

# Full-Length Practice Test 5

## Reading Comprehension

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**Time:** 50 minutes

**Questions:** 1-40

**Directions:** Read each passage carefully and answer the questions that follow. Choose the best answer based on the information provided in the passage.

### PASSAGE 1

The cardiovascular system functions as the body's transportation network, delivering oxygen and nutrients to tissues while removing metabolic waste products. The human heart is a four-chambered muscular pump divided into right and left sides. The right side receives deoxygenated blood from the body and pumps it to the lungs, while the left side receives oxygenated blood from the lungs and pumps it throughout the body. Each side contains an atrium that receives blood and a ventricle that pumps blood outward.

Four valves ensure unidirectional blood flow through the heart. The atrioventricular valves—the tricuspid valve on the right and the mitral valve on the left—prevent backflow from ventricles to atria. The semilunar valves—the pulmonary valve and aortic valve—prevent backflow from arteries into ventricles. Heart valve diseases can significantly impair cardiac function, and severe dysfunction may require surgical repair or replacement with prosthetic valves.

The cardiac cycle describes events during one heartbeat, divided into systole (contraction) and diastole (relaxation). During diastole, ventricles relax and fill with blood. During systole, ventricular contraction forces blood into the pulmonary artery and aorta. Blood pressure measurements reflect these phases: systolic pressure represents peak arterial pressure during contraction, while diastolic pressure represents minimum pressure during relaxation. Normal blood pressure is approximately 120/80 mmHg.

Hypertension, consistently elevated blood pressure above 130/80 mmHg, affects nearly half of American adults and significantly increases risks for heart attack, stroke, and kidney disease. Often called the "silent killer," hypertension typically produces no symptoms until serious damage occurs. Risk factors include obesity, high sodium intake, physical inactivity, excessive alcohol consumption, and genetic predisposition. Treatment combines lifestyle modifications with antihypertensive medications. For dental professionals, understanding cardiovascular conditions is crucial because some cardiac medications cause oral side effects like gingival hyperplasia, and patients with certain heart conditions may require antibiotic prophylaxis before invasive dental procedures.

1. According to the passage, what is the function of the right side of the heart?

- A. Pumps oxygenated blood to the body
  - B. Receives deoxygenated blood and pumps it to the lungs
  - C. Filters blood before circulation
  - D. Stores blood for emergency use
2. The passage indicates that atrioventricular valves prevent:
- A. Blood from entering the heart
  - B. Blood from flowing into arteries
  - C. Backflow from ventricles to atria
  - D. Oxygen from leaving the blood
3. Based on the passage, systolic pressure represents:
- A. Peak arterial pressure during ventricular contraction
  - B. Minimum arterial pressure during relaxation
  - C. Average pressure throughout the cardiac cycle
  - D. Pressure in the atria only
4. According to the passage, hypertension is often called the "silent killer" because:
- A. It always causes immediate death
  - B. It only affects certain populations
  - C. It can be easily cured
  - D. It typically produces no symptoms until serious damage occurs
5. The passage states that normal blood pressure is approximately:
- A. 140/90 mmHg
  - B. 120/80 mmHg
  - C. 100/60 mmHg
  - D. 130/85 mmHg
6. Based on the passage, which of the following is a risk factor for hypertension?
- A. High sodium intake
  - B. Regular exercise
  - C. Low body weight
  - D. Moderate alcohol consumption
7. According to the passage, some cardiac medications can cause which oral side effect?
- A. Tooth decay
  - B. Dry mouth
  - C. Bad breath
  - D. Gingival hyperplasia

8. The passage indicates that during diastole:
- A. Blood is ejected from ventricles
  - B. Arteries constrict
  - C. Ventricles relax and fill with blood
  - D. Heart valves remain permanently closed

## **PASSAGE 2**

The renal system, consisting of the kidneys, ureters, bladder, and urethra, performs essential functions including waste removal, fluid and electrolyte balance, blood pressure regulation, and red blood cell production regulation. Each kidney contains approximately one million nephrons, the functional units responsible for filtering blood and forming urine. Understanding renal physiology is crucial for healthcare professionals because kidney dysfunction affects multiple body systems and influences medication dosing and treatment planning.

The nephron consists of several specialized segments that sequentially process filtered blood. The glomerulus, a network of capillaries, performs filtration under high pressure, allowing water, small molecules, and ions to pass into Bowman's capsule while retaining blood cells and large proteins. This filtrate then flows through the proximal tubule, where about 65% of filtered water and sodium, along with most glucose and amino acids, are reabsorbed. The loop of Henle creates a concentration gradient that enables the kidneys to produce concentrated urine, conserving water when needed.

The distal tubule and collecting duct provide fine-tuning of urine composition under hormonal control. Antidiuretic hormone (ADH) increases water reabsorption, concentrating urine and conserving body water. Aldosterone promotes sodium reabsorption and potassium secretion, affecting blood pressure and electrolyte balance. The kidneys also produce erythropoietin, stimulating red blood cell production, and activate vitamin D, essential for calcium absorption. This multifunctional role explains why kidney disease produces such diverse symptoms.

Chronic kidney disease (CKD) involves progressive loss of nephron function, often resulting from diabetes or hypertension. As kidney function declines, waste products accumulate, fluid balance becomes disrupted, and electrolyte abnormalities develop. Advanced CKD may require dialysis or kidney transplantation. For dental professionals, CKD has important implications: patients may have bleeding tendencies due to platelet dysfunction, altered drug metabolism requiring medication adjustments, increased infection susceptibility, and potential oral manifestations including uremic breath, xerostomia, and increased calculus formation. Additionally, dialysis patients require careful scheduling to avoid treatment immediately before or after dialysis sessions when anticoagulation and fluid shifts are most pronounced.

9. According to the passage, nephrons are best described as:
- A. Blood vessels in the kidneys
  - B. Functional units responsible for filtering blood
  - C. Hormones that regulate kidney function
  - D. Waste products eliminated by kidneys
10. The passage indicates that the glomerulus:
- A. Reabsorbs most filtered water
  - B. Secretes hormones
  - C. Stores urine
  - D. Performs filtration under high pressure
11. Based on the passage, approximately what percentage of filtered water and sodium is reabsorbed in the proximal tubule?
- A. 65%
  - B. 35%
  - C. 80%
  - D. 50%
12. According to the passage, antidiuretic hormone (ADH) functions to:
- A. Increase water reabsorption
  - B. Decrease blood pressure
  - C. Stimulate sodium secretion
  - D. Inhibit red blood cell production
13. The passage states that chronic kidney disease often results from:
- A. Infections only
  - B. Genetic factors only
  - C. Diabetes or hypertension
  - D. Excessive water intake
14. Based on the passage, patients with advanced CKD may require:
- A. Only medication
  - B. Exercise therapy
  - C. Vitamin supplements
  - D. Dialysis or kidney transplantation
15. According to the passage, dental professionals should be aware that CKD patients may have:
- A. Enhanced healing
  - B. Reduced infection risk

- C. Bleeding tendencies due to platelet dysfunction
- D. No oral manifestations

16. The passage indicates that erythropoietin:
- A. Stimulates red blood cell production
  - B. Decreases blood pressure
  - C. Filters waste products
  - D. Absorbs calcium

### **PASSAGE 3**

Microbiology is the study of microorganisms—organisms too small to be seen with the naked eye—including bacteria, viruses, fungi, and protozoa. These microscopic entities play crucial roles in human health and disease, with some microorganisms being beneficial while others cause infections. Understanding microbial structure, growth requirements, transmission methods, and control strategies is fundamental for healthcare professionals who must prevent healthcare-associated infections and implement appropriate infection control measures.

Bacteria are prokaryotic cells lacking membrane-bound organelles and a true nucleus. They are classified by shape (cocci are spherical, bacilli are rod-shaped, and spirilla are spiral) and by Gram staining characteristics. Gram-positive bacteria have thick peptidoglycan cell walls that retain crystal violet stain, appearing purple, while Gram-negative bacteria have thinner peptidoglycan layers and outer membranes, appearing pink after counterstaining. This distinction is clinically significant because it affects antibiotic susceptibility—Gram-negative bacteria's outer membrane provides additional protection against many antibiotics.

Viruses differ fundamentally from bacteria, being acellular entities consisting only of genetic material (DNA or RNA) enclosed in a protein coat. Viruses cannot reproduce independently and must hijack host cell machinery to replicate. This obligate parasitism makes viral infections difficult to treat—antiviral drugs must target viral replication without severely damaging host cells. Antibiotics, which target bacterial cell walls or metabolic processes absent in human cells, are ineffective against viral infections, yet antibiotics are often inappropriately prescribed for viral illnesses, contributing to antibiotic resistance.

Infection control in healthcare settings relies on understanding disease transmission routes. Contact transmission occurs through direct physical contact or indirect contact with contaminated surfaces. Droplet transmission involves respiratory droplets traveling short distances (usually less than 6 feet) during coughing or sneezing. Airborne transmission occurs when smaller particles remain suspended in air and travel longer distances. Standard precautions, including hand hygiene, personal protective equipment, and environmental cleaning, form the foundation of infection control. For dental professionals, understanding microbiology is particularly important because the oral cavity harbors diverse microbial

communities, dental procedures generate aerosols, and inadequate sterilization can transmit bloodborne pathogens like hepatitis B, hepatitis C, and HIV.

17. According to the passage, bacteria are classified as:
  - A. Eukaryotic cells
  - B. Multicellular organisms
  - C. Viruses
  - D. Prokaryotic cells
  
18. The passage indicates that Gram-positive bacteria appear what color after staining?
  - A. Pink
  - B. Purple
  - C. Blue
  - D. Clear
  
19. Based on the passage, viruses are described as:
  - A. Prokaryotic organisms
  - B. Beneficial bacteria
  - C. Acellular entities with genetic material in a protein coat
  - D. Fungi with cell walls
  
20. According to the passage, why are antibiotics ineffective against viral infections?
  - A. Viruses lack the structures and processes that antibiotics target
  - B. Viruses are too large for antibiotics
  - C. Viruses always become resistant
  - D. Viruses hide inside bones
  
21. The passage states that droplet transmission typically involves respiratory droplets traveling:
  - A. Over 20 feet
  - B. Through the bloodstream
  - C. Only by contact
  - D. Less than 6 feet
  
22. Based on the passage, standard precautions include:
  - A. Vaccination only
  - B. Isolation of all patients
  - C. Hand hygiene and personal protective equipment
  - D. Antibiotic treatment for everyone
  
23. According to the passage, the Gram-negative bacteria's outer membrane:

- A. Makes them easier to treat
- B. Provides additional protection against many antibiotics
- C. Contains no peptidoglycan
- D. Is absent in all bacteria

24. The passage indicates that dental professionals must understand microbiology because:

- A. Dental work is always sterile
- B. The oral cavity contains no bacteria
- C. Infections never occur in dentistry
- D. Dental procedures generate aerosols and can transmit pathogens

#### **PASSAGE 4**

Pharmacology is the study of drugs and their interactions with living systems, encompassing drug mechanisms, therapeutic effects, adverse reactions, and dosing principles. Healthcare professionals must understand pharmacological concepts to prescribe medications safely, recognize drug interactions, and educate patients about proper medication use. Drugs can be administered through various routes—oral, intravenous, intramuscular, subcutaneous, topical, and inhalation—each with distinct advantages, absorption rates, and clinical applications.

Pharmacokinetics describes what the body does to a drug, encompassing absorption, distribution, metabolism, and elimination. Absorption is the process by which drugs enter the bloodstream from their administration site. Oral drugs must survive the acidic stomach environment and undergo first-pass metabolism in the liver before reaching systemic circulation, which can significantly reduce bioavailability. Distribution refers to drug movement from bloodstream to tissues, influenced by factors including blood flow, protein binding, and lipid solubility. Highly lipid-soluble drugs readily cross cell membranes and the blood-brain barrier.

Metabolism, occurring primarily in the liver, converts drugs into more water-soluble compounds for elimination. The cytochrome P450 enzyme system metabolizes many drugs, and genetic variations in these enzymes cause individuals to metabolize medications at different rates. Some people are "rapid metabolizers" who break down drugs quickly, potentially requiring higher doses, while "poor metabolizers" eliminate drugs slowly, risking toxicity at standard doses. Drug interactions often involve the P450 system—some drugs inhibit these enzymes, increasing other drugs' blood levels, while enzyme inducers accelerate metabolism, decreasing drug effectiveness.

Pharmacodynamics describes what drugs do to the body—their mechanisms of action and effects. Most drugs work by binding to specific receptors, with agonists activating receptors and antagonists blocking them. Drug selectivity is crucial; more selective drugs produce fewer side effects by targeting specific receptor subtypes. However, no drug is perfectly selective, explaining why medications cause adverse

effects. For dental professionals, pharmacological knowledge is essential for prescribing pain medications, antibiotics, and local anesthetics appropriately. Dentists must also recognize oral side effects of systemic medications, including xerostomia from anticholinergics and antihistamines, gingival overgrowth from calcium channel blockers and phenytoin, and bleeding risks with anticoagulants and antiplatelet drugs requiring treatment modifications.

25. According to the passage, pharmacokinetics describes:

- A. What the body does to a drug
- B. What drugs do to the body
- C. Only drug side effects
- D. How to prescribe medications

26. The passage indicates that oral drugs undergo first-pass metabolism in the:

- A. Kidneys
- B. Stomach
- C. Liver
- D. Intestines

27. Based on the passage, highly lipid-soluble drugs:

- A. Cannot cross cell membranes
- B. Readily cross cell membranes and the blood-brain barrier
- C. Are always toxic
- D. Never reach the brain

28. According to the passage, "rapid metabolizers":

- A. Eliminate drugs slowly
- B. Always experience toxicity
- C. Never need medications
- D. Break down drugs quickly and may require higher doses

29. The passage states that agonists:

- A. Activate receptors
- B. Block receptors
- C. Destroy cells
- D. Prevent all drug effects

30. Based on the passage, drug selectivity is important because:

- A. All drugs must be perfectly selective
- B. Drugs never cause side effects
- C. More selective drugs produce fewer side effects

D. Selectivity determines drug color

31. According to the passage, which medication class can cause gingival overgrowth?

A. Antibiotics

B. Pain relievers

C. Antihistamines

D. Calcium channel blockers

32. The passage indicates that some drugs inhibit P450 enzymes, which:

A. Increases other drugs' blood levels

B. Decreases all drug effectiveness

C. Has no clinical significance

D. Only affects metabolism speed

## **PASSAGE 5**

Genetics is the study of heredity and variation in living organisms, examining how traits pass from parents to offspring through genes. Modern genetics integrates molecular biology, revealing that DNA carries genetic information and understanding how gene expression is regulated. Genetic principles explain inherited diseases, guide genetic counseling, and increasingly influence medical treatment through personalized medicine approaches that tailor therapies based on individual genetic profiles.

DNA structure provides the foundation for heredity. The double helix consists of two complementary strands held together by base pairing—adenine with thymine and guanine with cytosine. During DNA replication, each strand serves as a template for synthesizing a new complementary strand, ensuring genetic information is accurately copied when cells divide. Genes are DNA segments that code for proteins, with the genetic code read in three-nucleotide codons that specify particular amino acids. Gene expression involves transcription (DNA to RNA) and translation (RNA to protein), with multiple regulatory mechanisms controlling when and how much protein is produced.

Inheritance patterns explain how genetic traits pass through families. Mendelian genetics describes simple patterns: autosomal dominant disorders (like Huntington's disease) require only one mutated allele for expression, while autosomal recessive disorders (like cystic fibrosis) require two mutated alleles. Sex-linked traits, carried on X chromosomes, predominantly affect males who have only one X chromosome. However, many traits show complex inheritance involving multiple genes and environmental interactions. Genetic testing can identify carriers of recessive disorders, diagnose genetic conditions, and assess disease risk, though it raises ethical considerations regarding privacy, discrimination, and psychological impact.

Genetic mutations—changes in DNA sequence—are the ultimate source of genetic variation. Mutations can result from DNA replication errors, exposure to mutagens like radiation or chemicals, or occur

spontaneously. While many mutations are neutral or harmful, some provide advantages that natural selection can favor. Cancer fundamentally involves accumulated mutations in genes controlling cell growth and division. Understanding cancer genetics has revolutionized treatment, with targeted therapies designed for specific genetic mutations in tumors. For dental professionals, genetics is increasingly relevant: hereditary conditions affect oral and craniofacial development, genetic polymorphisms influence periodontal disease susceptibility and drug metabolism, and oral cancer risk involves genetic factors. Additionally, some genetic syndromes require modified dental care approaches, and family history can guide preventive strategies and screening recommendations.

33. According to the passage, DNA strands are held together by:
- A. Hydrogen bonds only
  - B. Covalent bonds
  - C. Ionic attractions
  - D. Base pairing between adenine-thymine and guanine-cytosine
34. The passage indicates that during DNA replication:
- A. Only one strand is copied
  - B. Each strand serves as a template for a new complementary strand
  - C. DNA is destroyed
  - D. No new DNA is created
35. Based on the passage, autosomal dominant disorders require how many mutated alleles for expression?
- A. Three
  - B. Two
  - C. One
  - D. None
36. According to the passage, sex-linked traits predominantly affect:
- A. Females only
  - B. Neither males nor females
  - C. All family members equally
  - D. Males who have only one X chromosome
37. The passage states that mutations can result from:
- A. DNA replication errors or exposure to mutagens
  - B. Only environmental factors
  - C. Eating certain foods
  - D. Normal aging exclusively
38. Based on the passage, targeted cancer therapies are designed for:

- A. All cancers identically
- B. Only inherited cancers
- C. Specific genetic mutations in tumors
- D. Preventing all mutations

39. According to the passage, genes are best defined as:

- A. Proteins in cells
- B. DNA segments that code for proteins
- C. Only RNA molecules
- D. Cell membranes

40. The passage indicates that for dental professionals, genetics is relevant because:

- A. Hereditary conditions affect oral development and some syndromes require modified care
- B. All dental problems are genetic
- C. Genetics has no role in dentistry
- D. Only teeth color is genetic

## Language Usage

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**Time:** 30 minutes

**Questions:** 1-40

**Directions:** Each question presents a sentence or passage with underlined portions or asks you to identify errors or select the best revision. Choose the answer that corrects any errors or represents the best version.

1. The dental practice updated their equipment, they also hired two new hygienists this month.
  - A. equipment, they also hired
  - B. equipment and also hired
  - C. equipment they also hired
  - D. equipment; because they also hired
2. Neither the assistant nor the receptionists was able to find the patient's file yesterday.
  - A. nor the receptionists was able
  - B. or the receptionists was able
  - C. or the receptionists were able
  - D. nor the receptionists were able
3. The hygienist asked the patient when could she come back for her cleaning appointment.
  - A. when could she come back

- B. when she could have come back
  - C. when she could come back
  - D. when could she have come back
4. Between you and I, the new scheduling system is much more efficient than before.
- A. Between you and I, the new scheduling system is
  - B. Between you and me, the new scheduling system are
  - C. Between you and me, the new scheduling system is
  - D. Between you and I, the new scheduling systems are
5. The office offers many services including cleanings, examinations, and will provide cosmetic treatments.
- A. cleanings, examinations, and will provide cosmetic treatments
  - B. cleanings, examinations, and cosmetic treatments
  - C. cleaning, examination, and cosmetic treatment
  - D. cleanings, examinations, and providing cosmetic treatments
6. After completing the patient assessment the hygienist documented all findings in the chart.
- A. After completing the patient assessment, the hygienist documented
  - B. After completing, the patient assessment the hygienist documented
  - C. After completing the patient assessment the hygienist, documented
  - D. After completing the patient assessment; the hygienist documented
7. The new technology is more accurate than the old system, it also saves time.
- A. old system, it also saves
  - B. old system it also saves
  - C. old system; because it also saves
  - D. old system, and it also saves
8. Everyone in the clinic must complete their annual training before the end of the month.
- A. must complete their annual training
  - B. must complete its annual training
  - C. must complete his or her annual training
  - D. must completes his or her annual training
9. The dentist suggested that the patient brushes his teeth three times daily.
- A. suggested that the patient brushes his teeth
  - B. suggested that the patient brush his teeth
  - C. suggests that the patient brushes his teeth
  - D. suggested that the patient brushed his teeth

10. Working long hours, the dentist's schedule became overwhelming during the busy season.
- A. Working long hours, the dentist's schedule became overwhelming
  - B. Working long hours, the schedule of the dentist became overwhelming
  - C. Working long hours, the dentist found the schedule overwhelming
  - D. The dentist's schedule became overwhelming, working long hours
11. Each of the dental students have submitted their research papers by the deadline.
- A. have submitted their research papers
  - B. has submitted his or her research paper
  - C. have submitted his or her research papers
  - D. has submitted their research papers
12. The clinic is open daily, however it is closed on major holidays and weekends.
- A. daily, however it is
  - B. daily; however, it is
  - C. daily however, it is
  - D. daily, however, it is
13. Less patients came to the office during the winter months than expected.
- A. Fewer patients came
  - B. Less patient came
  - C. Lesser patients came
  - D. Less patients come
14. The assistant prepared the room, sterilized the instruments, and was setting up the operatory.
- A. prepared the room, sterilized the instruments, and was setting up
  - B. prepares the room, sterilized the instruments, and set up
  - C. prepared the room, sterilizes the instruments, and set up
  - D. prepared the room, sterilized the instruments, and set up
15. Dr. Anderson told Dr. Martinez that she needed to review the case before treatment.
- A. Dr. Anderson told Dr. Martinez that she needed
  - B. Dr. Anderson told Dr. Martinez that Anderson needed
  - C. Dr. Anderson told Dr. Martinez that Dr. Anderson needed
  - D. Dr. Anderson told Dr. Martinez she needed
16. The policy change effects all employees and will take effect immediately starting today.
- A. effects all employees and will take effect
  - B. affects all employees and will take effect

- C. effects all employees and will take affect
- D. affects all employees and will take affect

17. Good oral hygiene is essential for health, all patients should follow proper care routines.

- A. health, all patients should follow
- B. health; because all patients should follow
- C. health all patients should follow
- D. health. All patients should follow

18. The dentist which completed residency training last year has joined our practice.

- A. who completed residency training
- B. which completed residency training
- C. whom completed residency training
- D. which had completed residency training

19. Having examined the x-rays thoroughly, a diagnosis was provided by the dentist.

- A. Having examined the x-rays thoroughly, a diagnosis was provided by the dentist
- B. Having examined the x-rays thoroughly, the dentist's diagnosis was provided
- C. Having examined the x-rays thoroughly, the dentist provided a diagnosis
- D. A diagnosis was provided by the dentist, having examined the x-rays thoroughly

20. The patient should of made an appointment earlier in the week.

- A. should of made
- B. should have made
- C. should had made
- D. should has made

21. The treatment plan includes extractions, fillings, or placing crowns on the damaged teeth.

- A. extractions, fillings, or crowns
- B. extracting, filling, or placing crowns
- C. extractions, fillings, or placing crowns
- D. extraction, filling, or crown

22. Dental implants are highly effective, they provide long-lasting solutions for tooth loss.

- A. effective, they provide
- B. effective they provide
- C. effective; they provide
- D. effective; and they provide

23. Among the five treatment options, the surgical approach is the more complex choice.

- A. the more complex choice
- B. the most complex choice
- C. the more complexly choice
- D. the most complexly choice

24. The dental office is located at 789 oak street in downtown Seattle Washington.

- A. Oak Street in downtown Seattle, Washington
- B. oak street in downtown Seattle, Washington
- C. Oak street in downtown Seattle Washington
- D. oak Street in downtown Seattle, washington

25. After the procedure was completed the patient received detailed post-operative instructions.

- A. After the procedure was completed the patient received
- B. After the procedure, was completed the patient received
- C. After the procedure was completed; the patient received
- D. After the procedure was completed, the patient received

26. The hygienist asked the patient when can he schedule his next appointment.

- A. when can he schedule
- B. when he could schedule
- C. when could he schedule
- D. when he can schedule

27. The dentist and his staff both agrees that preventive care reduces future problems.

- A. both agrees that
- B. both agrees, that
- C. both agree that
- D. both agree, that

28. Daily brushing, regular flossing, and dental checkups is important for oral health.

- A. is important
- B. are important
- C. is importantly
- D. are importantly

29. The new equipment will improve accuracy, it will also reduce treatment time significantly.

- A. accuracy, it will also reduce
- B. accuracy it will also reduce
- C. accuracy; because it will also reduce
- D. accuracy, and it will also reduce

30. The practice treats patients with conditions such as cavities, gum disease, and tooth decay.
- A. conditions, such as cavities, gum disease, and tooth decay
  - B. conditions such as, cavities, gum disease, and tooth decay
  - C. conditions such as cavities gum disease and tooth decay
  - D. conditions such as cavities, gum disease, and tooth decay
31. Dentists, hygienists, and assistants all plays critical roles in patient care.
- A. all plays critical roles
  - B. all play critical role
  - C. all plays critical role
  - D. all play critical roles
32. The dentist asked the patient to lay down on the examination chair.
- A. to lie down on the examination chair
  - B. to lay down in the examination chair
  - C. to lie down in the examination chair
  - D. to lay down on the examination chair
33. Modern dental practice has evolved considerably, allowing practitioners to provide better care.
- A. considerably, allowing practitioners to provide
  - B. considerably; allowing practitioners to provide
  - C. considerably allowing practitioners to provide
  - D. considerably. Allowing practitioners to provide
34. Regular dental visits prevent problems, they help maintain optimal oral health.
- A. problems. They help maintain
  - B. problems, they help maintain
  - C. problems they help maintain
  - D. problems; and they help maintain
35. The dental program requires students to complete clinical hours before graduation.
- A. requires students to complete clinical hours, before graduation
  - B. require students to complete clinical hours before graduation
  - C. requires students to complete clinical hours before, graduation
  - D. requires students to complete clinical hours before graduation
36. The insurance covers routine services such as cleanings and examinations but not cosmetic work.
- A. services, such as cleanings and examinations but
  - B. services such as, cleanings and examinations, but

- C. services, such as cleanings and examinations, but
  - D. services such as cleanings and examinations, but
37. The clinic's new location is more accessible for patients than the previous office.
- A. more accessible for patients than the previous office
  - B. more accessible for patients than the previous office was
  - C. more accessibly for patients than the previous office
  - D. most accessible for patients than the previous office
38. Good dental health requires brushing twice daily, flossing regularly, and to visit the dentist.
- A. brushing twice daily, flossing regularly, and visiting the dentist
  - B. brushing twice daily, flossing regularly, and to visit the dentist
  - C. to brush twice daily, flossing regularly, and visiting the dentist
  - D. to brush twice daily, to floss regularly, and to visit the dentist
39. The patient explained that his tooth has been painful for several days before calling.
- A. has been painful
  - B. has hurt
  - C. will have been painful
  - D. had been painful
40. Preventive dentistry reduces treatment costs, it also improves long-term outcomes for patients.
- A. costs, it also improves
  - B. costs it also improves
  - C. costs, and it also improves
  - D. costs; because it also improves

## Quantitative Reasoning

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**Time:** 45 minutes

**Questions:** 1-40

**Directions:** Solve each problem and select the best answer from the choices provided. You may use scratch paper for calculations.

1. Solve for  $x$ :  $5x - 7 = 18$
- A. 3
  - B. 5
  - C. 11

D. 25

2. A clinic treated 180 patients in May and 225 patients in June. What is the percent increase?
  - A. 20%
  - B. 45%
  - C. 180%
  - D. 25%
  
3. If  $7y - 3 = 4y + 9$ , what is the value of  $y$ ?
  - A. 4
  - B. 6
  - C. 2
  - D. 12
  
4. A dental assistant earns \$42 per hour and works 6 hours per day for 4 days per week. How much does she earn per week?
  - A. \$252
  - B. \$168
  - C. \$672
  - D. \$1,008
  
5. What is 18% of 350?
  - A. 18
  - B. 35
  - C. 63
  - D. 70
  
6. If  $a = 5$  and  $b = -2$ , what is the value of  $3a^2 - 4b$ ?
  - A. 83
  - B. 67
  - C. 75
  - D. 58
  
7. A medication dosage is 0.5 mg per kilogram of body weight. How many milligrams should be given to a patient weighing 86 kilograms?
  - A. 40 mg
  - B. 43 mg
  - C. 50 mg
  - D. 86 mg

8. Solve:  $3(x + 5) = 2x + 21$
- A. 3
  - B. 5
  - C. 8
  - D. 6
9. A container has 8 red balls, 7 blue balls, and 5 green balls. If one ball is selected at random, what is the probability it is green?
- A.  $\frac{7}{20}$
  - B.  $\frac{2}{5}$
  - C.  $\frac{1}{4}$
  - D.  $\frac{8}{20}$
10. Convert 2.7 kilometers to meters.
- A. 27 meters
  - B. 2,700 meters
  - C. 270 meters
  - D. 27,000 meters
11. If  $x = 5$ , what is the value of  $4x^2 + 6x$ ?
- A. 130
  - B. 120
  - C. 140
  - D. 110
12. Office supplies decreased from \$2,500 to \$2,000. What is the percent decrease?
- A. 25%
  - B. 500%
  - C. 20%
  - D. 30%
13. Simplify:  $4(3x - 2) - 6(x + 3)$
- A.  $18x - 26$
  - B.  $12x - 26$
  - C.  $x - 10$
  - D.  $6x - 26$
14. The ratio of dentists to patients is 1:35. If there are 140 patients, how many dentists are there?
- A. 4
  - B. 35

- C. 5
- D. 40

15. Solve for x:  $x/6 + 4 = 10$

- A. 14
- B. 60
- C. 24
- D. 36

16. A patient's blood pressure increased from 115 mmHg to 133 mmHg. What is the amount of increase?

- A. 15 mmHg
- B. 18 mmHg
- C. 20 mmHg
- D. 133 mmHg

17. If  $6x - 4y = 30$  and  $x = 9$ , what is the value of y?

- A. 6
- B. 9
- C. 12
- D. 3

18. A dental office offers a 25% discount on whitening. If the original price is \$600, what is the discounted price?

- A. \$575
- B. \$500
- C. \$450
- D. \$150

19. Solve for x:  $9x - 4 = 6x + 17$

- A. 5
- B. 13
- C. 21
- D. 7

20. What is the mean of the data set: 15, 20, 25, 30, 35?

- A. 20
- B. 25
- C. 30
- D. 15

21. A solution contains 400 mL of liquid. If 32% is active ingredient, how many milliliters of active ingredient does it contain?
- A. 32 mL
  - B. 100 mL
  - C. 128 mL
  - D. 160 mL
22. If  $x^2 = 144$ , what are the possible values of  $x$ ?
- A. 144 only
  - B. 12 and -12
  - C. 12 only
  - D. -12 only
23. A hygienist sees 14 patients per day for 5 days per week for 4 weeks. How many patients in total?
- A. 70
  - B. 56
  - C. 140
  - D. 280
24. Simplify:  $(5x^4)(4x^3)$
- A.  $20x^7$
  - B.  $9x^{12}$
  - C.  $9x^7$
  - D.  $20x^{12}$
25. What is  $5/8$  expressed as a percent?
- A. 58%
  - B. 0.625%
  - C. 62.5%
  - D. 80%
26. A patient takes medication every 6 hours. How many doses in 3 days?
- A. 6
  - B. 12
  - C. 18
  - D. 24
27. If the perimeter of a rectangle is 70 cm and the length is 20 cm, what is the width?
- A. 15 cm
  - B. 25 cm

- C. 30 cm
- D. 35 cm

28. Solve:  $8x - 12 = 7x - 4$

- A. 6
- B. 16
- C. -8
- D. 8

29. Supplies cost \$750 before tax. With 6% sales tax, what is the total cost?

- A. \$756
- B. \$750
- C. \$795
- D. \$800

30. What is the median of: 10, 14, 18, 22, 26?

- A. 14
- B. 18
- C. 22
- D. 16

31. If  $5x - 8 = 17$ , what is the value of  $2x$ ?

- A. 5
- B. 10
- C. 15
- D. 10

32. A bottle holds 2.2 liters. How many milliliters is this?

- A. 2,200 mL
- B. 220 mL
- C. 22 mL
- D. 22,000 mL

33. Evaluate:  $(-5)^2 - 2(-3)$

- A. 19
- B. -19
- C. 31
- D. 25

34. A clinic has 30 employees. If 40% are dental hygienists, how many hygienists work there?

- A. 10
- B. 12
- C. 15
- D. 8

35. Solve for  $x$ :  $x/8 = 6$

- A. 48
- B. 14
- C. 8
- D. 2

36. What is 0.375 expressed as a fraction in simplest form?

- A.  $375/1000$
- B.  $75/200$
- C.  $15/40$
- D.  $3/8$

37. If  $x + y = 18$  and  $x - y = 6$ , what is the value of  $x$ ?

- A. 6
- B. 12
- C. 18
- D. 24

38. A patient's temperature is  $39^{\circ}\text{C}$ . Using  $F = (9/5)C + 32$ , what is it in Fahrenheit?

- A.  $100.2^{\circ}\text{F}$
- B.  $101.2^{\circ}\text{F}$
- C.  $102.2^{\circ}\text{F}$
- D.  $103.2^{\circ}\text{F}$

39. What is the range of: 16, 22, 28, 34, 40?

- A. 16
- B. 22
- C. 28
- D. 24

40. A clinic treated 150 patients in July and 225 patients in August. What is the ratio of July to August patients in simplest form?

- A. 2:3
- B. 3:2
- C. 5:7

D. 1:2

## Perceptual Ability

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**Time:** 45 minutes

**Questions:** 1-60

**Directions:** This section tests your ability to visualize and mentally manipulate objects in space. Carefully examine each question and select the best answer.

### ANGLE DISCRIMINATION (Questions 1-15)

**Directions:** For each question, rank the angles from smallest to largest or identify relationships between angles.

- Four angles are shown. Angle 1 measures  $60^\circ$ , Angle 2 measures  $118^\circ$ , Angle 3 measures  $81^\circ$ , and Angle 4 measures  $142^\circ$ . Which angle is closest to  $80^\circ$ ?
  - Angle 1
  - Angle 2
  - Angle 3
  - Angle 4
- Three angles are presented. Angle A =  $36^\circ$ , Angle B =  $128^\circ$ , Angle C =  $94^\circ$ . Which is the smallest angle?
  - Angle A
  - Angle B
  - Angle C
  - All equal
- Five angles measure  $26^\circ$ ,  $93^\circ$ ,  $57^\circ$ ,  $145^\circ$ , and  $88^\circ$ . Which is the second largest angle?
  - $26^\circ$
  - $93^\circ$
  - $88^\circ$
  - $145^\circ$
- Four angles are displayed:  $41^\circ$ ,  $106^\circ$ ,  $69^\circ$ , and  $131^\circ$ . Which is the largest angle?
  - $41^\circ$
  - $69^\circ$
  - $106^\circ$
  - $131^\circ$

5. Three angles measure  $78^\circ$ ,  $124^\circ$ , and  $44^\circ$ . What is the correct order from smallest to largest?
- A.  $44^\circ$ ,  $78^\circ$ ,  $124^\circ$
  - B.  $78^\circ$ ,  $44^\circ$ ,  $124^\circ$
  - C.  $124^\circ$ ,  $78^\circ$ ,  $44^\circ$
  - D.  $44^\circ$ ,  $124^\circ$ ,  $78^\circ$
6. Five angles are shown:  $33^\circ$ ,  $101^\circ$ ,  $72^\circ$ ,  $149^\circ$ , and  $58^\circ$ . Which angle is acute and closest to  $75^\circ$ ?
- A.  $33^\circ$
  - B.  $58^\circ$
  - C.  $72^\circ$
  - D.  $101^\circ$
7. Four angles measure  $19^\circ$ ,  $97^\circ$ ,  $50^\circ$ , and  $164^\circ$ . Which is the second smallest angle?
- A.  $19^\circ$
  - B.  $50^\circ$
  - C.  $97^\circ$
  - D.  $164^\circ$
8. Three angles are presented:  $35^\circ$ ,  $91^\circ$ , and  $156^\circ$ . Which angle is obtuse and greater than  $130^\circ$ ?
- A.  $35^\circ$
  - B.  $91^\circ$
  - C. All three
  - D.  $156^\circ$
9. Five angles measure  $42^\circ$ ,  $105^\circ$ ,  $68^\circ$ ,  $138^\circ$ , and  $51^\circ$ . Which angle measures exactly  $68^\circ$ ?
- A.  $42^\circ$
  - B.  $51^\circ$
  - C.  $68^\circ$
  - D.  $105^\circ$
10. Four angles are shown:  $66^\circ$ ,  $129^\circ$ ,  $31^\circ$ , and  $92^\circ$ . Which is the smallest angle?
- A.  $31^\circ$
  - B.  $66^\circ$
  - C.  $92^\circ$
  - D.  $129^\circ$
11. Three acute angles measure  $40^\circ$ ,  $73^\circ$ , and  $61^\circ$ . Which is the largest?
- A.  $40^\circ$
  - B.  $61^\circ$

- C. All equal
- D.  $73^\circ$

12. Five angles measure  $116^\circ$ ,  $87^\circ$ ,  $52^\circ$ ,  $167^\circ$ , and  $75^\circ$ . Which is the second smallest?

- A.  $52^\circ$
- B.  $75^\circ$
- C.  $87^\circ$
- D.  $116^\circ$

13. Four angles are displayed:  $23^\circ$ ,  $102^\circ$ ,  $74^\circ$ , and  $143^\circ$ . Which angle is closest to  $70^\circ$ ?

- A.  $23^\circ$
- B.  $102^\circ$
- C.  $74^\circ$
- D.  $143^\circ$

14. Three angles measure  $119^\circ$ ,  $46^\circ$ , and  $86^\circ$ . Which is acute and smallest?

- A.  $46^\circ$
- B.  $86^\circ$
- C.  $119^\circ$
- D. None

15. Five angles are shown:  $38^\circ$ ,  $107^\circ$ ,  $64^\circ$ ,  $151^\circ$ , and  $82^\circ$ . Which lists the two smallest in order?

- A.  $38^\circ$ ,  $64^\circ$
- B.  $64^\circ$ ,  $82^\circ$
- C.  $38^\circ$ ,  $151^\circ$
- D.  $151^\circ$ ,  $107^\circ$

### **APERTURES (Questions 16-30)**

**Directions:** A three-dimensional object is shown along with aperture openings. Determine which aperture the object could pass through if properly oriented.

16. A rectangular prism measures  $6\text{ cm} \times 10\text{ cm} \times 12\text{ cm}$ . Which aperture allows the largest face to pass through?

- A. A circle 10 cm diameter
- B. A rectangle  $10\text{ cm} \times 12\text{ cm}$
- C. A square  $10\text{ cm} \times 10\text{ cm}$
- D. A triangle 12 cm base

17. A cylinder with diameter 10 cm and height 16 cm is shown. When entering circular end first, what aperture is needed?

- A. A square  $16\text{ cm} \times 16\text{ cm}$
  - B. A rectangle  $10\text{ cm} \times 16\text{ cm}$
  - C. A triangle  $10\text{ cm}$  sides
  - D. A circle with at least  $10\text{ cm}$  diameter
18. A pyramid with square base  $10\text{ cm} \times 10\text{ cm}$  is presented. Which aperture accommodates the base?
- A. A square  $10\text{ cm} \times 10\text{ cm}$  or larger
  - B. A circle  $10\text{ cm}$  diameter
  - C. A rectangle  $8\text{ cm} \times 10\text{ cm}$
  - D. A triangle  $10\text{ cm}$  sides
19. A cube measuring  $9\text{ cm}$  per side is shown. What is the smallest square aperture needed?
- A.  $7\text{ cm} \times 7\text{ cm}$
  - B.  $11\text{ cm} \times 11\text{ cm}$
  - C.  $9\text{ cm} \times 9\text{ cm}$
  - D.  $18\text{ cm} \times 18\text{ cm}$
20. A triangular prism has base  $8\text{ cm}$  per side and length  $14\text{ cm}$ . Which aperture allows triangle-first passage?
- A. A square  $8\text{ cm} \times 8\text{ cm}$
  - B. A circle  $14\text{ cm}$  diameter
  - C. A rectangle  $8\text{ cm} \times 14\text{ cm}$
  - D. An equilateral triangle  $8\text{ cm}$  sides
21. An L-shaped object measures  $8\text{ cm}$  wide and  $11\text{ cm}$  tall overall. Which aperture accommodates it?
- A. A square  $8\text{ cm} \times 8\text{ cm}$
  - B. A rectangle  $8\text{ cm} \times 11\text{ cm}$  or larger
  - C. A circle  $9\text{ cm}$  diameter
  - D. A triangle  $11\text{ cm}$  base
22. A sphere with diameter  $13\text{ cm}$  is presented. What aperture is required?
- A. A circle with at least  $13\text{ cm}$  diameter
  - B. A square  $11\text{ cm} \times 11\text{ cm}$
  - C. A rectangle  $12\text{ cm} \times 14\text{ cm}$
  - D. A triangle  $13\text{ cm}$  sides
23. A rectangular block  $8\text{ cm} \times 10\text{ cm} \times 6\text{ cm}$  is shown. When oriented with  $8\text{ cm} \times 10\text{ cm}$  face forward, what aperture?
- A. A circle  $10\text{ cm}$  diameter
  - B. A square  $10\text{ cm} \times 10\text{ cm}$

- C. A rectangle  $8\text{ cm} \times 10\text{ cm}$
  - D. A rectangle  $6\text{ cm} \times 8\text{ cm}$
24. A hexagonal prism with  $8\text{ cm}$  wide base and  $15\text{ cm}$  length is displayed. Which aperture for hexagon-first entry?
- A. A circle  $7\text{ cm}$  diameter
  - B. A rectangle  $8\text{ cm} \times 15\text{ cm}$
  - C. A square  $8\text{ cm} \times 8\text{ cm}$
  - D. A hexagon approximately  $8\text{ cm}$  across
25. A T-shaped object measures  $12\text{ cm}$  wide and  $14\text{ cm}$  tall. What minimum aperture?
- A. A rectangle  $10\text{ cm} \times 12\text{ cm}$
  - B. A rectangle  $12\text{ cm} \times 14\text{ cm}$
  - C. A square  $12\text{ cm} \times 12\text{ cm}$
  - D. A circle  $14\text{ cm}$  diameter
26. An ellipsoid measures  $9\text{ cm} \times 12\text{ cm} \times 7\text{ cm}$ . When oriented with  $9\text{ cm} \times 12\text{ cm}$  face forward, which aperture?
- A. A circle  $12\text{ cm}$  diameter
  - B. A square  $12\text{ cm} \times 12\text{ cm}$
  - C. An ellipse or rectangle  $9\text{ cm} \times 12\text{ cm}$
  - D. A rectangle  $7\text{ cm} \times 9\text{ cm}$
27. A cross-shaped object has arms extending  $10\text{ cm}$  in each direction. What aperture for face-first passage?
- A. A square  $10\text{ cm} \times 10\text{ cm}$  or larger
  - B. A circle  $10\text{ cm}$  diameter
  - C. A rectangle  $10\text{ cm} \times 12\text{ cm}$
  - D. A triangle  $10\text{ cm}$  sides
28. A cone with base diameter  $12\text{ cm}$  is shown. Which aperture fits the base?
- A. A square  $10\text{ cm} \times 10\text{ cm}$
  - B. A rectangle  $9\text{ cm} \times 12\text{ cm}$
  - C. A triangle  $12\text{ cm}$  sides
  - D. A circle with at least  $12\text{ cm}$  diameter
29. A rectangular block with rounded ends measures  $8\text{ cm} \times 10\text{ cm} \times 14\text{ cm}$  with  $2\text{ cm}$  radius curves. Which aperture for curved end?
- A. A rectangle  $7\text{ cm} \times 9\text{ cm}$
  - B. A rounded rectangle approximately  $8\text{ cm} \times 10\text{ cm}$

- C. A circle 10 cm diameter
- D. A square 10 cm  $\times$  10 cm

30. An irregular object with dimensions 9 cm  $\times$  11 cm  $\times$  7 cm is shown. When oriented with smallest face forward, which aperture?
- A. A rectangle 9 cm  $\times$  7 cm
  - B. A square 9 cm  $\times$  9 cm
  - C. A circle 9 cm diameter
  - D. A rectangle 11 cm  $\times$  7 cm

### **ORTHOGRAPHIC PROJECTIONS (Questions 31-45)**

**Directions:** Three views (top, front, and end) of an object are shown. Select the answer that correctly represents the object or its views.

31. The top view shows a rectangle, front view shows a rectangle, end view shows a square. What is the object?
- A. A cube
  - B. A cylinder
  - C. A rectangular prism
  - D. A pyramid
32. Top view shows a circle, front view shows a rectangle, end view shows a circle. What is the object?
- A. A sphere
  - B. A cone
  - C. A cube
  - D. A cylinder
33. A stepped object has three levels. Which view shows all three levels most clearly?
- A. Top view only
  - B. Front view only
  - C. End view only
  - D. All three equally
34. Top view is triangle, front view is rectangle, end view is triangle. What is the object?
- A. A pyramid
  - B. A cone
  - C. A triangular prism
  - D. A rectangular prism
35. Top view shows square, front view shows square, end view shows square. What is the object?

- A. A cube
  - B. A rectangular prism
  - C. A pyramid
  - D. A cylinder
36. Top view shows square with smaller square inside, front view shows nested rectangles, end view shows nested rectangles. What does this represent?
- A. A solid cube
  - B. A pyramid in a box
  - C. Two cubes
  - D. A hollow rectangular frame
37. Top view shows cross, front view shows rectangle, end view shows cross. What is the object?
- A. A cross-shaped pyramid
  - B. A cross-shaped prism
  - C. Four rectangular prisms
  - D. A plus sign
38. Top view shows circle with line, front view shows rectangle with line, end view shows circle with line. What is the object?
- A. A cylinder with slot or hole
  - B. A sphere with rod
  - C. Two cylinders
  - D. A disc
39. Top view shows T-shape, front view shows rectangle, end view shows T-shape. What is the object?
- A. A T-shaped pyramid
  - B. Two rectangular prisms
  - C. A T-shaped prism
  - D. An L-shaped beam
40. Top view shows three squares in row, front view shows long rectangle, end view shows square. What is the object?
- A. Three cubes in a row
  - B. A pyramid
  - C. An L-structure
  - D. One long rectangular prism
41. Top view shows octagon, front view shows rectangle, end view shows octagon. What is the object?
- A. An octagonal pyramid

- B. Eight rectangular prisms
  - C. A cube
  - D. An octagonal prism
42. Top view shows oval, front view shows rectangle, end view shows oval. What is the object?
- A. A sphere
  - B. An elliptical cylinder
  - C. A cone
  - D. A cube
43. Top view shows pentagon, front view shows rectangle, end view shows pentagon. What is the object?
- A. A pentagonal prism
  - B. A pentagonal pyramid
  - C. Five rectangular prisms
  - D. A cube
44. Top view shows two circles, front view shows two rectangles, end view shows circle. What is the object?
- A. Two spheres
  - B. A dumbbell
  - C. Two cylinders stacked
  - D. Two cones
45. Top view shows L-shape, front view shows rectangle, end view shows L-shape. What is the object?
- A. An L-shaped pyramid
  - B. Two separate cubes
  - C. A T-shaped beam
  - D. An L-shaped prism

**CUBE COUNTING (Questions 46-60)**

**Directions:** A three-dimensional structure built from cubes is shown. Answer questions about cubes or painted surfaces.

46. A structure contains 3 layers arranged  $3 \times 3 \times 3$ . How many total cubes?
- A. 9
  - B. 27
  - C. 18
  - D. 81
47. In a  $3 \times 3 \times 3$  cube, how many cubes are on the surface (have at least one face exposed)?

- A. 27
- B. 8
- C. 26
- D. 19

48. A  $3 \times 5 \times 6$  structure is built. How many total cubes?

- A. 14
- B. 30
- C. 45
- D. 90

49. In a  $7 \times 7 \times 7$  cube where all faces are painted, how many cubes have exactly three painted faces?

- A. 8
- B. 24
- C. 12
- D. 64

50. A structure has 6 layers with 9 cubes per layer arranged  $3 \times 3$ . How many total cubes?

- A. 27
- B. 18
- C. 54
- D. 72

51. In a  $3 \times 4 \times 5$  structure, how many cubes are on corners?

- A. 12
- B. 8
- C. 24
- D. 6

52. A structure is 7 cubes high, 6 cubes wide, 5 cubes deep. How many total cubes?

- A. 18
- B. 210
- C. 180
- D. 150

53. In an L-shaped structure with 9 cubes on one arm and 8 on the other (sharing 1 corner), how many total cubes?

- A. 17
- B. 8
- C. 16

D. 15

54. A  $7 \times 7 \times 1$  flat structure has all faces painted. How many cubes have exactly two painted faces?

A. 4

B. 25

C. 49

D. 24

55. A staircase has 4 cubes on first step, 6 on second, 8 on third. How many total cubes?

A. 8

B. 12

C. 16

D. 18

56. A  $6 \times 7 \times 8$  structure is built. How many cubes are on corners?

A. 8

B. 12

C. 6

D. 24

57. In a  $9 \times 1 \times 1$  structure (9 cubes in row), if all surfaces painted, how many cubes have exactly four painted faces?

A. 2

B. 9

C. 7

D. 5

58. A pyramid has layers: bottom  $6 \times 6 = 36$  cubes, next  $4 \times 4 = 16$  cubes, next  $2 \times 2 = 4$  cubes, top 1 cube. How many total?

A. 36

B. 57

C. 52

D. 61

59. In a  $6 \times 6 \times 6$  cube with two corner cubes removed, how many cubes remain?

A. 214

B. 216

C. 212

D. 210

60. A plus-shaped structure uses 7 cubes for vertical arm and 7 for horizontal (sharing 1 center). How many total?
- A. 14
  - B. 7
  - C. 12
  - D. 13

## Biology

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**Time:** 30 minutes

**Questions:** 1-30

**Directions:** Select the best answer for each question based on your knowledge of biological concepts.

1. What is the primary function of the cell membrane?
  - A. Regulates what enters and exits the cell
  - B. Produces energy
  - C. Stores DNA
  - D. Synthesizes proteins
  
2. Which organelle is known as the "powerhouse of the cell"?
  - A. Nucleus
  - B. Ribosome
  - C. Mitochondrion
  - D. Lysosome
  
3. During which phase of mitosis do chromosomes become visible?
  - A. Anaphase
  - B. Prophase
  - C. Telophase
  - D. Metaphase
  
4. What type of transport does not require energy?
  - A. Passive transport
  - B. Active transport
  - C. Endocytosis
  - D. Exocytosis
  
5. What is the function of ribosomal RNA (rRNA)?

- A. Carries genetic information
  - B. Brings amino acids
  - C. Stores genetic code
  - D. Forms the ribosomal structure
6. How many chromosomes are in a human gamete after meiosis?
- A. 46
  - B. 92
  - C. 23
  - D. 12
7. In RNA, which base replaces thymine found in DNA?
- A. Adenine
  - B. Uracil
  - C. Guanine
  - D. Cytosine
8. Which type of inheritance involves traits located on sex chromosomes?
- A. Autosomal dominant
  - B. Autosomal recessive
  - C. Codominance
  - D. Sex-linked inheritance
9. Independent assortment of chromosomes occurs during which phase?
- A. Metaphase I
  - B. Prophase II
  - C. Anaphase II
  - D. Telophase I
10. Which blood component is primarily responsible for oxygen transport?
- A. White blood cells
  - B. Red blood cells
  - C. Platelets
  - D. Plasma
11. What is the primary function of the stomach?
- A. Absorb nutrients
  - B. Store bile
  - C. Chemical and mechanical digestion of food
  - D. Produce insulin

12. Which tissue type transmits electrical signals?
- A. Epithelial tissue
  - B. Connective tissue
  - C. Muscle tissue
  - D. Nervous tissue
13. In a cross between Aa and Aa, what percentage of offspring will be heterozygous?
- A. 25%
  - B. 75%
  - C. 100%
  - D. 50%
14. Which process produces gametes?
- A. Mitosis
  - B. Meiosis
  - C. Binary fission
  - D. Budding
15. What is the primary role of messenger RNA (mRNA)?
- A. Stores genetic information permanently
  - B. Forms ribosomes
  - C. Carries genetic instructions from DNA to ribosomes
  - D. Breaks down proteins
16. Which component initiates blood clotting at injury sites?
- A. Platelets
  - B. White blood cells
  - C. Red blood cells
  - D. Plasma proteins only
17. What type of muscle is found in the heart?
- A. Skeletal muscle
  - B. Smooth muscle
  - C. Voluntary muscle
  - D. Cardiac muscle
18. What is produced at the end of translation?
- A. DNA
  - B. Protein

- C. mRNA
- D. tRNA

19. Which organelle digests worn-out cell parts?

- A. Lysosome
- B. Ribosome
- C. Chloroplast
- D. Mitochondrion

20. What do osteoblasts do in bone tissue?

- A. Break down bone
- B. Build new bone
- C. Store minerals
- D. Produce blood cells

21. Bacteria are classified as which type of cell?

- A. Eukaryotic
- B. Viral
- C. Prokaryotic
- D. Fungal

22. What is the primary waste product of cellular respiration besides water?

- A. Carbon dioxide
- B. Oxygen
- C. Nitrogen
- D. Glucose

23. Which system uses hormones to regulate body functions?

- A. Nervous system
- B. Digestive system
- C. Respiratory system
- D. Endocrine system

24. If DNA has the sequence GCTA, what is the mRNA sequence?

- A. GCTA
- B. TACG
- C. CGAU
- D. ATGC

25. Which vessels carry blood back to the heart?

- A. Arteries
  - B. Veins
  - C. Capillaries
  - D. Arterioles
26. What is the function of the Golgi apparatus?
- A. Modifies and packages proteins
  - B. Produces ATP
  - C. Synthesizes lipids only
  - D. Replicates DNA
27. What term describes the observable traits of an organism?
- A. Genotype
  - B. Allele
  - C. Chromosome
  - D. Phenotype
28. In which phase does the cell grow and prepare for division?
- A. M phase
  - B. S phase
  - C. Interphase
  - D. Cytokinesis
29. What are the main organs of the respiratory system?
- A. Heart and blood vessels
  - B. Lungs and airways
  - C. Stomach and intestines
  - D. Kidneys and bladder
30. What distinguishes eukaryotic cells from prokaryotic cells?
- A. Presence of ribosomes
  - B. Ability to reproduce
  - C. Presence of cytoplasm
  - D. Presence of membrane-bound organelles

## General Chemistry

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**Time:** 30 minutes

**Questions:** 1-30

**Directions:** Select the best answer for each question. A periodic table is available for reference during this section.

1. What is the mass number of an atom?
  - A. Number of protons only
  - B. Number of electrons only
  - C. Number of neutrons only
  - D. Sum of protons and neutrons
2. Which subatomic particle has no charge?
  - A. Proton
  - B. Electron
  - C. Neutron
  - D. Ion
3. What type of bond forms when electrons are transferred from one atom to another?
  - A. Covalent bond
  - B. Ionic bond
  - C. Metallic bond
  - D. Hydrogen bond
4. How many electrons can the first energy level hold?
  - A. 2
  - B. 8
  - C. 18
  - D. 32
5. What is the product when an acid neutralizes a base?
  - A. Only water
  - B. Only hydrogen gas
  - C. Only oxygen
  - D. Salt and water
6. What is the molar mass of sodium chloride (NaCl)? (Na = 23 g/mol, Cl = 35.5 g/mol)
  - A. 23 g/mol
  - B. 35.5 g/mol
  - C. 58.5 g/mol
  - D. 70 g/mol
7. Which pH value indicates an acidic solution?

- A. 14
- B. 4
- C. 7
- D. 10

8. In the equation  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ , what is the coefficient of  $\text{H}_2$ ?

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

9. Atoms of the same element with the same number of protons but different mass numbers are called:

- A. Isotopes
- B. Ions
- C. Molecules
- D. Isomers

10. According to Boyle's Law, if pressure increases at constant temperature, what happens to volume?

- A. Volume increases
- B. Volume stays constant
- C. Volume decreases
- D. Volume becomes infinite

11. What occurs when two atoms share electrons?

- A. An ionic bond forms
- B. Atoms become ions
- C. Atoms lose mass
- D. A covalent bond forms

12. How many moles are in 54 grams of water ( $\text{H}_2\text{O}$ )? (Molar mass = 18 g/mol)

- A. 18 moles
- B. 3 moles
- C. 54 moles
- D. 6 moles

13. What is the SI unit for amount of substance?

- A. Grams
- B. Liters
- C. Moles
- D. Atoms

14. Which property describes acids?
- A. Taste sour and turn litmus red
  - B. Taste bitter and feel slippery
  - C. Have pH greater than 7
  - D. Release  $\text{OH}^-$  ions
15. Which state of matter has definite shape and volume?
- A. Solid
  - B. Liquid
  - C. Gas
  - D. Plasma
16. What do atoms achieve through covalent bonding?
- A. Complete electron loss
  - B. Stable electron configurations by sharing
  - C. Increased mass
  - D. Nuclear changes
17. How many hydrogen atoms are in  $2\text{Ca}(\text{OH})_2$ ?
- A. 2
  - B. 1
  - C. 4
  - D. 8
18. What is the pH of a neutral solution at  $25^\circ\text{C}$ ?
- A. 7
  - B. 0
  - C. 14
  - D. 1
19. Which group on the periodic table contains the noble gases?
- A. Group 1
  - B. Group 2
  - C. Group 17
  - D. Group 18
20. What type of reaction is  $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ ?
- A. Synthesis
  - B. Decomposition

- C. Single replacement
- D. Combustion

21. How many times more acidic is pH 1 compared to pH 4?

- A. 3 times
- B. 4 times
- C. 1000 times
- D. 100 times

22. What is the charge of an electron?

- A. Positive
- B. Neutral
- C. Variable
- D. Negative

23. How many valence electrons does an element in Group 2 have?

- A. 2
- B. 8
- C. 1
- D. 7

24. According to the Law of Conservation of Mass, what happens during chemical reactions?

- A. Mass is created
- B. Mass is destroyed
- C. Mass is conserved
- D. Atoms disappear

25. A 3 M solution is diluted from 30 mL to 90 mL. What is the new concentration?

- A. 3 M
- B. 1 M
- C. 9 M
- D. 0.5 M

26. What do acids release in water according to the Arrhenius definition?

- A.  $H^+$  ions
- B.  $OH^-$  ions
- C.  $Na^+$  ions
- D.  $Cl^-$  ions

27. How many particles are in one mole of a substance?

- A.  $3.14 \times 10^{23}$
- B.  $1.66 \times 10^{24}$
- C.  $1.00 \times 10^{23}$
- D.  $6.022 \times 10^{23}$

28. According to Charles's Law, what happens to volume when temperature decreases at constant pressure?
- A. Volume increases
  - B. Volume decreases
  - C. Volume stays constant
  - D. Volume doubles
29. A neutral oxygen atom (atomic number = 8) has how many electrons?
- A. 16
  - B. 6
  - C. 8
  - D. 10
30. What happens to gas pressure when volume increases at constant temperature?
- A. Pressure decreases
  - B. Pressure increases
  - C. Pressure stays constant
  - D. Pressure becomes zero

## Answer Explanations - Practice Test 5

### Reading Comprehension

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#### 1. Correct Answer: B (Receives deoxygenated blood and pumps it to the lungs)

The passage explicitly states in the first paragraph that "the right side receives deoxygenated blood from the body and pumps it to the lungs for oxygenation." This describes the right side's function in the pulmonary circulation.

#### 2. Correct Answer: C (Backflow from ventricles to atria)

The passage states that "the atrioventricular (AV) valves—the tricuspid valve on the right and the mitral valve on the left—prevent backflow from ventricles to atria during ventricular contraction." This is their specific function.

#### 3. Correct Answer: A (Peak arterial pressure during ventricular contraction)

The passage explains that "systolic pressure represents the peak arterial pressure during ventricular contraction." This occurs when the ventricles contract and eject blood.

**4. Correct Answer: D (It typically produces no symptoms until serious damage occurs)**

The passage states that hypertension is "often called the 'silent killer,' [because] hypertension typically produces no symptoms until serious damage occurs." This makes it particularly dangerous.

**5. Correct Answer: B (120/80 mmHg)**

The passage explicitly states that "normal blood pressure is approximately 120/80 mmHg." This is a specific numerical value provided in the text.

**6. Correct Answer: A (High sodium intake)**

The passage lists risk factors for hypertension including "obesity, high sodium intake, physical inactivity, excessive alcohol consumption, and genetic predisposition." High sodium intake is specifically mentioned.

**7. Correct Answer: D (Gingival hyperplasia)**

The passage states that "some cardiac medications cause oral side effects like gingival hyperplasia." This is the specific oral side effect mentioned for cardiac medications.

**8. Correct Answer: C (Ventricles relax and fill with blood)**

The passage explains that "during diastole, the ventricles relax and fill with blood from the atria." This describes what happens during the relaxation phase of the cardiac cycle.

**9. Correct Answer: B (Functional units responsible for filtering blood)**

The passage states that "each kidney contains approximately one million nephrons, the functional units responsible for filtering blood and forming urine." Nephrons are explicitly defined as functional units.

**10. Correct Answer: D (Performs filtration under high pressure)**

The passage explains that "the glomerulus, a network of capillaries, performs filtration under high pressure, allowing water, small molecules, and ions to pass into Bowman's capsule." This describes its primary function.

**11. Correct Answer: A (65%)**

The passage explicitly states that the filtrate "flows through the proximal tubule, where about 65% of filtered water and sodium, along with most glucose and amino acids, are reabsorbed." This is a specific percentage given.

**12. Correct Answer: A (Increase water reabsorption)**

The passage states that "antidiuretic hormone (ADH) increases water reabsorption, concentrating urine and conserving body water." This is ADH's primary function.

**13. Correct Answer: C (Diabetes or hypertension)**

The passage states that "chronic kidney disease (CKD) involves progressive loss of nephron function, often resulting from diabetes or hypertension." These are identified as common causes.

**14. Correct Answer: D (Dialysis or kidney transplantation)**

The passage states that "advanced CKD may require dialysis or kidney transplantation." These are the treatment options for advanced kidney disease.

**15. Correct Answer: C (Bleeding tendencies due to platelet dysfunction)**

The passage explains that CKD patients "may have bleeding tendencies due to platelet dysfunction." This is one of the important clinical implications mentioned for dental professionals.

**16. Correct Answer: A (Stimulates red blood cell production)**

The passage states that "the kidneys also produce erythropoietin, stimulating red blood cell production." This is explicitly stated as erythropoietin's function.

**17. Correct Answer: D (Prokaryotic cells)**

The passage states that "bacteria are prokaryotic cells lacking membrane-bound organelles and a true nucleus." This is the fundamental classification of bacteria.

**18. Correct Answer: B (Purple)**

The passage explains that "Gram-positive bacteria have thick peptidoglycan cell walls that retain crystal violet stain, appearing purple." Purple is the color after Gram staining.

**19. Correct Answer: C (Acellular entities with genetic material in a protein coat)**

The passage states that "viruses differ fundamentally from bacteria, being acellular entities consisting only of genetic material (DNA or RNA) enclosed in a protein coat." This defines their structure.

**20. Correct Answer: A (Viruses lack the structures and processes that antibiotics target)**

The passage explains that "antibiotics, which target bacterial cell walls or metabolic processes absent in human cells, are ineffective against viral infections" because viruses lack these structures. They are acellular and don't have the bacterial structures antibiotics target.

**21. Correct Answer: D (Less than 6 feet)**

The passage states that "droplet transmission involves respiratory droplets traveling short distances (usually less than 6 feet) during coughing or sneezing." This is the specific distance mentioned.

**22. Correct Answer: C (Hand hygiene and personal protective equipment)**

The passage states that "standard precautions, including hand hygiene, personal protective equipment, and environmental cleaning, form the foundation of infection control." These are key components.

**23. Correct Answer: B (Provides additional protection against many antibiotics)**

The passage explains that "Gram-negative bacteria's outer membrane provides additional protection against many antibiotics." This makes them more difficult to treat.

**24. Correct Answer: D (Dental procedures generate aerosols and can transmit pathogens)**

The passage states that understanding microbiology is important for dental professionals "because the oral cavity harbors diverse microbial communities, dental procedures generate aerosols, and inadequate sterilization can transmit bloodborne pathogens."

**25. Correct Answer: A (What the body does to a drug)**

The passage explicitly states that "pharmacokinetics describes what the body does to a drug, encompassing absorption, distribution, metabolism, and elimination." This is the definition of pharmacokinetics.

**26. Correct Answer: C (Liver)**

The passage states that "oral drugs must survive the acidic stomach environment and undergo first-pass metabolism in the liver before reaching systemic circulation." The liver is where first-pass metabolism occurs.

**27. Correct Answer: B (Readily cross cell membranes and the blood-brain barrier)**

The passage states that "highly lipid-soluble drugs readily cross cell membranes and the blood-brain barrier." Their lipid solubility allows them to pass through lipid membranes.

**28. Correct Answer: D (Break down drugs quickly and may require higher doses)**

The passage explains that "some people are 'rapid metabolizers' who break down drugs quickly, potentially requiring higher doses." This describes their characteristic and clinical implication.

**29. Correct Answer: A (Activate receptors)**

The passage states that "most drugs work by binding to specific receptors, with agonists activating receptors and antagonists blocking them." Agonists activate receptors.

**30. Correct Answer: C (More selective drugs produce fewer side effects)**

The passage explains that "drug selectivity is crucial; more selective drugs produce fewer side effects by targeting specific receptor subtypes." This explains why selectivity matters.

**31. Correct Answer: D (Calcium channel blockers)**

The passage states that oral side effects include "gingival overgrowth from calcium channel blockers and phenytoin." Calcium channel blockers are specifically mentioned as causing this side effect.

**32. Correct Answer: A (Increases other drugs' blood levels)**

The passage states that "some drugs inhibit these enzymes, increasing other drugs' blood levels." Enzyme inhibition leads to increased drug concentrations because metabolism is slowed.

**33. Correct Answer: D (Base pairing between adenine-thymine and guanine-cytosine)**

The passage states that "the double helix consists of two complementary strands held together by base pairing—adenine with thymine and guanine with cytosine." This describes how the strands are held together.

**34. Correct Answer: B (Each strand serves as a template for a new complementary strand)**

The passage explains that "during DNA replication, each strand serves as a template for synthesizing a new complementary strand, ensuring genetic information is accurately copied." This is the mechanism of replication.

**35. Correct Answer: C (One)**

The passage states that "autosomal dominant disorders (like Huntington's disease) require only one mutated allele for expression." One mutated allele is sufficient for dominant disorders.

**36. Correct Answer: D (Males who have only one X chromosome)**

The passage states that "sex-linked traits, carried on X chromosomes, predominantly affect males who have only one X chromosome." Males are more affected because they have only one X chromosome.

**37. Correct Answer: A (DNA replication errors or exposure to mutagens)**

The passage states that "mutations can result from DNA replication errors, exposure to mutagens like radiation or chemicals, or occur spontaneously." Both sources are mentioned.

**38. Correct Answer: C (Specific genetic mutations in tumors)**

The passage states that "understanding cancer genetics has revolutionized treatment, with targeted therapies designed for specific genetic mutations in tumors." These therapies target specific mutations.

**39. Correct Answer: B (DNA segments that code for proteins)**

The passage states that "genes are DNA segments that code for proteins, with the genetic code read in three-nucleotide codons that specify particular amino acids." This defines what genes are.

**40. Correct Answer: A (Hereditary conditions affect oral development and some syndromes require modified care)**

The passage states that "for dental professionals, genetics is increasingly relevant: hereditary conditions affect oral and craniofacial development" and "some genetic syndromes require modified dental care approaches." This explains the relevance to dentistry.

## Language Usage

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### 1. Correct Answer: B (equipment and also hired)

The original sentence contains a comma splice (two independent clauses joined only by a comma). Option B corrects this by removing the comma and creating a compound predicate with "and," making it concise and grammatically correct: "updated...and also hired."

### 2. Correct Answer: D (nor the receptionists were able)

With "neither...nor" constructions, the verb must agree with the subject closest to it. Since "receptionists" (plural) is nearest to the verb, the verb must be "were" (plural), not "was" (singular). Option D correctly uses the plural verb form with "nor."

### 3. Correct Answer: C (when she could come back)

In indirect questions embedded within statements, normal word order (subject-verb) is used, not inverted question order (verb-subject). The original uses inverted order "when could she." Option C correctly uses "when she could come back."

### 4. Correct Answer: C (Between you and me, the new scheduling system is)

After the preposition "between," pronouns must be in the objective case. "Between" requires "me" (objective case), not "I" (subjective case). Additionally, "system" (singular) requires the singular verb "is."

### 5. Correct Answer: B (cleanings, examinations, and cosmetic treatments)

The sentence requires parallel structure. The original uses two nouns and then a verb phrase ("will provide cosmetic treatments"), which is not parallel. Option B maintains parallel structure by using three nouns: "cleanings, examinations, and cosmetic treatments."

### 6. Correct Answer: A (After completing the patient assessment, the hygienist documented)

Introductory dependent clauses should be followed by a comma to separate them from the main clause. The phrase "After completing the patient assessment" is an introductory adverbial clause that requires a comma before the independent clause.

### 7. Correct Answer: D (old system, and it also saves)

The original sentence is a comma splice (two independent clauses joined only by a comma). Option D corrects this by adding the coordinating conjunction "and" after the comma, properly connecting the two independent clauses.

### 8. Correct Answer: C (must complete his or her annual training)

"Everyone" is a singular indefinite pronoun and requires a singular pronoun reference. Standard formal grammar requires "his or her" to agree with the singular subject "everyone."

**9. Correct Answer: B (suggested that the patient brush his teeth)**

After verbs like "suggested," "recommended," or "required," the subjunctive mood is used, requiring the base form of the verb without "s." The correct construction is "suggested that the patient brush" (not "brushes").

**10. Correct Answer: C (Working long hours, the dentist found the schedule overwhelming)**

The original sentence contains a dangling modifier. "Working long hours" must modify a subject that can logically work long hours—the dentist, not the schedule. Option C correctly places "the dentist" as the subject being modified.

**11. Correct Answer: B (has submitted his or her research paper)**

The subject "each" is singular and requires a singular verb and pronoun. Option B correctly uses "has" (singular verb) and "his or her" (singular pronoun) with "paper" (singular noun) to agree with "each."

**12. Correct Answer: B (daily; however, it is)**

"However" is a conjunctive adverb connecting two independent clauses. When used this way, it requires a semicolon before it and a comma after it. Option B uses the correct punctuation.

**13. Correct Answer: A (Fewer patients came)**

"Less" is used with uncountable nouns, while "fewer" is used with countable nouns. "Patients" is countable, so "fewer" is correct.

**14. Correct Answer: D (prepared the room, sterilized the instruments, and set up)**

The original sentence lacks parallel structure. The first two verbs are in simple past tense ("prepared," "sterilized"), but the third uses past progressive ("was setting up"). Option D maintains parallel structure by using three simple past tense verbs.

**15. Correct Answer: C (Dr. Anderson told Dr. Martinez that Dr. Anderson needed)**

The original sentence has an ambiguous pronoun. "She" could refer to either Dr. Anderson or Dr. Martinez. Option C eliminates ambiguity by using the proper name "Dr. Anderson" instead of the unclear pronoun.

**16. Correct Answer: B (affects all employees and will take effect)**

"Affect" is a verb meaning to influence. "Effect" as a noun means result; "take effect" is an idiom meaning to become operative. The sentence needs the verb "affects" to indicate that the policy influences employees, followed by "take effect."

**17. Correct Answer: D (health. All patients should follow)**

The original sentence is a comma splice (two independent clauses incorrectly joined by only a comma). Option D corrects this by using a period to create two separate sentences, providing the clearest separation.

**18. Correct Answer: A (who completed residency training)**

"Which" is used for things; "who" is used for people. Since "the dentist" is a person, the correct relative pronoun is "who," not "which."

**19. Correct Answer: C (Having examined the x-rays thoroughly, the dentist provided a diagnosis)**

The original sentence contains a dangling modifier. The phrase "Having examined the x-rays thoroughly" must modify "the dentist" (who did the examining), not "a diagnosis." Option C correctly places "the dentist" immediately after the modifying phrase.

**20. Correct Answer: B (should have made)**

"Should of" is incorrect; the correct phrase is "should have." "Of" is a preposition and cannot function as a helping verb. Option B correctly uses "should have."

**21. Correct Answer: A (extractions, fillings, or crowns)**

The original sentence lacks parallel structure. Option A maintains parallel structure by using three noun forms: "extractions, fillings, or crowns." All three are in parallel grammatical form.

**22. Correct Answer: C (effective; they provide)**

The original sentence is a comma splice (two independent clauses joined only by a comma). Option C correctly uses a semicolon to connect two closely related independent clauses without a coordinating conjunction.

**23. Correct Answer: B (the most complex choice)**

When comparing more than two items (five treatment options), use the superlative form ("most complex"), not the comparative form ("more complex"). Option B properly uses the superlative.

**24. Correct Answer: A (Oak Street in downtown Seattle, Washington)**

Street names should be capitalized ("Oak Street," not "oak street"). When a city and state are used together, a comma must separate them. Option A correctly capitalizes the street name and adds the necessary comma between city and state.

**25. Correct Answer: D (After the procedure was completed, the patient received)**

Introductory dependent clauses should be followed by a comma to separate them from the main clause. Option D correctly includes the necessary comma after the introductory clause.

**26. Correct Answer: B (when he could schedule)**

In indirect questions within reported speech, normal word order (subject-verb) is used, and the tense typically shifts back. "Asked" (past tense) in the main clause suggests shifting "can" to "could." Option B uses correct word order and appropriate tense.

**27. Correct Answer: C (both agree that)**

The compound subject "the dentist and his staff" is plural (two parties), so the verb must be "agree" (plural), not "agrees" (singular). Option C correctly uses the plural verb form.

**28. Correct Answer: B (are important)**

The compound subject consists of three items ("brushing," "flossing," and "checkups") connected by commas and "and," making it plural. Therefore, the verb must be "are" (plural), not "is" (singular). Option B correctly uses the plural verb.

**29. Correct Answer: D (accuracy, and it will also reduce)**

The original sentence is a comma splice (two independent clauses joined only by a comma). Option D corrects this by adding the coordinating conjunction "and" after the comma, which properly connects the two independent clauses.

**30. Correct Answer: D (conditions such as cavities, gum disease, and tooth decay)**

When "such as" introduces examples that specify or define what is being discussed, no comma is placed before "such as." The phrase acts as a restrictive element identifying which types of conditions are being referenced. The correct structure is "conditions such as cavities, gum disease, and tooth decay" with no comma before "such as," and commas only separating the items in the series. This follows standard American English grammar conventions for restrictive clauses with "such as."

**31. Correct Answer: D (all play critical roles)**

The compound subject "dentists, hygienists, and assistants" is plural, so the verb must be "play" (plural), not "plays" (singular). Additionally, "roles" (plural) is correct since multiple people play multiple roles. Option D uses correct subject-verb agreement.

**32. Correct Answer: A (to lie down on the examination chair)**

"Lie" means to recline or rest in a horizontal position (intransitive verb). "Lay" means to place or put something down (transitive verb requiring an object). Since the patient is reclining, "lie" is correct. The preposition "on" is appropriate for the surface of the chair.

**33. Correct Answer: C (considerably allowing practitioners to provide)**

The participial phrase "allowing practitioners to provide better care" modifies the main clause. Omitting the comma creates a tighter connection between the evolution and its result, maintaining smooth flow without unnecessary punctuation. Option C correctly presents this without the comma.

**34. Correct Answer: A (problems. They help maintain)**

The original sentence is a comma splice (two independent clauses joined only by a comma). Option A corrects this by using a period to create two separate sentences, providing clear separation between the complete thoughts.

**35. Correct Answer: D (requires students to complete clinical hours before graduation)**

The sentence is correct as written. "Program" (singular subject) takes "requires" (singular verb). The clause structure is correct, and no comma is needed before "before" because the dependent clause is restrictive (essential to meaning).

**36. Correct Answer: C (services, such as cleanings and examinations, but)**

The phrase "such as cleanings and examinations" is a nonrestrictive element providing examples, so it should be set off with commas on both sides. Option C correctly places commas before "such as" and after "examinations," with "but" properly positioned to connect the contrasting information.

**37. Correct Answer: B (more accessible for patients than the previous office was)**

When making comparisons, both elements should be grammatically complete and parallel. Option B completes the comparison properly by adding "was" to create parallel structure, making it clear we're comparing "new location is accessible" to "previous office was [accessible]."

**38. Correct Answer: A (brushing twice daily, flossing regularly, and visiting the dentist)**

The original sentence lacks parallel structure with an infinitive phrase at the end. Option A maintains parallel structure by using three gerunds: "brushing, flossing, and visiting." All three verb forms are consistent.

**39. Correct Answer: D (had been painful)**

The past perfect tense "had been painful" is correct because the pain began in the past and continued up to another past point (calling). This sequence of past events requires past perfect to show the earlier, ongoing action.

**40. Correct Answer: C (costs, and it also improves)**

The original sentence is a comma splice (two independent clauses joined only by a comma). Option C corrects this by adding the coordinating conjunction "and" after the comma, which properly connects the two independent clauses.

## Quantitative Reasoning

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**1. Correct Answer: B (5)**

To solve  $5x - 7 = 18$ , first add 7 to both sides:  $5x = 25$ . Then divide both sides by 5:  $x = 5$ . Verification:  
 $5(5) - 7 = 25 - 7 = 18 \checkmark$

**2. Correct Answer: D (25%)**

Percent increase formula:  $(\text{New} - \text{Old})/\text{Old} \times 100$ . Calculate:  $(225 - 180)/180 \times 100 = 45/180 \times 100 = 0.25 \times 100 = 25\%$ . Patient visits increased by 25%.

**3. Correct Answer: A (4)**

To solve  $7y - 3 = 4y + 9$ , subtract  $4y$  from both sides:  $3y - 3 = 9$ . Add 3 to both sides:  $3y = 12$ . Divide by 3:  $y = 4$ . Verification:  $7(4) - 3 = 28 - 3 = 25$ , and  $4(4) + 9 = 16 + 9 = 25 \checkmark$

**4. Correct Answer: D (\$1,008)**

Calculate weekly earnings:  $\$42/\text{hour} \times 6 \text{ hours}/\text{day} \times 4 \text{ days}/\text{week} = \$1,008$  per week. Break it down: Daily earnings =  $\$42 \times 6 = \$252$ ; Weekly earnings =  $\$252 \times 4 = \$1,008$ .

**5. Correct Answer: C (63)**

To find 18% of 350, multiply:  $0.18 \times 350 = 63$ . Alternatively, 18% is the same as  $18/100$ , so  $(18/100) \times 350 = 6,300/100 = 63$ .

**6. Correct Answer: A (83)**

Substitute  $a = 5$  and  $b = -2$  into  $3a^2 - 4b$ . Calculate:  $3(5)^2 - 4(-2) = 3(25) - (-8) = 75 + 8 = 83$ .

**7. Correct Answer: B (43 mg)**

Multiply the dosage rate by body weight:  $0.5 \text{ mg}/\text{kg} \times 86 \text{ kg} = 43 \text{ mg}$ . The units of kilograms cancel out, leaving milligrams as the answer.

**8. Correct Answer: D (6)**

Expand the left side:  $3(x + 5) = 3x + 15$ . Set equal to right side:  $3x + 15 = 2x + 21$ . Subtract  $2x$  from both sides:  $x + 15 = 21$ . Subtract 15:  $x = 6$ .

**9. Correct Answer: C (1/4)**

Total balls =  $8 + 7 + 5 = 20$  balls. Green balls = 5. Probability of selecting green =  $5/20 = 1/4$  (simplified by dividing numerator and denominator by 5).

**10. Correct Answer: B (2,700 meters)**

To convert kilometers to meters, multiply by 1,000 (since  $1 \text{ km} = 1,000 \text{ m}$ ):  $2.7 \text{ km} \times 1,000 \text{ m}/\text{km} = 2,700$  meters. This is a standard metric conversion.

**11. Correct Answer: A (130)**

Substitute  $x = 5$  into  $4x^2 + 6x$ :  $4(5)^2 + 6(5) = 4(25) + 30 = 100 + 30 = 130$ . Follow the order of operations: exponents first, then multiplication, then addition.

**12. Correct Answer: C (20%)**

Percent decrease =  $(\text{Old} - \text{New})/\text{Old} \times 100 = (2,500 - 2,000)/2,500 \times 100 = 500/2,500 \times 100 = 0.20 \times 100 = 20\%$ . The supplies decreased by 20%.

**13. Correct Answer: D (6x - 26)**

Distribute:  $4(3x - 2) - 6(x + 3) = 12x - 8 - 6x - 18$ . Combine like terms:  $(12x - 6x) + (-8 - 18) = 6x - 26$ . Remember to distribute the negative sign in  $-6(x + 3)$ .

**14. Correct Answer: A (4)**

If the ratio is 1:35 and there are 140 patients, find the number of dentists:  $140 \div 35 = 4$  dentists. This maintains the 1:35 ratio ( $4:140 = 1:35$ ).

**15. Correct Answer: D (36)**

Solve  $x/6 + 4 = 10$ . First subtract 4 from both sides:  $x/6 = 6$ . Then multiply both sides by 6:  $x = 36$ . Verification:  $36/6 + 4 = 6 + 4 = 10 \checkmark$

**16. Correct Answer: B (18 mmHg)**

The increase is found by subtracting the original value from the new value:  $133 - 115 = 18$  mmHg. This represents the amount of increase in blood pressure.

**17. Correct Answer: A (6)**

Substitute  $x = 9$  into  $6x - 4y = 30$ :  $6(9) - 4y = 30$ , which gives  $54 - 4y = 30$ . Subtract 54 from both sides:  $-4y = -24$ . Divide by -4:  $y = 6$ .

**18. Correct Answer: C (\$450)**

Calculate the 25% discount amount:  $0.25 \times \$600 = \$150$ . Subtract the discount from the original price:  $\$600 - \$150 = \$450$ . The discounted price is \$450.

**19. Correct Answer: D (7)**

Solve  $9x - 4 = 6x + 17$ . Subtract  $6x$  from both sides:  $3x - 4 = 17$ . Add 4 to both sides:  $3x = 21$ . Divide by 3:  $x = 7$ .

**20. Correct Answer: B (25)**

To find the mean, add all values and divide by the count:  $(15 + 20 + 25 + 30 + 35)/5 = 125/5 = 25$ . The mean is the arithmetic average of the data set.

**21. Correct Answer: C (128 mL)**

Calculate 32% of 400 mL:  $0.32 \times 400 = 128$  mL. Alternatively, 32% is the same as  $32/100$ , and  $400 \times 32/100 = 12,800/100 = 128$  mL.

**22. Correct Answer: B (12 and -12)**

When  $x^2 = 144$ , take the square root of both sides. Remember that square roots have both positive and negative solutions:  $x = +12$  or  $x = -12$ . Both values satisfy the equation:  $(12)^2 = 144$  and  $(-12)^2 = 144$ .

**23. Correct Answer: D (280)**

Multiply:  $14 \text{ patients/day} \times 5 \text{ days/week} \times 4 \text{ weeks} = 280 \text{ patients total}$ . Calculate step by step:  $14 \times 5 = 70 \text{ patients per week}$ , then  $70 \times 4 = 280 \text{ patients in 4 weeks}$ .

**24. Correct Answer: A ( $20x^7$ )**

When multiplying powers with the same base, multiply the coefficients and add the exponents:  $(5x^4)(4x^3) = (5 \times 4)(x^{4+3}) = 20x^7$ . Coefficient:  $5 \times 4 = 20$ . Exponent:  $4 + 3 = 7$ .

**25. Correct Answer: C (62.5%)**

Convert the fraction to a decimal first:  $5/8 = 0.625$ . Then multiply by 100 to get the percentage:  $0.625 \times 100 = 62.5\%$ . Alternatively,  $5/8 = 62.5/100 = 62.5\%$ .

**26. Correct Answer: B (12)**

Calculate total hours in 3 days:  $3 \text{ days} \times 24 \text{ hours/day} = 72 \text{ hours}$ . Divide by the dosing interval:  $72 \text{ hours} \div 6 \text{ hours/dose} = 12 \text{ doses}$ . The patient takes medication 4 times per day for 3 days.

**27. Correct Answer: A (15 cm)**

Perimeter formula for rectangle:  $P = 2L + 2W$ . Substitute known values:  $70 = 2(20) + 2W$ , which gives  $70 = 40 + 2W$ . Subtract 40:  $30 = 2W$ . Divide by 2:  $W = 15 \text{ cm}$ .

**28. Correct Answer: D (8)**

Solve  $8x - 12 = 7x - 4$ . Subtract  $7x$  from both sides:  $x - 12 = -4$ . Add 12 to both sides:  $x = 8$ . Verification:  $8(8) - 12 = 64 - 12 = 52$  and  $7(8) - 4 = 56 - 4 = 52 \checkmark$

**29. Correct Answer: C (\$795)**

Calculate 6% tax on \$750:  $0.06 \times \$750 = \$45$ . Add tax to original cost:  $\$750 + \$45 = \$795$ . The total cost including sales tax is \$795.

**30. Correct Answer: B (18)**

The median is the middle value when data is arranged in order. The data set 10, 14, 18, 22, 26 is already ordered. With 5 values, the middle (3rd) value is 18.

**31. Correct Answer: D (10)**

First solve for  $x$ :  $5x - 8 = 17$ . Add 8 to both sides:  $5x = 25$ . Divide by 5:  $x = 5$ . Then calculate  $2x$ :  $2(5) = 10$ .

**32. Correct Answer: A (2,200 mL)**

Convert liters to milliliters by multiplying by 1,000 (since 1 L = 1,000 mL):  $2.2 \text{ L} \times 1,000 \text{ mL/L} = 2,200 \text{ mL}$ . This is a standard metric conversion.

**33. Correct Answer: C (31)**

Calculate step by step:  $(-5)^2 - 2(-3)$ . First,  $(-5)^2 = 25$  (squaring a negative gives a positive). Second,  $-2(-3) = +6$  (multiplying two negatives gives a positive). Finally,  $25 + 6 = 31$ .

**34. Correct Answer: B (12)**

Calculate 40% of 30:  $0.40 \times 30 = 12$  hygienists. Alternatively, 40% is the same as  $2/5$ , and  $30 \times 2/5 = 60/5 = 12$  hygienists work at the clinic.

**35. Correct Answer: A (48)**

Solve  $x/8 = 6$  by multiplying both sides by 8:  $x = 6 \times 8 = 48$ . Verification:  $48/8 = 6 \checkmark$

**36. Correct Answer: D (3/8)**

Convert 0.375 to a fraction:  $0.375 = 375/1000$ . Simplify by dividing both numerator and denominator by 125:  $375/1000 = 3/8$ . This fraction is in simplest form since 3 and 8 share no common factors.

**37. Correct Answer: B (12)**

Use the elimination method. Add the two equations:  $(x + y) + (x - y) = 18 + 6$ , which gives  $2x = 24$ . Divide by 2:  $x = 12$ . The y terms cancel when adding the equations.

**38. Correct Answer: C (102.2°F)**

Substitute  $C = 39$  into  $F = (9/5)C + 32$ :  $F = (9/5)(39) + 32 = 1.8(39) + 32 = 70.2 + 32 = 102.2^\circ\text{F}$ . This represents a fever temperature.

**39. Correct Answer: D (24)**

The range is the difference between the maximum and minimum values:  $40 - 16 = 24$ . Range measures the spread of the data from lowest to highest value.

**40. Correct Answer: A (2:3)**

Write the ratio: 150:225. Simplify by dividing both numbers by their GCF (75):  $150/75 = 2$  and  $225/75 = 3$ . The simplest form of the ratio is 2:3.

## Perceptual Ability

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### ANGLE DISCRIMINATION (Questions 1-15)

**1. Correct Answer: C (Angle 3)**

The angles measure: Angle 1 =  $60^\circ$ , Angle 2 =  $118^\circ$ , Angle 3 =  $81^\circ$ , Angle 4 =  $142^\circ$ . The question asks which is closest to  $80^\circ$ . Comparing distances from  $80^\circ$ : Angle 1 ( $60^\circ$ ) is  $20^\circ$  away, Angle 2 ( $118^\circ$ ) is  $38^\circ$  away, Angle 3 ( $81^\circ$ ) is only  $1^\circ$  away, and Angle 4 ( $142^\circ$ ) is  $62^\circ$  away. Angle 3 at  $81^\circ$  is closest to  $80^\circ$ .

**2. Correct Answer: A (Angle A)**

The three angles measure: Angle A =  $36^\circ$ , Angle B =  $128^\circ$ , Angle C =  $94^\circ$ . Comparing all three,  $36^\circ$  is the smallest angle.

**3. Correct Answer: B ( $93^\circ$ )**

The five angles measure  $26^\circ$ ,  $93^\circ$ ,  $57^\circ$ ,  $145^\circ$ , and  $88^\circ$ . Ordering from largest to smallest:  $145^\circ$ ,  $93^\circ$ ,  $88^\circ$ ,  $57^\circ$ ,  $26^\circ$ . The second largest angle is  $93^\circ$ .

**4. Correct Answer: D ( $131^\circ$ )**

The four angles measure  $41^\circ$ ,  $106^\circ$ ,  $69^\circ$ , and  $131^\circ$ . Comparing all measurements,  $131^\circ$  is the largest angle shown.

**5. Correct Answer: A ( $44^\circ$ ,  $78^\circ$ ,  $124^\circ$ )**

The three angles measure  $78^\circ$ ,  $124^\circ$ , and  $44^\circ$ . Arranging from smallest to largest:  $44^\circ$ ,  $78^\circ$ ,  $124^\circ$ . This represents the correct ascending order.

**6. Correct Answer: C ( $72^\circ$ )**

Acute angles measure less than  $90^\circ$ . From the five angles ( $33^\circ$ ,  $101^\circ$ ,  $72^\circ$ ,  $149^\circ$ ,  $58^\circ$ ), the acute angles are  $33^\circ$ ,  $72^\circ$ , and  $58^\circ$ . Comparing distances from  $75^\circ$ :  $33^\circ$  is  $42^\circ$  away,  $72^\circ$  is  $3^\circ$  away, and  $58^\circ$  is  $17^\circ$  away. Angle  $72^\circ$  is closest to  $75^\circ$ .

**7. Correct Answer: B ( $50^\circ$ )**

The four angles measure  $19^\circ$ ,  $97^\circ$ ,  $50^\circ$ , and  $164^\circ$ . Ordering from smallest to largest:  $19^\circ$ ,  $50^\circ$ ,  $97^\circ$ ,  $164^\circ$ . The second smallest angle is  $50^\circ$ .

**8. Correct Answer: D ( $156^\circ$ )**

Obtuse angles measure between  $90^\circ$  and  $180^\circ$ . From the three angles ( $35^\circ$ ,  $91^\circ$ ,  $156^\circ$ ), only  $156^\circ$  is both obtuse AND greater than  $130^\circ$ . Angles  $35^\circ$  is acute and  $91^\circ$  is obtuse but less than  $130^\circ$ .

**9. Correct Answer: C ( $68^\circ$ )**

The five angles measure  $42^\circ$ ,  $105^\circ$ ,  $68^\circ$ ,  $138^\circ$ , and  $51^\circ$ . The angle measuring exactly  $68^\circ$  is the third option listed.

**10. Correct Answer: A ( $31^\circ$ )**

The four angles measure  $66^\circ$ ,  $129^\circ$ ,  $31^\circ$ , and  $92^\circ$ . Comparing all measurements,  $31^\circ$  is the smallest angle.

**11. Correct Answer: D ( $73^\circ$ )**

The three acute angles measure  $40^\circ$ ,  $73^\circ$ , and  $61^\circ$ . Comparing all three,  $73^\circ$  is the largest angle.

**12. Correct Answer: B ( $75^\circ$ )**

The five angles measure  $116^\circ$ ,  $87^\circ$ ,  $52^\circ$ ,  $167^\circ$ , and  $75^\circ$ . Ordering from smallest to largest:  $52^\circ$ ,  $75^\circ$ ,  $87^\circ$ ,  $116^\circ$ ,  $167^\circ$ . The second smallest is  $75^\circ$ .

**13. Correct Answer: C ( $74^\circ$ )**

The four angles measure  $23^\circ$ ,  $102^\circ$ ,  $74^\circ$ , and  $143^\circ$ . Comparing distances from  $70^\circ$ :  $23^\circ$  is  $47^\circ$  away,  $102^\circ$  is  $32^\circ$  away,  $74^\circ$  is  $4^\circ$  away, and  $143^\circ$  is  $73^\circ$  away. Angle  $74^\circ$  is closest to  $70^\circ$ .

**14. Correct Answer: A ( $46^\circ$ )**

Acute angles measure less than  $90^\circ$ . From the three angles ( $119^\circ$ ,  $46^\circ$ ,  $86^\circ$ ), angles  $46^\circ$  and  $86^\circ$  are acute. The smallest of these is  $46^\circ$ .

**15. Correct Answer: A ( $38^\circ$ ,  $64^\circ$ )**

The five angles measure  $38^\circ$ ,  $107^\circ$ ,  $64^\circ$ ,  $151^\circ$ , and  $82^\circ$ . Ordering all angles from smallest to largest:  $38^\circ$ ,  $64^\circ$ ,  $82^\circ$ ,  $107^\circ$ ,  $151^\circ$ . The two smallest angles in order are  $38^\circ$ ,  $64^\circ$ .

**APERTURES (Questions 16-30)**

**16. Correct Answer: B (A rectangle  $10\text{ cm} \times 12\text{ cm}$ )**

A rectangular prism measuring  $6\text{ cm} \times 10\text{ cm} \times 12\text{ cm}$  has three possible face orientations. The largest face measures  $10\text{ cm} \times 12\text{ cm}$ . This rectangular aperture would accommodate the largest face when properly oriented.

**17. Correct Answer: D (A circle with at least  $10\text{ cm}$  diameter)**

When a cylinder with diameter  $10\text{ cm}$  is oriented with its circular end forward, the cross-section presented is circular with  $10\text{ cm}$  diameter. The aperture must be a circle with at least  $10\text{ cm}$  diameter to allow passage.

**18. Correct Answer: A (A square  $10\text{ cm} \times 10\text{ cm}$  or larger)**

A pyramid with a square base measuring  $10\text{ cm} \times 10\text{ cm}$  requires a square aperture of at least  $10\text{ cm} \times 10\text{ cm}$  to accommodate the base when oriented base-first.

**19. Correct Answer: C ( $9\text{ cm} \times 9\text{ cm}$ )**

A cube measuring  $9\text{ cm}$  on each side, when oriented face-first, presents a square cross-section of  $9\text{ cm} \times 9\text{ cm}$ . This is the exact size needed for the smallest square aperture through which it can pass.

**20. Correct Answer: D (An equilateral triangle  $8\text{ cm}$  sides)**

A triangular prism with an equilateral triangular base measuring 8 cm on each side, when entering triangle-first, requires an aperture matching that triangular shape with 8 cm sides.

**21. Correct Answer: B (A rectangle 8 cm × 11 cm or larger)**

An L-shaped object with overall dimensions of 8 cm wide and 11 cm tall requires a rectangular aperture of at least 8 cm × 11 cm to accommodate the entire object's profile when passing through.

**22. Correct Answer: A (A circle with at least 13 cm diameter)**

A sphere with a 13 cm diameter requires a circular aperture of at least 13 cm diameter to pass through, regardless of orientation, since a sphere presents the same circular profile from any angle.

**23. Correct Answer: C (A rectangle 8 cm × 10 cm)**

A rectangular block measuring 8 cm × 10 cm × 6 cm, when oriented with the 8 cm × 10 cm face forward, requires a rectangular aperture of at least 8 cm × 10 cm to pass through.

**24. Correct Answer: D (A hexagon approximately 8 cm across)**

A hexagonal prism with an 8 cm wide hexagonal base, when entering hexagon-first, requires an aperture that matches the hexagonal shape, approximately 8 cm across at its widest point.

**25. Correct Answer: B (A rectangle 12 cm × 14 cm)**

A T-shaped object with overall dimensions of 12 cm wide and 14 cm tall requires a rectangular aperture of at least 12 cm × 14 cm to accommodate the entire T profile when passing through face-first.

**26. Correct Answer: C (An ellipse or rectangle 9 cm × 12 cm)**

An ellipsoid measuring 9 cm × 12 cm × 7 cm, when oriented with the 9 cm × 12 cm face forward, requires an elliptical or rectangular aperture of approximately 9 cm × 12 cm.

**27. Correct Answer: A (A square 10 cm × 10 cm or larger)**

A cross-shaped object with arms extending 10 cm in each direction requires a square aperture of at least 10 cm × 10 cm to accommodate the full width and height of the cross profile when entering face-first.

**28. Correct Answer: D (A circle with at least 12 cm diameter)**

A cone with a base diameter of 12 cm, when oriented base-first, presents a circular cross-section of 12 cm diameter. The aperture must be a circle with at least 12 cm diameter.

**29. Correct Answer: B (A rounded rectangle approximately 8 cm × 10 cm)**

A rectangular block measuring 8 cm × 10 cm × 14 cm with 2 cm radius curves on the ends requires a rounded rectangular aperture of approximately 8 cm × 10 cm to accommodate the curved end profile.

**30. Correct Answer: A (A rectangle 9 cm × 7 cm)**

An irregular object with maximum dimensions of 9 cm × 11 cm × 7 cm, when oriented with its smallest face (9 cm × 7 cm) forward, requires a rectangular aperture of at least 9 cm × 7 cm.

## **ORTHOGRAPHIC PROJECTIONS (Questions 31-45)**

### **31. Correct Answer: C (A rectangular prism)**

A rectangular top view combined with a rectangular front view and square end view indicates a rectangular prism (box shape) with different length, width, and height dimensions—not a perfect cube.

### **32. Correct Answer: D (A cylinder)**

A cylinder shows circles in both the top and end views (looking along and perpendicular to the axis) and a rectangle in the front view (side profile). This combination uniquely identifies a cylinder oriented horizontally.

### **33. Correct Answer: B (Front view only)**

In a stepped object with three distinct levels, the front view (elevation) shows all three levels as steps or tiers most clearly, displaying the height differences between the three levels in a side profile.

### **34. Correct Answer: C (A triangular prism)**

A triangular top view combined with a rectangular front view and triangular end view indicates a triangular prism with the triangular cross-section visible in the top and end views, and the length shown in the front view.

### **35. Correct Answer: A (A cube)**

When the top, front, and end views all show squares of the same size, the three-dimensional object is a cube. All three orthogonal views of a cube appear as identical squares.

### **36. Correct Answer: D (A hollow rectangular frame)**

Nested squares in the top view and nested rectangles in the front and end views indicate a hollow rectangular structure—essentially a rectangular frame or box with walls but empty inside, not solid.

### **37. Correct Answer: B (A cross-shaped prism)**

A cross-shaped top view, rectangular front view, and cross-shaped end view indicates a three-dimensional object with a uniform cross-shaped cross-section throughout its length—a cross-shaped prism.

### **38. Correct Answer: A (A cylinder with slot or hole)**

A circle with a line through it in two views, combined with a rectangle with a line in the third view, suggests a cylindrical object with a slot, groove, or rectangular feature cut through it.

### **39. Correct Answer: C (A T-shaped prism)**

T-shaped top and end views combined with a rectangular front view indicates a three-dimensional object with a uniform T-shaped cross-section throughout its length—a T-shaped prism or beam.

**40. Correct Answer: A (Three cubes in a row)**

Three squares in a row in the top view, a long rectangle in the front view, and a square in the end view suggests three cube-like units arranged in a linear row.

**41. Correct Answer: D (An octagonal prism)**

Octagonal top and end views combined with a rectangular front view indicates an octagonal prism—an object with a uniform octagonal cross-section throughout its length.

**42. Correct Answer: B (An elliptical cylinder)**

An oval (ellipse) in the top and end views combined with a rectangular front view indicates an elliptical cylinder—a cylinder with an elliptical rather than circular cross-section.

**43. Correct Answer: A (A pentagonal prism)**

Pentagonal top and end views combined with a rectangular front view indicates a pentagonal prism—an object with a uniform pentagonal cross-section throughout its length.

**44. Correct Answer: C (Two cylinders stacked)**

Two circles in the top view, two rectangles in the front view (showing two separate rectangular sections), and a circle in the end view suggests two cylindrical objects stacked vertically one on top of the other.

**45. Correct Answer: D (An L-shaped prism)**

L-shaped top and end views combined with a rectangular front view indicates a three-dimensional object with a uniform L-shaped cross-section throughout its length—an L-shaped prism or beam.

**CUBE COUNTING (Questions 46-60)**

**46. Correct Answer: B (27)**

A structure with 3 layers arranged  $3 \times 3 \times 3$  contains: 3 cubes wide  $\times$  3 cubes deep  $\times$  3 cubes high = 27 total cubes. This is a standard  $3 \times 3 \times 3$  cube.

**47. Correct Answer: C (26)**

In a  $3 \times 3 \times 3$  cube structure containing 27 total cubes, only the center cube (1 cube) has no faces exposed. Therefore, cubes on the surface with at least one face exposed =  $27 - 1 = 26$  cubes.

**48. Correct Answer: D (90)**

A  $3 \times 5 \times 6$  structure contains:  $3 \text{ cubes} \times 5 \text{ cubes} \times 6 \text{ cubes} = 90$  total cubes. Multiply the three dimensions to find the total count.

**49. Correct Answer: A (8)**

In a  $7 \times 7 \times 7$  cube, cubes with exactly three painted faces are corner cubes. Any rectangular prism has exactly 8 corners (vertices), so there are 8 corner cubes with three painted faces.

**50. Correct Answer: C (54)**

With 6 layers and 9 cubes per layer arranged  $3 \times 3$ : Total cubes =  $6 \text{ layers} \times 9 \text{ cubes per layer} = 54$  cubes. Alternatively,  $3 \times 3 \times 6 = 54$  cubes.

**51. Correct Answer: B (8)**

Any rectangular prism has exactly 8 corners (vertices). In a  $3 \times 4 \times 5$  structure, there are 8 corner cubes where three edges meet.

**52. Correct Answer: B (210)**

A structure 7 cubes high  $\times$  6 cubes wide  $\times$  5 cubes deep contains:  $7 \times 6 \times 5 = 210$  total cubes. Multiply the three dimensions to find the total count.

**53. Correct Answer: C (16)**

An L-shaped structure with 9 cubes on one arm and 8 on the other, sharing 1 corner cube: Total =  $9 + 8 - 1 = 16$  cubes. Subtract the shared corner cube to avoid counting it twice.

**54. Correct Answer: D (24)**

In a  $7 \times 7 \times 1$  flat structure, cubes with exactly two painted faces are the perimeter cubes excluding corners. Perimeter cubes =  $7 + 7 + 7 + 7 - 4 \text{ corners} = 28 - 4 = 24$  cubes with two painted faces.

**55. Correct Answer: D (18)**

A staircase structure with 4 cubes on first step, 6 on second, and 8 on third contains:  $4 + 6 + 8 = 18$  total cubes. This is the sum of the arithmetic sequence.

**56. Correct Answer: A (8)**

Any rectangular prism has exactly 8 corners (vertices). In a  $6 \times 7 \times 8$  structure, there are 8 corner cubes where three faces meet at each corner position.

**57. Correct Answer: C (7)**

In a  $9 \times 1 \times 1$  structure (9 cubes in a row), the 2 end cubes have 5 faces painted, and the 7 middle cubes have exactly 4 faces painted (top, bottom, front, back—not the two sides touching adjacent cubes).

**58. Correct Answer: B (57)**

Bottom layer:  $6 \times 6 = 36$  cubes. Next layer:  $4 \times 4 = 16$  cubes. Next layer:  $2 \times 2 = 4$  cubes. Top layer: 1 cube. Total =  $36 + 16 + 4 + 1 = 57$  cubes in this pyramid structure.

**59. Correct Answer: A (214)**

A  $6 \times 6 \times 6$  cube contains 216 total cubes. With two corner cubes removed:  $216 - 2 = 214$  cubes remain.

**60. Correct Answer: D (13)**

A plus-shaped structure with 7 cubes for vertical arm and 7 cubes for horizontal arm, sharing 1 center cube: Total =  $7 + 7 - 1 = 13$  cubes. The center cube where the arms intersect is counted only once.

## Biology

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**1. Correct Answer: A (Regulates what enters and exits the cell)**

The primary function of the cell membrane (plasma membrane) is to regulate what enters and exits the cell, acting as a selective barrier. It controls the passage of substances, maintaining proper internal conditions through selective permeability, allowing beneficial materials in while keeping harmful substances out.

**2. Correct Answer: C (Mitochondrion)**

Mitochondria are known as the "powerhouse of the cell" because they produce ATP (adenosine triphosphate) through cellular respiration. They convert nutrients like glucose into usable energy through oxidative phosphorylation and the citric acid cycle.

**3. Correct Answer: B (Prophase)**

During prophase of mitosis, chromosomes condense and become visible under a microscope. The nuclear envelope breaks down, and the mitotic spindle begins to form. This is the first stage of mitosis where chromosomes can be clearly observed.

**4. Correct Answer: A (Passive transport)**

Passive transport does not require energy (ATP) because substances move down their concentration gradient, from areas of high concentration to areas of low concentration. Examples include diffusion, osmosis, and facilitated diffusion. Active transport, endocytosis, and exocytosis all require energy.

**5. Correct Answer: D (Forms the ribosomal structure)**

Ribosomal RNA (rRNA) is a structural component that forms the ribosome itself. Along with ribosomal proteins, rRNA makes up the ribosome's structure and also has catalytic functions in forming peptide bonds during translation.

**6. Correct Answer: C (23)**

Human gametes (sex cells—sperm and egg) contain 23 chromosomes, which is the haploid number ( $n = 23$ ). This is half the number found in somatic cells (46 chromosomes). When two gametes unite during fertilization, the diploid number of 46 is restored.

**7. Correct Answer: B (Uracil)**

In RNA, uracil (U) replaces thymine (T) found in DNA. The base pairing in RNA is: adenine pairs with uracil, and guanine pairs with cytosine. This is a key structural difference between DNA and RNA.

**8. Correct Answer: D (Sex-linked inheritance)**

Sex-linked inheritance involves traits located on sex chromosomes (X or Y chromosomes). Most sex-linked traits are X-linked, affecting males more frequently since they have only one X chromosome, while females have two X chromosomes.

**9. Correct Answer: A (Metaphase I)**

Independent assortment of chromosomes occurs during metaphase I of meiosis, when homologous chromosome pairs line up randomly at the cell's equator. This random arrangement creates genetic variation in gametes because maternal and paternal chromosomes assort independently.

**10. Correct Answer: B (Red blood cells)**

Red blood cells (erythrocytes) are primarily responsible for oxygen transport throughout the body. They contain hemoglobin, an iron-containing protein that binds to oxygen in the lungs and releases it to tissues, and also helps transport some carbon dioxide back to the lungs.

**11. Correct Answer: C (Chemical and mechanical digestion of food)**

The primary function of the stomach is chemical and mechanical digestion of food. The stomach secretes gastric acid and enzymes (like pepsin) for chemical breakdown, while muscular contractions churn food mechanically, producing chyme that moves to the small intestine.

**12. Correct Answer: D (Nervous tissue)**

Nervous tissue transmits electrical signals throughout the body. It consists of neurons that generate and conduct electrical impulses (action potentials) and glial cells that support and protect neurons. This tissue enables rapid communication and coordination.

**13. Correct Answer: D (50%)**

In a cross between Aa and Aa, the Punnett square produces: AA (25%), Aa (50%), and aa (25%). The heterozygous genotype (Aa) appears in 50% or  $\frac{2}{4}$  of offspring.

**14. Correct Answer: B (Meiosis)**

Meiosis is the specialized cell division process that produces gametes (sex cells). It involves two successive divisions (meiosis I and II) and reduces the chromosome number from diploid ( $2n$ ) to haploid ( $n$ ), producing four genetically different haploid cells.

**15. Correct Answer: C (Carries genetic instructions from DNA to ribosomes)**

The primary role of messenger RNA (mRNA) is to carry genetic instructions from DNA in the nucleus to ribosomes in the cytoplasm. During transcription, DNA is copied into mRNA, which then serves as the template for protein synthesis during translation.

**16. Correct Answer: A (Platelets)**

Platelets (thrombocytes) are the blood component that initiates blood clotting at injury sites. When a blood vessel is damaged, platelets adhere to the injury site, aggregate together, and release chemicals that trigger the coagulation cascade, forming a clot to stop bleeding.

**17. Correct Answer: D (Cardiac muscle)**

Cardiac muscle is the specialized type of muscle tissue found exclusively in the heart. It is involuntary (not under conscious control), striated in appearance, and has unique properties including rhythmic contraction and intercalated discs that allow coordinated contraction.

**18. Correct Answer: B (Protein)**

Translation is the process by which ribosomes synthesize proteins using mRNA as a template. The ribosome reads the mRNA codons and assembles amino acids in the specified sequence to create a polypeptide chain (protein). The end product of translation is always a protein.

**19. Correct Answer: A (Lysosome)**

Lysosomes are membrane-bound organelles containing digestive enzymes that break down worn-out cell parts, damaged organelles, macromolecules, and foreign materials. They function as the cell's recycling center and waste disposal system through enzymatic digestion.

**20. Correct Answer: B (Build new bone)**

Osteoblasts are bone cells responsible for building new bone tissue. They synthesize and secrete the organic components of bone matrix (primarily collagen) and regulate mineralization. This contrasts with osteoclasts, which break down bone tissue.

**21. Correct Answer: C (Prokaryotic)**

Bacteria are classified as prokaryotic cells. Prokaryotes lack a membrane-bound nucleus and other membrane-bound organelles. Their DNA is located in a nucleoid region rather than enclosed in a nuclear envelope.

**22. Correct Answer: A (Carbon dioxide)**

The primary waste product of cellular respiration besides water is carbon dioxide. During cellular respiration, glucose is broken down to produce ATP (energy), with carbon dioxide and water as byproducts. The equation is:  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$ .

**23. Correct Answer: D (Endocrine system)**

The endocrine system uses hormones to regulate body functions. It consists of glands (such as the pituitary, thyroid, adrenal glands, and pancreas) that secrete hormones directly into the bloodstream to regulate processes like metabolism, growth, and reproduction.

**24. Correct Answer: C (CGAU)**

Following complementary base pairing rules for DNA to mRNA transcription: G pairs with C, C pairs with G, T pairs with A, and A pairs with U (uracil in RNA, not thymine). Therefore, DNA sequence GCTA transcribes to mRNA sequence CGAU.

**25. Correct Answer: B (Veins)**

Veins are blood vessels that carry blood back to the heart from the body's tissues. Most veins carry deoxygenated blood (except pulmonary veins which carry oxygenated blood from the lungs to the heart). Veins have thinner walls than arteries and contain valves to prevent backflow.

**26. Correct Answer: A (Modifies and packages proteins)**

The Golgi apparatus (Golgi complex) modifies, sorts, and packages proteins that come from the endoplasmic reticulum. It processes proteins by adding carbohydrate groups or other modifications, sorts them based on their destinations, and packages them into vesicles for transport.

**27. Correct Answer: D (Phenotype)**

Phenotype describes the observable traits or characteristics of an organism, resulting from the interaction of its genotype (genetic makeup) with the environment. Examples include physical appearance, biochemical properties, and behavior—any trait that can be observed or measured.

**28. Correct Answer: C (Interphase)**

Interphase is the phase in which the cell grows and prepares for division. It consists of three stages: G1 (cell growth), S (DNA replication), and G2 (preparation for mitosis). Most of a cell's life is spent in interphase, not in active division.

**29. Correct Answer: B (Lungs and airways)**

The main organs of the respiratory system are the lungs and airways (including the trachea, bronchi, and bronchioles). The lungs are where gas exchange occurs, with oxygen entering the blood and carbon dioxide being removed. The airways transport air to and from the lungs.

**30. Correct Answer: D (Presence of membrane-bound organelles)**

Eukaryotic cells are distinguished from prokaryotic cells by the presence of membrane-bound organelles, including a nucleus (containing DNA), mitochondria, endoplasmic reticulum, and Golgi apparatus. Prokaryotic cells lack these membrane-bound structures.

## General Chemistry

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### 1. Correct Answer: D (Sum of protons and neutrons)

The mass number of an atom is the sum of protons and neutrons in the nucleus. It represents the total number of nucleons (particles in the nucleus). The mass number is different from the atomic number, which is only the number of protons.

### 2. Correct Answer: C (Neutron)

Neutrons are subatomic particles that have no electrical charge—they are electrically neutral. They are located in the nucleus along with protons. Protons have a positive charge (+1), electrons have a negative charge (-1), and ions are charged atoms or molecules.

### 3. Correct Answer: B (Ionic bond)

An ionic bond forms when electrons are transferred completely from one atom (typically a metal) to another (typically a nonmetal). The atom that loses electrons becomes a positively charged cation, and the atom that gains electrons becomes a negatively charged anion. The electrostatic attraction between oppositely charged ions creates the ionic bond.

### 4. Correct Answer: A (2)

The first energy level (shell) can hold a maximum of 2 electrons, calculated using the formula  $2n^2$  where  $n$  is the shell number. For the first shell:  $2(1)^2 = 2(1) = 2$  electrons maximum.

### 5. Correct Answer: D (Salt and water)

When an acid neutralizes a base, a neutralization reaction occurs, producing salt and water. For example:  $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ . The  $\text{H}^+$  from the acid combines with the  $\text{OH}^-$  from the base to form water, while the remaining ions form a salt.

### 6. Correct Answer: C (58.5 g/mol)

The molar mass of sodium chloride ( $\text{NaCl}$ ) is calculated by adding the atomic masses: 1 sodium atom (23 g/mol) + 1 chlorine atom (35.5 g/mol) = 58.5 g/mol total.

### 7. Correct Answer: B (4)

The pH scale ranges from 0 to 14, with pH 7 being neutral. Acidic solutions have pH values less than 7. Among the options, pH 4 indicates an acidic solution. pH 7 is neutral, while pH 10 and 14 are basic.

**8. Correct Answer: D (3)**

In the balanced equation  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ , the coefficient of  $\text{H}_2$  is 3. This coefficient indicates that 3 molecules of hydrogen gas react with 1 molecule of nitrogen gas to produce 2 molecules of ammonia.

**9. Correct Answer: A (Isotopes)**

Isotopes are atoms of the same element that have the same number of protons (same atomic number) but different numbers of neutrons, resulting in different mass numbers. For example, carbon-12 and carbon-14 are isotopes, both with 6 protons but 6 and 8 neutrons respectively.

**10. Correct Answer: C (Volume decreases)**

According to Boyle's Law, at constant temperature, pressure and volume are inversely proportional ( $P_1V_1 = P_2V_2$ ). When pressure increases, volume decreases proportionally. This explains why compressing a gas increases its pressure while decreasing its volume.

**11. Correct Answer: D (A covalent bond forms)**

When two atoms share electrons, a covalent bond forms. This type of bonding typically occurs between nonmetal atoms, where each atom contributes electrons to form shared pairs that hold the atoms together.

**12. Correct Answer: B (3 moles)**

To calculate moles, divide mass by molar mass:  $\text{moles} = 54 \text{ g} \div 18 \text{ g/mol} = 3 \text{ moles}$ . This shows that 54 grams of water contains 3 moles of  $\text{H}_2\text{O}$  molecules.

**13. Correct Answer: C (Moles)**

The mole is the SI unit for measuring the amount of substance in chemistry. One mole contains Avogadro's number ( $6.022 \times 10^{23}$ ) of particles, whether atoms, molecules, or formula units. This unit connects the microscopic scale to the macroscopic scale.

**14. Correct Answer: A (Taste sour and turn litmus red)**

Acids have characteristic properties including tasting sour (like lemon juice or vinegar), turning blue litmus paper red, and having pH values less than 7. Bases, in contrast, taste bitter, feel slippery, turn red litmus paper blue, and have pH greater than 7.

**15. Correct Answer: A (Solid)**

Solids have both definite shape and definite volume because their particles are in fixed positions held together by strong intermolecular forces. Liquids have definite volume but take the shape of their container. Gases have neither definite shape nor volume.

**16. Correct Answer: B (Stable electron configurations by sharing)**

Through covalent bonding, atoms achieve stable electron configurations by sharing electrons rather than transferring them completely. This sharing allows atoms to fill their valence shells and achieve stability, similar to noble gases.

**17. Correct Answer: C (4)**

The formula  $2\text{Ca}(\text{OH})_2$  represents 2 formula units of calcium hydroxide. Each  $\text{Ca}(\text{OH})_2$  contains 2 OH groups, and each OH group contains 1 hydrogen atom. Therefore: 2 formula units  $\times$  2 OH groups per unit  $\times$  1 hydrogen per OH = 4 hydrogen atoms total.

**18. Correct Answer: A (7)**

A neutral solution at  $25^\circ\text{C}$  has a pH of exactly 7. At this pH, the concentration of hydrogen ions ( $\text{H}^+$ ) equals the concentration of hydroxide ions ( $\text{OH}^-$ ), resulting in neither acidic nor basic properties.

**19. Correct Answer: D (Group 18)**

The noble gases are located in Group 18 of the periodic table and include helium, neon, argon, krypton, xenon, and radon. These elements are characterized by complete valence electron shells, making them very stable and largely unreactive.

**20. Correct Answer: B (Decomposition)**

The reaction  $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$  represents a decomposition reaction, where a single compound breaks down into two or more simpler substances. This is the opposite of a synthesis reaction ( $\text{A} + \text{B} \rightarrow \text{AB}$ ). Water decomposes into hydrogen and oxygen.

**21. Correct Answer: C (1000 times)**

The pH scale is logarithmic with base 10. Each unit represents a 10-fold difference in hydrogen ion concentration. A difference of 3 pH units represents  $10^3 = 1000$ -fold difference. A solution with pH 1 has 1000 times more  $\text{H}^+$  ions than a solution with pH 4.

**22. Correct Answer: D (Negative)**

Electrons are subatomic particles that carry a negative electrical charge (-1). They are located outside the nucleus in electron shells or orbitals and have negligible mass compared to protons and neutrons.

**23. Correct Answer: A (2)**

Elements in Group 2 (the alkaline earth metals) have 2 valence electrons in their outermost energy level. This includes beryllium, magnesium, calcium, strontium, barium, and radium. Because they need to lose only two electrons to achieve a stable configuration, they typically form +2 ions.

**24. Correct Answer: C (Mass is conserved)**

According to the Law of Conservation of Mass, during chemical reactions, mass is conserved—atoms are neither created nor destroyed, they are simply rearranged as existing bonds break and new bonds form. The total mass of reactants equals the total mass of products.

**25. Correct Answer: B (1 M)**

Using the dilution formula  $M_1V_1 = M_2V_2$ :  $(3\text{ M})(30\text{ mL}) = M_2(90\text{ mL})$ . Solving:  $90 = 90M_2$ , so  $M_2 = 1\text{ M}$ . Diluting from 30 mL to 90 mL (3-fold dilution) reduces the concentration from 3 M to 1 M.

**26. Correct Answer: A ( $\text{H}^+$  ions)**

According to the Arrhenius definition, acids are substances that release hydrogen ions ( $\text{H}^+$ ) when dissolved in water. For example, HCl dissociates to produce  $\text{H}^+$  and  $\text{Cl}^-$  ions. Bases, in contrast, release  $\text{OH}^-$  ions in water.

**27. Correct Answer: D ( $6.022 \times 10^{23}$ )**

Avogadro's number is  $6.022 \times 10^{23}$ , representing the number of particles (atoms, molecules, or formula units) in one mole of any substance. This fundamental constant allows chemists to convert between particle count and moles, connecting microscopic and macroscopic scales.

**28. Correct Answer: B (Volume decreases)**

According to Charles's Law, at constant pressure, the volume of a gas is directly proportional to its absolute temperature in Kelvin ( $V_1/T_1 = V_2/T_2$ ). When temperature decreases, gas molecules move slower and require less space, causing volume to decrease proportionally.

**29. Correct Answer: C (8)**

A neutral atom has equal numbers of protons and electrons, making the overall charge zero. Oxygen has an atomic number of 8, meaning it has 8 protons. Therefore, a neutral oxygen atom also has 8 electrons to balance the positive charge of the protons.

**30. Correct Answer: A (Pressure decreases)**

According to Boyle's Law, at constant temperature, pressure and volume are inversely proportional ( $P_1V_1 = P_2V_2$ ). When volume increases, pressure decreases proportionally. This is because gas molecules have more space to move and collide with container walls less frequently.