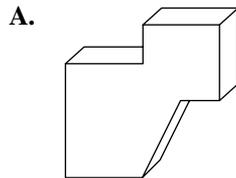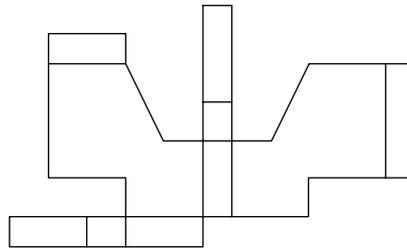
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Reading Comprehension

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

Tube worms live anchored to the sea floor, 1,700 feet below the ocean surface, near natural spring vents that spew forth water from the Earth. They live off geothermal energy instead of sunlight. There are two species of the tube worm family, with very different lengths of life and growth rates, but similarities as well.

The slow-growing tube worms are known to live as long as 250 years, making them the longest-living sea invertebrates known. This species lives near cold sea-floor seeps and may not grow at all from one year to the next. Even when they do grow, it is generally from a half an inch to four inches per year. In spite of their slow growth, due to their long lives, they can reach nine feet before they die, although they are thinner than the hot-water worms.

The seeps under the slow-growing tube worms are rich with oily materials. The environment in which they live is slow and peaceful, stable, and low-energy. The cold-water seeps and the tube worms that reside there may live hundreds or thousands of years.

In stark contrast, the fast-growing tube worms live a quick and short life, growing rapidly. They attach themselves near hot steaming vents that force water into the sea, growing about two and a half feet a year, and up to eight feet overall. They live by absorbing sulfur compounds metabolized by bacteria in a symbiotic relationship.

The hot water vents spew forth scalding water filled with hydrogen sulfide, which the tiny bacteria living in the worms' tissues consume. These tube worms live a rapid life, with none of the relaxing characteristics of the cold-water tube worms.

1. The word anchored in the first sentence is closest in meaning to

   A. affixed.
   B. contentedly.
   C. feeding.
   D. above.

2. The expression *spew forth* in the first sentence is closest in meaning to

   A. inhale.
   B. discharge.
   C. control.
   D. eliminate.

3. The author implies that a vent and a seep are

   A. the same.
   B. different in that a vent involves rapid discharge while a seep involves slow discharge.
   C. different in that a vent involves discharge while a seep involves intake.
   D. different in that a vent involves slow discharge while a seep involves rapid discharge.

4. The passage indicates that the two types of tube worms discussed are

   A. from totally different families.
   B. different in that one is not a true tube worm at all.
   C. from the same family but different species.
   D. from the same species and only differ because of habitat.

5. The author states that the cold-water tube worm

   A. grows slower than the hot-water tube worm.
   B. grows faster than the hot-water tube worm.
   C. does not grow as high as the hot-water tube worm.
   D. does not live as long as the hot-water tube worm.

6. The word *stark* in the fourth paragraph is closest in meaning to

    A. complete.

    B. somewhat.

    C. comparative.

    D. interesting.

7. The word *overall* in the fourth paragraph is closest in meaning to

    A. lifetime.

    B. annually.

    C. generally.

    D. rapidly.

8. The word *scalding* in the last paragraph is closest in meaning to

    A. hydrogen-filled.

    B. bacteria-filled.

    C. boiling.

    D. rapidly spewing.

9. The author indicates that the ingredients in the water that come from the two types of vents are

    A. different only because the heat of the hot vents destroys the oil as it spews forth.

    B. different in that one contains bacteria and the other contains oily materials.

    C. the same.

    D. different in that one contains oily materials and the other contains hydrogen sulfide.

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Passage 2

A new procedure has been developed to treat aneurysms, particularly those that occur near the brain stem, where surgery is dangerous.

Aneurysms are blood sacs formed by the enlargement of the weakened wall of an artery or vein. They are dangerous and, thus, must generally be removed before they cause considerable damage. If one ruptures, it can cause strokes or fatal hemorrhaging, the latter of which occurs in 50 percent of all patients. Before rupturing, an aneurysm frequently shows no sign or symptom that it exists. Brain aneurysms occur in approximately 5 percent of the population. Most patients are between 40 and 65 years old, with hemorrhages most prevalent in those between 50 and 54.

The new procedure involves inserting a soft, flexible micro-catheter through the femoral artery in the groin area and snaking it up through blood vessels to the brain. Inside the catheter is a small, coiled wire, which can be extruded after it reaches its destination. After the coil is outside the catheter, a low voltage electrical current is applied, and the coil detaches at a preset solder point. Additional coils are snaked through the catheter and also detached at the site, creating a basket, or metal framework, which causes the blood to clot around it. The micro-catheter is withdrawn, the clot remains, and the healed aneurysm no longer is exposed to the stress that can cause another rupture.

The procedure lasts two hours, which is half as long as invasive surgery, and recovery time is generally limited to a few days instead of a few weeks. The procedure was discovered in the 1990s, was approved by the U.S. Food and Drug Administration in 1995, and is available in various hospitals where there are advanced neurology departments and specialists trained in the procedure. Many lives have been saved by use of the procedure, because the alternative would have been to watch and wait rather than risk the hazards of surgery.

10. The author implies that the procedure described is useful for

    A. all aneurysms.
    B. aneurysms that occur anywhere in the brain.
    C. aneurysms that occur near the brain stem only.
    D. aneurysms that occur near large blood vessels.

11. The word *They* in the first paragraph refers to

    A. aneurysms.
    B. brain stems.
    C. surgeries.
    D. procedures.

12. The word *considerable* in the second paragraph is closest in meaning to

    A. slight.
    B. kind.
    C. significant.
    D. recurring.

13. The word *one* in the second paragraph refers to

    A. brain stem.
    B. aneurysm.
    C. procedure.
    D. surgery.

14. The word *snaking* in the third paragraph is closest in meaning to

    A. meandering.
    B. extruding.
    C. living.
    D. damaging.

15. The word *withdrawn* in the third paragraph is closest in meaning to

    A. removed.
    B. too large.
    C. charged.
    D. inserted.

16. An aneurysm is most similar to

    A. an ulcer.
    B. a hernia.
    C. a heart attack.
    D. cancer.

17. The author indicates that half of the patients who have a brain aneurysm could also have

    A. a stroke.
    B. a seizure.
    C. a heart attack.
    D. hemorrhaging that results in death.

18. The author indicates that the point of creating a basket near the aneurysm is to

    A. catch the aneurysm when it breaks off.
    B. serve as a base for a blood clot to form.
    C. dissolve the aneurysm.
    D. provide a means of studying the aneurysm.

19. The author indicates that the femoral artery is

    A. small.
    B. in the upper thigh.
    C. in the brain.
    D. connected to the brain.

20. The author states that the electrical charge is applied in order to

    A. stimulate the brain.
    B. stimulate the aneurysm.
    C. dissolve the aneurysm.
    D. separate the coil from the wire.

21. The author implies that the wire breaks off

    A. randomly.
    B. by being cut with an additional tool.
    C. at a predetermined and prepared location on the wire.
    D. inside the micro-catheter.

22. According to the passage, traditional surgical techniques take

    A. longer and require more recuperation time than the new procedure.
    B. longer but require less recuperation time than the new procedure.
    C. less time and require less recuperation time than the new procedure.
    D. less time but require longer recuperation time than the new procedure.

23. The author implies that the new procedure

    A. can be performed at any hospital.
    B. is performed only at hospitals containing the required equipment and certified doctors.
    C. is performed by certified doctors but requires no special equipment.
    D. is performed by any surgeon using special equipment.

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Passage 3

Scientists have discovered the bones of what may be the largest meat-eating dinosaur ever to walk the Earth. The discovery was made by a team of researchers from Argentina and North America in Patagonia, a desert on the eastern slopes of the Andes in South America. Besides the interesting fact that the dinosaur was huge and horrifying, it is even more astounding that the bones of a number of the dinosaurs were found together. This discovery challenges the prior theory that the biggest meat-eaters lived as loners and instead indicates that they may have lived and hunted in packs. The Tyrannosaurus Rex lived in North America and was believed to hunt and live alone.

The newly discovered meat-eater appears to be related to the Giganotosaurus family, being as closely related to it as a fox would be to a dog. It is actually not of the same family at all as the Tyrannosaurus Rex, being as different from it as a cat is from a dog.

The fossilized remains indicate that the animals lived about 100 million years ago. With needle-shaped noses and razor sharp teeth, they were larger than the Tyrannosaurus Rex, although their legs were slightly shorter, and their jaws were designed to be better able to dissect their prey quickly and precisely.

24. The author states that the newly discovered dinosaur remains are evidence that it was the largest

   A. dinosaur ever.
   B. carnivorous dinosaur.
   C. herbivorous dinosaur.
   D. South American dinosaur.

25. The word *besides* in the first paragraph is closest in meaning to

   A. in spite of.
   B. in addition to.
   C. although.
   D. mostly.

26. The word *horrifying* in the first paragraph is closest in meaning to

   A. frightening.
   B. large.
   C. fast.
   D. interesting.

27. The word *astounding* in the first paragraph is closest in meaning to

   A. terrifying.
   B. pleasing.
   C. displeasing.
   D. surprising.

28. The author implies that the most interesting fact about the find is that this dinosaur

   A. lived and hunted with others.
   B. had a powerful jaw and sharp teeth.
   C. was found in the Andes.
   D. was larger than Tyrannosaurus Rex.

29. The passage indicates that prior to this discovery, scientists believed that

   A. meat-eating dinosaurs lived alone.
   B. there were no meat-eating dinosaurs in the Andes.
   C. Tyrannosaurus Rex lived in the Andes.
   D. meat-eating dinosaurs were small in stature.

30. The word *it* in the second paragraph refers to

   A. newly discovered meat-eater.
   B. relationship.
   C. *Giganotosaurus.*
   D. dog.

31. The author states that the newly discovered meat-eating dinosaur is

   A. closely related to Tyrannosaurus Rex.
   B. not closely related to Tyrannosaurus Rex.
   C. not closely related to Giganotosaurus.
   D. closely related to the large cat family.

32. The word *dissect* in the last sentence is closest in meaning to

   A. dismember.
   B. swallow.
   C. chew.
   D. escape.

33. The word *prey* in the last sentence of the passage is closest in meaning to

   A. victim.
   B. enemy.
   C. dinosaurs.
   D. attacker.

Passage 4

Scientists have developed a new bionic computer chip that can be mated with human cells to combat disease. The tiny device, smaller and thinner than a strand of hair, combines a healthy human cell with an electronic circuitry chip. Doctors can control the activity of the cell by controlling the chip with a computer.

It has long been established that cell membranes become permeable when exposed to electrical impulses. Researchers have conducted genetic research for years with a trial-and-error process of bombarding cells with electricity in an attempt to introduce foreign substances such as new drug treatments or genetic material. They were unable to apply a particular level of voltage for a particular purpose. With the new invention, the computer sends electrical impulses to the chip, which triggers the cell's membrane pores to open and activate the cell in order to correct diseased tissues. It permits physicians to open a cell's pores with control.

Researchers hope that eventually they will be able to develop more advanced chips, whereby they can choose a particular voltage to activate particular tissues, whether they be muscle, bone, brain, or others. They believe that they will be able to implant multiple chips into a person to deal with one problem or more than one problem.

34. The word *mated* in the first sentence is closest in meaning to

  A. avoided.
  B. combined.
  C. introduced.
  D. developed.

35. The word *strand* in the second sentence is closest in meaning to

  A. type.
  B. thread.
  C. chip.
  D. color.

36. The author implies that scientists are excited about the new technology because

  A. it is less expensive than current techniques.
  B. it allows them to be able to shock cells for the first time.
  C. it is more precise than previous techniques.
  D. it is possible to kill cancer with a single jolt.

37. The author states that scientists previously were aware that

  A. they could control cells with a separate computer.
  B. electronic impulses could affect cells.
  C. electric charges could harm a person.
  D. cells interact with each other through electrical charges.

38. The word *bombarding* in the second paragraph is closest in meaning to

  A. barraging.
  B. influencing.
  C. receiving.
  D. testing.

39. The author implies that up to now, the point of applying electric impulse to cells was to

  A. kill them.
  B. open their walls to introduce medication.
  C. stop growth.
  D. combine cells.

40. The word *particular* in the third paragraph is closest in meaning to

  A. huge.
  B. slight.
  C. specific.
  D. controlled.

41. The word *others* in the third paragraph refers to other

  A. researchers.
  B. chips.
  C. voltages.
  D. tissues.

42. The author indicates that it is expected doctors will be able to

  A. place one large chip in a person to control multiple problems.
  B. place more than one chip in a single person.
  C. place a chip directly inside a cell.
  D. place a chip inside a strand of hair.
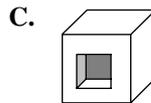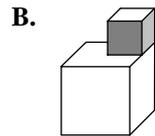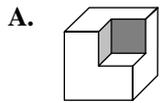
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## Passage 5

The immune system aids the human body in defending itself against pathogens and infectious diseases. The first lines of defense are nonspecific—they do not distinguish between invading organisms. The nonspecific lines of defense include the skin, the outer layer of which is composed of thick dead skin cells that bacteria and viruses cannot penetrate; the mucous membranes lining the digestive and respiratory tracts; the hairs lining the nasal cavity, which filter out invading organisms; and the strong stomach acids, which kill most bacteria on food. Any organisms that get past these nonspecific barriers encounter the next line of nonspecific defenses—various white blood cells. The neutrophils and monocytes are phagocytic, engulfing bacteria and viruses in infected tissues. Some monocytes develop into large phagocytic cells called macrophages that move throughout the body engulfing any bacteria or viruses they encounter along the way. Other white blood cells, called natural killer cells, attack and destroy cancer cells and body cells infected with viruses. Other nonspecific lines of defense include various antimicrobial proteins, such as interferons, that either attack microorganisms directly or inhibit their reproduction. The human body's inflammatory response is yet another line of nonspecific defense. The inflammatory response is initiated following any kind of damage or physical injury, which triggers the release of chemical signals, such as histamine. These chemicals may induce nearby blood vessels to dilate and become leaky, causing more blood flow to the area. Other chemicals may attract phagocytes to the area, which consume any bacteria or cellular debris. The accumulated white blood cells and their breakdown products cause localized swelling of the infected tissue.

When the nonspecific defense systems are inadequate to eradicate the invading organisms, a specific defense system takes over. White blood cells, called lymphocytes, are responsible for producing the specific immune system response. The immune system defends against invading microorganisms and cancer cells, which the body recognizes as foreign, by producing a specific response to each invading agent. As such, the immune system must initially be stimulated by a foreign agent, referred to as an antigen. When an antigen is detected, the immune system produces chemicals, called antibodies, that attach specifically to that antigen and counter its effects.

Not only can the immune system provide a specific response, but it has the ability to recognize an invading agent as having been encountered previously and, therefore, can respond to the agent much more quickly the second time it is encountered. This recognition system is referred to as immunological memory. The first time an antigen is encountered, the immune system elicits a primary immune response, which typically takes several days to become effective against the invading organism. A subsequent exposure to the same antigen elicits a faster and stronger immune response, referred to as the secondary immune response. The secondary immune response is possible because of the long-lived memory cells produced by the immune system during the first exposure to the antigen.

We can take advantage of this secondary immune response with the use of vaccines. Vaccines are made from a killed or inactivated version of a specific invading agent, such as the flu virus. When we receive a vaccination, our immune system is stimulated to respond as if the actual virus has been encountered and produces antibodies to the antigens delivered in the vaccine, as part of the primary immune response. If we are later exposed to the real agent (flu virus), our immune system responds quickly with a strong secondary immune response, inactivating the invading agent (flu virus). Thus, vaccines are effective because they act as antigens, stimulating both primary immune response and immunological memory.

While we usually must rely on the work of the immune system, often with the help of vaccines, to fight off viral infections, we can sometimes use antibiotics to help fight off bacterial infections. While a healthy immune system will usually eventually kill off invading bacteria, the use of antibiotics—chemicals that interfere with bacterial growth and development—allow the body to rid itself of the bacterial infection, and the accompanying unpleasant effects of that infection, much more quickly.

43. Antibodies are produced by the immune system when it is stimulated by

   A. phagocytes.
   B. lymphocytes.
   C. nasal cilia.
   D. antigens.

44. Which of the following components of the body's defense system against pathogens and infectious agents is nonspecific?

   A. lymphocytes
   B. antigens
   C. antibodies
   D. neutrophils

45. The purpose of vaccinations is to

    A. make us ill so that we can fight the illness in the future.

    B. create antibodies in our immune system.

    C. eliminate influenza.

    D. develop internal vaccines.

46. A physical injury may result in the release of histamines. Its purpose is to

    A. attract phagocytes to the area of injury.

    B. create swelling of the infected or damaged tissue.

    C. dilate the blood vessels.

    D. prevent the growth of cancer cells.

47. What is the secondary immune response?

    A. the second line of defense by the body's immune system, specifically the development of interferon.

    B. the development of antimicrobial proteins.

    C. the engulfing of bacteria by macrophages.

    D. immunological memory, and the ability to "remember" previously encountered antigens.

48. When the body is invaded by cancer cells, the immune system responds by

    A. sending white blood cells to destroy the cancer cells

    B. releasing histamines to flood the cells.

    C. developing strong stomach acids.

    D. expanding the mucous membranes of the respiratory system.

49. When an antigen is recognized by the immune system as having been encountered previously, the immune system

    A. develops more antigens.

    B. responds with a faster immune response.

    C. hibernates until it can process the information.

    D. destroys memory cells.

50. Which of the following components of the body's defense system against pathogens and infectious agents is specific?

    A. neutrophils

    B. monocytes

    C. macrophages

    D. lymphocytes

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

STOP

Quantitative Reasoning

Time: 45 Minutes

40 Questions

1. Janice buys a quart of milk and two dozen eggs. If milk costs $1.39 and eggs are $1.28 a dozen, how much change will Janice get back if she pays with a $10.00 bill?

    A. $3.95
    B. $4.06
    C. $5.94
    D. $6.05
    E. $7.33

2. If 400 people can be seated in 8 subway cars, how many people can be seated in 5 subway cars?

    A. 200
    B. 250
    C. 280
    D. 300
    E. 350

3. Devin throws a football $7\frac{1}{3}$ yards. Carl throws it $2\frac{1}{2}$ times farther. How much farther did Carl's throw travel than Devin's?

    A. $2\frac{1}{2}$ yards

    B. $7\frac{1}{3}$ yards

    C. 11 yards
    D. 12 yards

    E. $18\frac{1}{3}$ yards

4. Solve for m: $3m - 12 = -6$

    A. −6
    B. −4
    C. −2
    D. 0
    E. 2

5. If the area of a square is 400, what is the length of its side?

    A. 20
    B. 40
    C. 80
    D. 100
    E. 200

6. Roger collects bottle caps. Each cap can be traded for 5 cents. If Roger receives $40.50, how many bottle caps did he trade?

    A. 810
    B. 405
    C. 202
    D. 200
    E. 8

7. The cube of 8 is

    A. 2.
    B. 24.
    C. 256.
    D. 512.
    E. 8,000.

8. Fencing costs $4.75 per foot. Posts cost $12.50 each. How much will it cost to fence a garden if 10 posts and 34 feet of fencing are needed?

    A. $472.50
    B. $336.50
    C. $315.50
    D. $294.50
    E. $286.50

9. $\dfrac{\cos\theta}{\sin\theta} =$

    A. $\tan\theta$.
    B. $\cot\theta$.
    C. $\sec\theta$.
    D. $\csc\theta$.
    E. $\sin^2\theta$.

10. Jared rents 3 videos for $8.00. What would the cost of 2 video rentals be?

    A. $1.33
    B. $5.00
    C. $5.33
    D. $5.67
    E. $6.00

11. Multiply $(2x + 1)(2x + 1)$.

    A. $2x^2 + 1$
    B. $4x^2 + 1$
    C. $4x^2 + 2x + 1$
    D. $2x^2 + 2x + 1$
    E. $4x^2 + 4x + 1$

12. A batch of cookies requires 2 cups of milk and 4 eggs. If you have 9 cups of milk and 9 eggs, how many batches of cookies can be made?

    A.   9
    B.   6
    C.   4
    D.   2
    E.   1

13. On a map, 1 centimeter represents 4 miles. A distance of 10 miles would be how far apart on the map?

    A. $1\frac{3}{4}$ cm
    B.   2 cm
    C. $2\frac{1}{2}$ cm
    D.   4 cm
    E.   5 cm

14. If $a^{\frac{1}{3}} = 2$, then what is the value of a?

    A.   4
    B.   8
    C.   16
    D.   32
    E.   64

15. Sandy bought $4\frac{1}{2}$ lbs of apples and 6 kiwi fruits. Brandon bought $3\frac{1}{4}$ lbs of apples and 9 kiwi fruits. If apples cost $1.39 per lb and kiwis are 2 for $1.00, how much more money did Sandy spend than Brandon?

    A. $0.24
    B. $0.34
    C. $0.94
    D. $1.54
    E. $2.32

16. $\frac{24}{96} - \frac{8}{12} =$

    A. $-\frac{5}{12}$
    B. $-\frac{1}{4}$
    C. $\frac{5}{96}$
    D. $\frac{4}{21}$
    E. $\frac{1}{4}$

17. $\frac{3}{4} \div \frac{4}{3} =$

    A.   0
    B.   1
    C. $\frac{9}{16}$
    D. $\frac{4}{3}$
    E. $\frac{16}{9}$

18. A taxi ride costs $3.00 for the first mile and $1.00 each additional half mile. What is the cost of a 10-mile ride?

    A. $10
    B. $12
    C. $13
    D. $21
    E. $23

19. What is the value of $64^{-\frac{1}{3}}$?

    A. $-\frac{1}{4}$
    B. $-\frac{1}{8}$
    C. $\frac{1}{16}$
    D. $\frac{1}{8}$
    E. $\frac{1}{4}$

20. If $\sin x > 0$ and $\sec x < 0$, then which quadrant must $\angle x$ lie in?

    A.   I
    B.   II
    C.   III
    D.   IV
    E.   I and II

21. What is the area of the figure shown?

13'

10'

16'
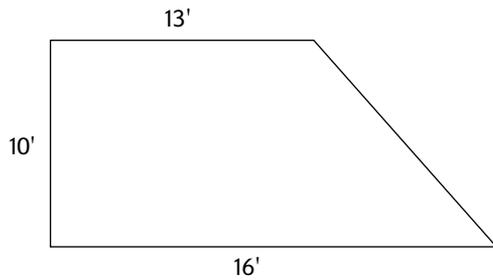
- A. 130 ft^2
- B. 145 ft^2
- C. 154 ft^2
- D. 160 ft^2
- E. 164 ft^2

22. Mr. Triber earns a weekly salary of $300 plus 10% commission on all sales. If he sold $8,350 last week, what were his total earnings?

- A. $835
- B. $865
- C. $1,135
- D. $1,270
- E. $1,835

23. If $7^{2x-1} = 7^{5x+8}$, what is the value of x?

- A. −3
- B. −1
- C. 1
- D. 3
- E. 9

24. Staci earns $9.50 an hour plus 3% commission on all sales made. If her total sales during a 30-hour work week were $500, how much did she earn?

- A. $15
- B. $250
- C. $285
- D. $300
- E. $315

25. Solve the following equation for x: $5^9 = 5^{4x+1}$

- A. −2
- B. 1
- C. 2
- D. 3
- E. 4

26. If the diameter of a circle is increased by 100%, the area is increased by

- A. 50%
- B. 100%
- C. 200%
- D. 300%
- E. 400%

27. What is the amplitude of the function $f(x) = 3 + 2\sin(7x)$?

- A. 2
- B. 3
- C. 5
- D. 7
- E. 12

28. Which of the following is an equation of a line parallel to the line $4x + 2y = 12$?

- A. $y = 2x + 6$
- B. $y = -2x + 7$
- C. $y = \frac{1}{2}x + 4$
- D. $y = -\frac{1}{2}x + 4$
- E. $y = 2x + 4$

29. A card is selected at random from a standard deck of 52 cards. What is the probability that the card is an ace?

- A. $\frac{1}{52}$
- B. $\frac{1}{26}$
- C. $\frac{1}{13}$
- D. $\frac{2}{13}$
- E. $\frac{4}{13}$

30. Temperatures in degrees Fahrenheit can be converted to temperatures in degrees Celsius by means of the formula $C = \frac{5}{9}(F - 32)$. Which of the following statements is TRUE?

- A. 41° Fahrenheit is hotter than 5° Celsius.
- B. 41° Fahrenheit is colder than 5° Celsius.
- C. 50° Fahrenheit is hotter than 10° Celsius.
- D. 50° Fahrenheit is colder than 10° Celsius.
- E. 50° Fahrenheit is the same as 10° Celsius.

31. Janet has seven coins in her purse: a penny, 2 nickels, a dime, 2 quarters, and a half-dollar. If she selects a coin at random from her purse, what is the probability that the value of the coin is at least 25 cents?

A. $\frac{1}{7}$

B. $\frac{2}{7}$

C. $\frac{3}{7}$

D. $\frac{4}{7}$

E. $\frac{5}{7}$

32. If the average (arithmetic mean) of 82, 74, and w is 76, what is the value of w?

A. 71
B. 72
C. 73
D. 74
E. 75

33. A right triangle has an area of 24 feet. If one leg is 3 times as long as the other, what is the length of the longest side?

A. 12.6
B. 12
C. 8.4
D. 6.3
E. 4.2

34. There are five more boys in the kindergarten class than girls. If there are 27 children all together, how many are boys?

A. 10
B. 11
C. 16
D. 17
E. 22

35. If $2^{3x} = 4^{x+1}$, then what is the value of x?

A. 0
B. $\frac{1}{2}$
C. 2
D. 4
E. 8

36. Simplify $\dfrac{15\sqrt{3}}{\sqrt{5}}$.

A. $3\sqrt{3}$
B. $3\sqrt{15}$
C. $5\sqrt{15}$
D. $15\sqrt{15}$
E. $75\sqrt{3}$

37. Given that the point $(x, 1)$ lies on a line with a slope of $-\frac{3}{2}$ and a y-intercept of -2, find the value of x.

A. -2
B. -1
C. 0
D. 1
E. 2

38. At a neighborhood grocery store, the three stock workers earn \$28,000 a year, the two department managers earn \$31,000 a year, and the store manager earns \$34,000 a year. What is the average (arithmetic mean) salary of these employees?

A. \$29,000
B. \$30,000
C. \$31,000
D. \$32,000
E. \$33,000

39. Which of the following values of x is a solution to the equation $\sin x = \frac{1}{2}$?

A. $x = 30°$
B. $x = 45°$
C. $x = 60°$
D. $x = 75°$
E. $x = 90°$

GO ON TO THE NEXT PAGE

40. If the area of the circle is 121π, find the area of the square.
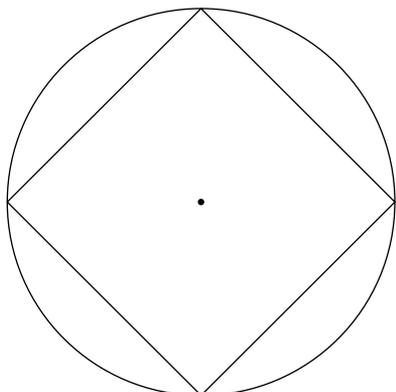
   A.   121
   B.   242
   C.   363
   D.   484
   E.   726

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

STOP

Answer Key for Practice Test 2

Natural Sciences

Biology

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

Chemistry

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

Perceptual Ability Test

Part 1

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

Part 2

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

Part 3

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

Part 4

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

Part 5

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

Part 6

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

Reading Comprehension

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

Quantitative Reasoning

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

Answers and Explanations for Practice Test 2

Natural Sciences

Biology

1. **E.** Only eukaryotic cells have a membrane-bound nucleus and other organelles. Bacterial cells are prokaryotic and lack an organized nucleus or other membrane-bound organelles.

2. **A.** Diffusion involves the passive movement of substances down a concentration gradient (from a region of higher concentration to a region of lower concentration). Osmosis is a special form of diffusion that involves the movement of water from a region of higher concentration to a region of lower concentration. The passive nature of diffusion and osmosis does not require the input of energy. However, an input of energy is required for the movement of substances against a concentration gradient (from a region of lower concentration to a region of higher concentration). This type of energy-requiring movement against a concentration gradient is referred to as active transport.

3. **B.** In humans, and most other organisms, growth and tissue repair involves the production of new cells through the process of mitosis, a type of cell division that produces two identical daughter cells from each parent cell. Meiosis (A) is a type of cell division that occurs only in the germ cells that give rise to gametes (for example, eggs and sperm in humans). Meiosis results in the formation of four genetically unique daughter cells from each parent cell. Fission (C) is a type of asexual reproduction that occurs in bacteria. Budding (D) is a type of asexual reproduction that occurs in yeast and hydra.

4. **D.** Cellular respiration takes place in the mitochondria of the cells of most organisms and results in the production of energy (ATP) through the breakdown of glucose molecules.

5. **D.** During photosynthesis, light energy is absorbed by the pigment chlorophyll (found in the chloroplasts of plant cells, algal cells, and some bacterial cells) and is used to produce chemical energy in the form of glucose, from carbon dioxide and water.

6. **B.** Enzymes are a type of protein that speed up the rate of chemical reactions by lowering the activation energy required for the reaction to take place. The enzymes themselves are not directly involved in the reaction, so they are not altered or destroyed by the reaction they catalyze.

7. **A.** According to the endosymbiont theory, mitochondria and chloroplasts originated as small prokaryotes living as endosymbionts within larger cells. The proposed ancestors of mitochondria are aerobic, heterotrophic prokaryotes, and the proposed ancestors of chloroplasts are photosynthetic prokaryotes.

8. **B.** Ferns have vascular tissue (xylem and phloem).

9. **C.** The teeth of primates (which include lemurs, monkeys, apes, and humans) have finite growth. Certain teeth (primarily the incisors) of some groups of organisms (including most rodents) continue to grow throughout the life of the organism and must be worn away through chewing or gnawing.

10. **E.** *Homo sapiens* (humans) are members of *phylum* Chordata, *sub-phylum* vertebrata, *class* Mammalia.

11. **A.** Calcitonin, which lowers the calcium levels of the blood, is produced by the thyroid gland.

12. **C.** Blood pressure is a measure of the amount of force exerted by the blood on the walls of the blood vessels. By taking your pulse (A), you can measure your heart rate (B), or the number of times your heart beats per minute. The diastole (E) is the relaxation phase of the cardiac cycle, and the systole (D) is the contraction phase of the cardiac cycle.

13. **D.** Digestion is the process through which humans transform organic molecules taken in as food into a form that is readily usable by the body.

14. **C.** Carbohydrates, primarily glucose, provide the most basic, direct source of energy for use by the human body. Other macromolecules such as lipids (fats), proteins, and nucleic acids are broken down and used for energy after the body's stores of glucose have been used up.

15. E. The kidney serves as the primary functional unit of the human excretory system. The function of the vertebrate excretory system, which includes the ureters (A), urethra (B), bladder (C), and kidneys (E) is to rid the body of metabolic waste products and regulate the osmotic balance of the blood. The small intestine (D) is part of the vertebrate digestive system, which functions in the ingestion, digestion, absorption, and elimination of food.

16. B. The endocrine system is composed of a series of glands that produce hormones that are responsible for coordinating the various systems in the human body. The human excretory system (A) is responsible for eliminating wastes from the body and maintaining osmotic balance of the blood. The human nervous system (D) controls the body's responses to internal and external stimuli. The human circulatory system is responsible for transporting gases, nutrients, and waste products throughout the body.

17. E. In human reproduction, fertilization takes place in the Fallopian tubes, which lead from each ovary to the uterus. The vagina (A) receives the penis and sperm. The cervix (B) is the constricted region at the base of the uterus. The uterus (C) is a muscular organ within which the fetus develops. The ovary (D) is the organ in which eggs form.

18. A. The brain and spinal cord make up the central nervous system of vertebrate organisms. The peripheral nervous system is composed of the nerves and ganglia leading from the central nervous system to the rest of the body. The somatic nervous system carries signals to skeletal muscles, usually in response to an external stimulus. The autonomic nervous system conveys signals that regulate involuntary control of the cardiac muscles and the smooth muscles of the digestive, cardiovascular, excretory, and endocrine systems. 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.

19. C. When air is inhaled into the human respiratory system, it passes from the nasal cavity into the larynx. From the larynx, air moves into the trachea, also called the windpipe. The trachea branches into two bronchi, one leading to each lung. Within the lung, the bronchi branch into finer and finer tubes called bronchioles. The smallest bronchioles terminate into air sacs referred to as alveoli, the surface of which serves as the primary site for gas exchange in the human respiratory system.

20. E. The spleen is composed primarily of lymph nodes and is responsible for destroying old red blood cells. The liver (D) helps to sequester and remove toxins from the body. The pancreas (A) and gall bladder (B) produce enzymes that aid in digestion. The appendix (C) plays a small role in the human immune system but is functionally dispensable.

21. D. Antibiotics are only effective against bacteria; they are not effective against viruses or other infectious agents.

22. A. The skeletal system is derived from the mesoderm layer during human development.

23. C. After fertilization, a special form of cell division referred to as cleavage occurs. 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.

24. D. For a given trait to be expressed, genes on DNA in the nucleus of the cell must be transcribed onto a molecule of mRNA (messenger RNA) and carried out of the nucleus into the cytoplasm. The mRNA attaches to a ribosome in the cytoplasm, while tRNA (transfer RNA) molecules add appropriate amino acids to the growing polypeptide chain, according to the message encoded on the mRNA, translating the DNA message into protein.

25. B. The genetic makeup of an individual is referred to as his or her genotype. The physical appearance of an individual is referred to as his or her phenotype (C). The genetic code (E) refers to the triplet of nitrogen bases that code for amino acids. A gene pool (D) refers to the genetic constitution of a population. A genome (A) refers to the entire genetic complement of a particular type of organism.

26. D. An individual with two different alleles for a given trait (in this case, earlobe type) is said to be heterozygous for that trait. If both alleles for a given trait are the same (for example, two alleles for attached earlobes), the individual is said to be homozygous for the trait (A). Dominance (C) and recessiveness (B) refer to the expression of alleles when present together in an individual. In this example, a person with one allele for free earlobes and one allele for attached earlobes would have free earlobes because the allele for free earlobes is dominant over the allele for attached earlobes. Heterogeneous (E) refers to genetic diversity among individuals at the population level, not the genetic make-up of an individual.

27. C. The M, N, and MN blood groups in humans are an example of codominance, in which both alleles are expressed equally in the phenotype. With complete dominance (A), the dominant allele masks the recessive allele. With incomplete dominance (D), the phenotype is usually intermediate between the dominant and recessive phenotypes, with neither allele fully expressed. There is no condition referred to as complete recessiveness (B). Heterozygosity (E) refers to the allelic make-up of an individual with two different alleles for a particular trait.

28. E. A woman with type-AB blood and a man with type-O blood could produce children with either type-A or type-B blood. The woman would carry one A allele and one B allele for blood type, and the man would carry two O alleles. The A and B alleles are codominant, and the O allele is recessive to both the A and B alleles. Because the children would receive one allele from their mother and one allele from their father, the children could have the genotypes AO (with type-A blood) or BO (with type-B blood).

29. A. Using restriction digestion of a sample of DNA from an individual and subsequent electrophoresis of the restricted sample (Restriction Fragment Length Polymorphism–RFLP–Analysis) a DNA fingerprint of the individual can be produced. Such fingerprints can then be used for identification in paternity suits and analysis of crime scene evidence.

30. A. All of the offspring would inherit at least one dominant allele from the homozygous dominant parent and, therefore, have round ears.

31. D. The sex chromosome complement of human females is XX, and the sex chromosome complement of human males is XY. Daughters receive one X chromosome from their mother and one X chromosome from their father. With two X chromosomes, sex-linked recessive disorders are less common among females than males, as there is a chance that a female will carry at least one unaffected X chromosome (with the dominant allele), masking the presence of the recessive allele. However, it is possible for a daughter to inherit the recessive allele from both parents and show the homozygous recessive trait. Sons inherit their X chromosome from their mother and their Y chromosome from their father. Thus, even an unaffected, heterozygous mother has a 50-50 chance of producing an affected son. Because all known sex-linked traits are carried on the X chromosome, males cannot inherit a sex-linked trait from their father through the Y chromosome.

32. A. Evolution involves changes in the genetic composition (allelic and genotypic frequencies) of a population over time. Several factors influence the rate of evolution in a population, including mutation, genetic drift, population size, migration into or out of the population, and natural selection. Natural selection is based on the relative reproductive fitness of individuals within a population and is sometimes referred to as "survival of the fittest."

33. C. A species consists of a group of related individuals who are capable of interbreeding and producing fertile offspring. A population (B) refers to a group of individuals of the same species that share a common geographic area. A community (A) refers to all of the populations of different species that share a common geographic area and have the potential to interact with each other. A gene pool (D) refers to the total complement of genes in a population at any given time. A family (E) is part of the taxonomic hierarchy used to define relationships among organisms.

34. B. A community includes all the organisms living in a given area, which have the potential to interact with each other. An ecosystem includes a local community and the physical surroundings (abiotic factors) with which the organisms interact.

35. E. Producers are organisms that are capable of manufacturing their own food, usually through the process of photosynthesis. Producers in terrestrial ecosystems include any plant that is consumed by another organism. Producers in aquatic ecosystems are usually small, often single-celled forms of algae and photosynthetic bacteria (phytoplankton). Organisms that feed on the producers are referred to as primary consumers (B). Because they eat plant material, the primary consumers are often referred to as herbivores (C). Organisms that feed upon the

primary consumers are referred to as secondary consumers. The secondary consumers, which feed on other animals, are also referred to as carnivores (A). There may be several trophic levels of consumers present in a given food chain. Many organisms feed at several layers of the food chain—for example, a hawk might consume a mouse, or it might consume a snake that has consumed a mouse. Organisms that feed on both producers and consumers are referred to as omnivores. Decomposers (D), which include fungi, bacteria, and slime molds, break down dead and decaying material and recycle the nutrients back into the ecosystem. The decomposers are often depicted as being at the end of a food chain; however, they actually operate at all levels of the food chain, breaking down waste.

36. D. A prolonged period of drought would cause a decrease in population size, regardless of the initial density of the population and, thus, would be considered a density-independent factor affecting population size. The availability of food, water, or shelter, and the level of toxins present in the ecosystem, would affect denser populations to a greater degree than less dense populations, and would thus be considered density-dependent factors affecting population size.

37. C. When consumed, toxins are usually sequestered and stored in the liver and fatty tissue of the organisms that consumed them. Thus, when a toxin enters the food chain, it becomes more and more concentrated at each trophic level. This increase in toxin concentration at subsequent levels of the food chain is referred to as *biological magnification.*

38. D. Parasitism involves one organism (for example, tapeworm) living in or on a host organism (for example, human). Predation (C) involves one organism (for example, mountain lion) killing and consuming another organism (for example, deer). Mutualism (A) is a type of symbiotic relationship in which both organisms benefit from the relationship (for example, green algae and fungi living together as a lichen). Commensalism (B) is a symbiotic relationship in which the symbiont benefits, but the host is neither helped nor harmed.

39. E. Natural selection will help to increase the frequency of favorable traits in a population. Evolution (D) is the result of changes in the genetic make-up of a population over time. The rate of evolution is affected by the degree of natural selection operating on various traits. Genetic drift (A) and genetic bottlenecking (C) are both associated with small population size and a decrease in the amount of genetic variation within a population. Migration (B) into or out of the population also affects the relative allelic and genotypic frequencies within the population and, as such, also affects evolution of the population.

40. A. Sociobiology examines the evolution of social behavior, which includes competitive behaviors, mating behaviors, diverse modes of communication, and social interactions within and between species.

Chemistry

41. E. Silver is a metal. It is in Group 11 and is one of the coinage metals.

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. There are 24 valence electrons in sulfur trioxide. All four of the atoms are in Group 6A, and each has six valence electrons.

44. E. Incomplete combustion of a hydrocarbon always yields $CO(g)$ and $H_2O(g)$. The coefficients must be "1" for $CO(g)$ to balance the carbons and a "2" for water to balance the 4 hydrogen atoms. The odd number of O atoms in methanol matches the odd number of O atoms in CO.

45. C. The mols of ammonia depend on Avogadro's number and the count of ammonia molecules. Convert molecules to mols using Avogadro's number: mols = (1 mol / 6.02×10^{23} molecules) (3.0×10^{24} molecules).

46. B. Polonium-210 has atomic number Z = 84 and mass number A = 210. Alpha particles have a mass number of 4 and Z = 2. Loss of an alpha particle will decrease the charge by two units and the mass by four. The product has Z = 82 and mass number A = 206.

47. E. The flash point depends on the compound's reactivity with oxygen.

48. B. The lower the pK_a, the stronger the acid. The *p* indicates the negative logarithm base 10. Very strong acids will actually have negative values for pK_a.

49. A. Binary acids formed by the halogens increase in acid strength from top to bottom of the group, HF < HCl < HBr < HI < $HClO_4$. Perchloric acid is stronger than any of the binary halogen acids. The larger the anion, the weaker the bond between the proton and the anion resulting in a stronger acid.

50. D. The transition state exists at the maximum of the energy path.

51. E. Calcium chloride produces three ions per formula unit. This means $i = 3$, not 2.

52. C. Group A elements are the representative elements.

53. D. There are four atoms in an fcc unit cell. One eighth of an atom from each of the eight corners contributes one atom. One half of an atom comes from each face. Since there are six faces, there are three more atoms inside the cube.

54. A. All "s" atomic orbitals (1s, 2s, 3s, 4s, 5s, and so on) have an angular momentum quantum number equal to zero.

55. B. The covalent bond length between hydrogen and halogens, HX, increases HF < HCl < HBr < HI < HA. The shorter the bond, the stronger the bond.

56. E. Decomposition of $KClO_3$ yields O_2. 246 tons $KClO_3$ = (96 tons O_2)(1 ton mol O_2/ 32 tons O_2)(2 ton mol $KClO_3$/ 3 ton mol O_2) (123 tons $KClO_3$ /1 ton mol $KClO_3$).

57. D. The reverse activation energy equals E_a reverse = E_a forward – ΔH. For this reaction +227. kJ/mol = 232. kJ/mol – 4.18 kJ/mol.

58. B. A ferromagnetic solid like iron has domains of unpaired electrons. The electrons in these domains have similarly oriented spins.

59. C. Lithium is in Group 1A with one unpaired outer electron.

60. E. Methane has a central carbon atom with four attached H atoms. These are bonded to the central carbon by overlap of a 1s atomic orbital with a lobe of an $sp^3$3 hybrid orbital.

61. B. The density of a gas will decrease as a gas expands. The density is inversely proportional to the amount of expansion. D final = (Density initial) (volume initial / volume final) = (0.1786 kg/m^3) (1 / 1.5)

62. C. The absolute value for the m_ℓ quantum number can NEVER be larger than the value for ℓ.

63. B. The charge carried by an Avogadro's number of electrons is a Faraday, 96,500 coulombs.

64. A. Real gases follow the ideal gas law more closely at high temperatures and low pressures. The ideal gas law assumes that gas molecules have no intermolecular interactions and have no volume. These assumptions are approximated better when the particles have high average kinetic energy at high temperatures (above 273 Kelvin) and at high volume (low pressures, below 1 atmosphere).

65. C. The oxidation number for Mn changes from +7 in MnO_4^- to +4 in MnO_2. This reduction requires that Mn gain 3 electrons. The 3 electrons must be added to the reactant side of the equation.

66. E. The atomic number of an atom decreases by one unit when a K shell electron is captured by the nucleus. One proton is converted to a neutron.

67. C. Both reactants and products are in the reaction mixture when a reversible reaction reaches equilibrium. The relative amounts are determined by the equilibrium constant.

68. E. The cell voltage must be positive. The cell voltage is determined from the sum of the reduction potential as written for one half-cell and the voltage for a half-cell reversed as oxidation. $E^0 = E^0_{reduction} + E^0_{oxidation}$; $E^0 = 0.53$ V – (– 0.14 V) = 0.67 V

69. B. The Q term is the reaction quotient. It equals the nonstandard state concentrations or pressures for reactants and products. It equals the mass action expression with concentrations or pressures for the existing conditions. It equals equilibrium constant, K, when the system reaches equilibrium.

70. C. Amphoteric compounds can act as both an acid and a base. Aluminum hydroxide can release hydroxide ions acting as a base. The H atoms bonded to the O atoms can be released so the compound acts as an acid.

71. D. Addition of Br_2 to an alkene replaces the double bond with single bonds to the Br atoms.

72. A. The meta dichlorobenzene has the Cl atoms in the 1 and 3 positions.

73. E. Markonikov's rule predicts that hydration of an alkene will yield the most branched (substituted) alcohol.

74. E. The carbon in the –C:::N: group is relatively electron poor with a partial positive charge. Ortho-para directors are able to donate an electron pair that can be delocalized in the aromatic ring.

75. C. Explanation of the answer: FT–IR is best for functional groups, MS for molecular fragments, and NMR for bonding structure.

76. D. Carbons 2 and 4 have no hydrogen, and being flanked by carbonyls, the hydrogens on carbon 3 will be far more acidic than those on carbons 1, 5, and 6.

77. D. Reactions between alkyl halides and primary and secondary amines are replacement reactions. The alkyl group from the halide replaces a hydrogen on the nitrogen of the amine. The reaction between an alkyl halide and a tertiary amine is an addition reaction. The alkyl group adds to the lone pair of the amine.

78. C. Allylic hydrogen atoms are bonded to carbon atoms bonded to the doubly bonded C atoms.

79. E. The two H atoms are 2°.

80. D. The double bond is cleaved in ozonolysis. Attach a = O to each of the formerly double-bonded carbon atoms. The ozonolysis of $CH_3CH::CHCH_3$ produces two molecules of CH_3CHO.

81. E. The C-I-P rules place higher priority on atomic number. The lowest priority atom projects back from the plane of the page. When the decreasing priority is counterclockwise the configuration is "S."

82. B. A meso compound is achiral but contains chiral centers.

83. A. Dehydration of the primary alcohol gives 1-butene. The secondary alcohol gives 2-butene.

84. E. Alkynes have a triple bond and are short four hydrogen atoms. The general formula is C_nH_{2n-2}.

85. B. Both butane and 2-methylpropane have the formula C_4H_{10}.

86. C. There are six carbons in the longest carbon chain so it is a hexane. The –OH group is in the 2 position with the methyl in the 3 position.

87. B. Aldehydes are oxidized to carboxylic acids by $KMnO_4$.

88. A. Lithium aluminum hydride is a reducing agent; it will reduce an aldehyde to an alcohol.

89. C. Lithium aluminum hydride is a reducing agent. Aldehydes are reduced to primary alcohols by $LiAlH_4$.

90. D. Esters are reduced to alcohols by $LiAlH_4$.

91. D. The position of the carbonyl oxygen is important, which is why we distinguish between aldehydes (terminal carbonyls) and ketones (non-terminal carbonyls). Aldehydes can be oxidized to carboxylic acid, which is a common property that chemists use to distinguish between different types of sugars (aldoses versus ketoses).

92. B. The triple bond consists of two π bonds and one σ bond. Each of the π bonds contains two π electrons.

93. A. Hot sulfuric acid will dehydrate an alcohol to form a symmetric ether.

94. C. Hot concentrated sulfuric acid will dehydrate a carboxylic acid to yield an acid anhydride.

95. D. Symmetric ethers have the general formula R-O-R.

96. B. Oxidation of arenes, $ArCHR_2$, with acidic $KMnO_4$ will yield a carboxylic acid such as $ArCO_2H$.

97. E. Epoxides can be made from alkenes using peroxyacids such as RCOOOH.

98. B. Grignard reagents and carbon dioxide react to extend the carbon chain of the R chain in the Grignard to yield a carboxylic acid after hydrolysis.

$$CO_2 + C_2H_5MgCl \longrightarrow C_2H_5CO_2MgCl \xrightarrow{H_3O^+} C_2H_5CO_2H$$

99. D. In formaldehyde there are 6 sigma electrons in single bonds, 2 pi electrons in the double bond, and 4 nonbonding electrons in unshared electron pairs on the O atom.

100. D. The $4n + 2$ rule predicts that monocyclic hydrocarbons will be aromatic if they have a π electron count of 6, 10, and so on. Structure D has 6 π electrons where 4 come from the two double bonds and 2 come from one of the lone pairs on the S atom. Structure A has 8 π electrons. Structure B has 4 π electrons. Structure C has 4. Structure E has 4.

Reading Comprehension

1. A. Affixed is correct. Tube worms attach to the bottom.

2. B. Discharge is correct. Natural spring vents discharge water.

3. B. Different in that a vent involves rapid discharge while a seep involves slow discharge. The author uses the two words in different contexts.

4. C. The two types of worms are from the same family but different species.

5. A. Grows more slowly than the hot-water tube worm. See paragraphs two and five, which distinguish between the growth rates of the two worms.

6. A. Complete is correct and is used as an adjective.

7. A. The implication in the passage is that these tube worms will grow to 8 feet in the lifetime.

8. C. Boiling is correct since the first part of the sentence states that these are hot water vents. Boiling water is scalding.

9. D. The two types of water differ in that one contains oily materials, and the other contains hydrogen sulfide, resulting in two different types of tube worms.

10. C. Aneurysms that occur near the brain stem only is correct. The first paragraph explains that these aneurysms are dangerous to repair with surgery.

11. A. Aneurysms is correct. The noun is found in the previous sentence, and no other noun in the sentence could make sense.

12. C. The paragraph discusses the danger of aneurysms, and therefore they can cause significant damage. The other choices in this context are not relevant.

13. B. Aneurysm is correct. The noun to which one refers actually appears two sentences before the reference.

14. A. Meandering is correct. The idea is that it moves slowly and deliberately toward its destination.

15. A. Removed is the only logical choice in the context of the sentence. One would not leave a catheter of this sort inside the patient.

16. B. A hernia is caused by a weakening of the muscle wall. An aneurysm is caused by the weakening of the arterial wall.

17. D. Hemorrhaging that results in death is correct. The second paragraph states that this can occur in 50 percent of patients.

18. B. Serve as a base for a blood clot to form is correct. This is explained in the second paragraph.

19. B. In the upper thigh is correct. In the reading, it states that the femoral artery is in the groin area. The word "femoral" is related to femur, which is the thigh bone, and the groin area is where the thigh meets the hip area.

20. D. Separate the coil from the wire is correct. This is explained in the second paragraph. After the coil is outside the catheter, a low-voltage electrical current is applied, and the coil detaches at a preset solder point.

21. C. At a predetermined and prepared location on the wire is correct. The same sentence that answers Question 20 says it is a preset location.

22. A. Longer and require more recuperation time than the new procedure is correct. This is explained in the last paragraph where it says: The procedure lasts two hours, which is half as long as invasive surgery, and recovery time is generally limited to a few days instead of a few weeks.

23. B. Is performed only at hospitals containing the required equipment and certified doctors. This is also explained in the last paragraph where it says . . . is available in various hospitals where there are advanced neurology departments and specialists trained in the procedure.

24. B. Carnivorous dinosaur is correct. Carnivorous means the same as meat-eating, which is stated in the first sentence.

25. B. The sentence presents two facts, thereby implying that the second fact is in addition to the first fact.

26. A. Frightening is correct, since dinosaurs are frightening creatures.

27. D. It is unusual to find a collection of bones from several different dinosaurs together—it's a surprising event.

28. A. Lived and hunted with others is correct. The first paragraph states that it is more astounding that the bones were found with other bones, because that indicates they were not loners.

29. A. Meat-eating dinosaurs lived alone. The same sentences say that this discovery challenges the prior theory that they were loners.

30. C. The newly discovered dinosaur is related to the Giganotosaurus.

31. B. Not closely related to Tyrannosaurus Rex is correct. The passage states that it is as close to T. Rex as a cat to a dog, which is not close.

32. A. To dissect is to take apart, or dismember.

33. A. The dinosaurs killed their victims, which were their prey.

34. B. To mate is to put pieces together to fit. Thus, combined is correct.

35. B. Hair is like a thread.

36. C. It is more precise than previous techniques. The passage indicates that they will have control, whereas they previously did not.

37. B. Electronic impulses could affect cells. The first paragraph indicates that they have known this for a while.

38. A. The word bombarding is similar to "bomb". Even if you don't know the other words, barraging is the only one that makes sense within the paragraph, and among the choices. Barraging is correct.

39. B. Open their walls to introduce medication is correct. The passage states that they have used electrical charges in an attempt to introduce foreign substances such as new drug treatments or genetic material.

40. C. If a choice is made to select a particular voltage, the implication is that it is a specific choice.

41. D. Tissues is correct. The passage indicates that others is a pronoun for other tissues, because it says . . . to activate particular tissues, whether they be muscle, bone, brain, or others.

42. B. Place more than one chip in a single person. The last sentence of the passage answers this question: They believe that they will be able to implant multiple chips into a person to deal with one problem or more than one problem.

43. D. Foreign bodies that invade the immune system are known as antigens.

44. D. Nonspecific lines of defense are those that do not distinguish between invading organisms. Neutrophils (and monocytes) are phagocytes, and will attack both bacteria and viruses. Lymphocytes are specific. Antigens are foreign agents that attack the body, and antibodies are the chemicals that fight them.

45. B. The vaccine stimulates our immune system into creating antibodies. These antibodies are quick to recognize the actual agent (disease) when encountered, and can now respond to it quickly, because of immunological memory.

46. C. Specifically, histamines cause the blood vessels to dilate, helping blood to flow quickly to the damaged area, which helps the healing process.

47. D. The ability of the immune system to remember previously encountered antigens is the body's secondary line of defense by the immune system. The chemical interferon (choice A) is an antimicrobial protein, which is also a choice in choice B—and thus, a duplicate choice. Be aware of clues like this to help eliminate certain answers.

48. A. There are different kinds of white blood cells, whose role it is to destroy cancer cells. Some cells are called natural killer cells, and their function is to kill the cancer cells. Histamines, stomach acids, and mucous membranes do not destroy cancer cells.

49. B. Known as immunological memory, the recognition of the previously encountered antigens results in a faster and stronger immune response to new antigens invading the body.

50. D. Lymphocytes are part of the specific immune response. Neutrophils, monocytes, and macrophages are all nonspecific lines of defense against pathogens and infectious agents.

Quantitative Reasoning

1. D. The cost for milk and 2 dozen eggs is $1.39 + (2 \times \$1.28) = \$3.95$. The change is $\$10.00 - \$3.95 = \$6.05$.

2. B. If 400 people fit in 8 subway cars, then $400 \div 8$, or 50, people fit in one subway car. Therefore, 50×5, or 250, people fit in 5 subway cars.

3. C. Carl's throw went $7\frac{1}{3} \times 2\frac{1}{2} = \frac{22}{3} \times \frac{5}{2} = \frac{110}{6} = 18\frac{1}{3}$ yards. The difference between the two throws is $18\frac{1}{3} - 7\frac{1}{3} = 11$ yards.

4. C. $3m - 12 + 12 = -6 + 12$ so that $3m = 6$. Dividing both sides by 3 results in $m = 2$.

5. A. The area of a square is s^2 where s is a side of the square. If $s^2 = 400$, then $s = \sqrt{400} = 20$.

6. A. Let c represent the number of caps traded in. Then $0.05c = 40.50$ and $c = \frac{40.50}{0.05} = 810$.

7. D. The cube of 8 is $8^3 = 8 \times 8 \times 8 = 512$.

8. E. The total cost for the posts and fencing is $(10 \times \$12.50) + (34 \times \$4.75) = \$125.00 + \$161.50 = \$286.50$.

9. B. One of the fundamental trigonometric identities is that $\frac{\cos\theta}{\sin\theta} = \cot\theta$.

10. C. Using the ratio $\frac{\text{price}}{\text{video}}$, the proportion $\frac{8}{3} = \frac{x}{2}$ can be used to find the cost to rent two videos. Cross multiply. $8 \times 2 = 3x$ so $16 = 3x$ and $x = \frac{16}{3} = \$5.33$.

11. E. Using the distributive property, $(2x + 1)(2x + 1) = 4x^2 + 2x + 2x + 1 = 4x^2 + 4x + 1$.

12. D. With 9 cups of milk, $\frac{9}{2} = 4\frac{1}{2}$ or 4 full batches can be made. However, with 9 eggs, only $\frac{9}{4} = 2\frac{1}{4}$ or 2 full batches can be made. At most, only 2 batches can be made with the given ingredients.

13. C. The proportion $\frac{1 \text{ cm}}{4 \text{ miles}} = \frac{x \text{ cm}}{10 \text{ miles}}$ models this situation. Cross multiply. $1 \times 10 = 4x$ so $10 = 4x$ and $x = \frac{10}{4} = 2\frac{1}{2}$ cm.

14. B. This equation is solved by the number whose cube root is 2. The number with this property is 8.

15. A. The cost of Sandy's purchase is $(4\frac{1}{2} \times \$1.39) + (6 \times \$0.50) = \$9.26$. The cost of Brandon's purchase is $(3\frac{1}{4} \times \$1.39) + (9 \times \$0.50) = \$9.02$. Sandy spent $\$9.26 - \$9.02 = \$0.24$ more.

16. A. The least common denominator of 96 and 12 is 96, so $\frac{24}{96} - \frac{8}{12} = \frac{24}{96} - \frac{64}{96} = \frac{-40}{96} = -\frac{5}{12}$.

17. C. $\frac{3}{4} \div \frac{4}{3} = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$

18. D. In a 10-mile trip, after the first mile, there are 9 additional miles. If each additional half mile is $1, then an additional mile is $2. The cost of the trip is $3 for the first mile + $(\$2 \times 9)$ for the additional miles. $\$3 + \$18 = \$21$.

19. **E.** $64^{\frac{1}{3}} = \sqrt[3]{\frac{1}{64}} = \frac{1}{4}$.

20. **B.** The sine function is positive in the first and second quadrants, and the secant function is negative in the second and third quadrants. Thus, $\angle x$ must lie in the second quadrant.

21. **B.** Divide the figure into a rectangle and triangle as shown.

13'

10'   10'

←——————— 13' ———————→|←— 3' —→
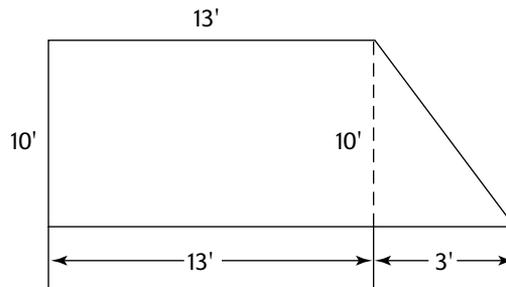
The area of the figure equals the area of the rectangle plus the area of the triangle. The rectangle = length × width or $10 \times 13 = 130$ ft^2; the triangle = $\frac{1}{2}$ base × height or $\frac{1}{2} \times 3 \times 10 = 15$ ft^2. Together, the area is $130 + 15 = 145$ ft^2.

22. **C.** The amount of commission is $10\% \times \$8,350 = \$835$. Total earnings are $\$300 + \$835$ commission $= \$1,135$.

23. **A.** For this equation to be true, it must be the case that $2x - 1 = 5x + 8$. This is true when $x = -3$.

24. **D.** For a 30-hour week with $500 in sales, total earnings are $(30 \times \$9.50) + (3\% \times \$500) = \$285 + \$15 = \$300$.

25. **C.** This equation can only be true if $9 = 4x + 1$, that is, if $x = 2$.

26. **E.** The radius $r = \frac{d}{2}$. The area of the circle is $\pi r^2 = \pi \left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$. If the diameter is increased 100%, the diameter is $2d$ and $r = \frac{2d}{2} = d$. The area of the enlarged circle is $\pi r^2 = \pi d^2$. The enlarged circle is $\frac{\pi d^2}{\frac{\pi d^2}{4}} = \pi d^2 \div \frac{\pi d^2}{4} = \pi d^2 \cdot \frac{4}{\pi d^2} = 4$ or 400% bigger.

27. **A.** The amplitude of a sine curve is the coefficient of the sine term, which in this case is 2.

28. **B.** Begin by writing the line $4x + 2y = 12$ in slope-intercept form as $y = -2x + 6$. The slope of this line is the coefficient of the x-coordinate, which is -2. Since parallel lines have the same slope, we need to find an equation with a slope of -2. All of the answer choices are in slope-intercept form, and the choice with x coefficient of -2 is (**B**).

29. **C.** There are four aces in a standard deck of 52 cards. Therefore, the probability of selecting an ace is $\frac{4}{52} = \frac{1}{13}$.

30. **E.** Using the conversion formula reveals that 41° Fahrenheit is the same as 5° Celsius and that 50° Fahrenheit is the same as 10° Celsius. The only correct statement, therefore, is (**E**).

31. **C.** There are 7 coins in her purse, and three of them are worth 25 cents or more. Therefore, the probability that the value of the coin is at least 25 cents is $\frac{3}{7}$.

32. **B.** $\frac{82 + 74 + w}{3} = 76$. Cross-multiply

$156 + w = 228$

$w = 72$.

33. **A.** The area of a triangle is $\frac{1}{2} bh$. Let b represent the length of one leg. Then $h = 3b$, so the area is $\frac{1}{2} bh = \frac{1}{2} \cdot b \cdot 3b = \frac{3}{2} b^2 = 24$. Therefore, $\frac{2}{3} \cdot \frac{3}{2} b^2 = \frac{2}{3} \cdot 24$ and $b^2 = 16$. $b = \sqrt{16} = 4$ and $h = 3 \times 4 = 12$. The longest side of a right triangle is the hypotenuse. Using the Pythagorean Theorem, leg^2 + leg^2 = hypotenuse^2, so $4^2 + 12^2 = c^2$ and $16 + 144 = c^2$. Therefore, $160 = c^2$ and $c = \sqrt{160} = 12.6$.

34. C. Let b represent the number of boys in the class and g represent the number of girls. Then $b + g = 27$. If $b = g + 5$, then $(g + 5) + g = 27$. $2g + 5 = 27$ and $2g = 22$, so $g = 11$. Therefore, the number of boys is $27 - 11$ or 16.

35. C. In order to solve the equation, rewrite 4^{x+1} as $2^{2(x+1)}$. Thus, we are given $2^{3x} = 2^{2(x+1)}$, which is only true of $3x = 2(x + 1)$ or when $x = 2$.

36. B. $\dfrac{15\sqrt{3}}{\sqrt{5}} = \dfrac{15\sqrt{3}}{\sqrt{5}} \cdot \dfrac{\sqrt{5}}{\sqrt{5}} = \dfrac{15\sqrt{15}}{5} = 3\sqrt{15}$.

37. A. The equation of a line with a slope of $-\dfrac{3}{2}$ and a y-intercept of -2 is $y = -\dfrac{3}{2}x - 2$. To find the value of x in the point $(x, 1)$, substitute 1 for y and solve the equation for x. Then $1 = -\dfrac{3}{2}x - 2$ and $3 = -\dfrac{3}{2}x$. So $(3)\left(-\dfrac{2}{3}\right) = \left(-\dfrac{2}{3}\right)\left(-\dfrac{3}{2}\right)x$ and $x = -\dfrac{6}{3}$ or -2.

38. B. $\dfrac{3(28{,}000) + 2(31{,}000) + 1(34{,}000)}{6} = \dfrac{84{,}000 + 62{,}000 + 34{,}000}{6} = \dfrac{180{,}000}{6} = 30{,}000$

39. A. The value of $\sin x$ is $\dfrac{1}{2}$ when $x = 30°$.

40. B. The area of the circle is $\pi r^2 = 121\pi$. So $r^2 = 121$ and $r = 11$. The radius represents half the diagonal of the square, so the diagonal is 22 units long. If x represents the length of a side of the square, then x^2 is the area of the square. Using the Pythagorean Theorem, $x^2 + x^2 = 22^2$ and $2x^2 = 484$. Therefore $x^2 = \dfrac{484}{2} = 242$.