Full-Length Practice Test 8

Reading Comprehension

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 consists of the heart, blood vessels, and blood, working together to transport oxygen, nutrients, hormones, and waste products throughout the body. This intricate system maintains homeostasis, regulates body temperature, and supports immune function through continuous circulation. The heart functions as a muscular pump divided into four chambers, with the right side pumping deoxygenated blood to the lungs and the left side pumping oxygenated blood to the body. Understanding cardiovascular anatomy and physiology is essential for healthcare professionals because cardiovascular disease remains the leading cause of death globally, and many medical conditions affect or are affected by cardiovascular function.

The heart's pumping action follows a coordinated cardiac cycle involving electrical signals, mechanical contractions, and valve operations. The sinoatrial (SA) node, located in the right atrium, serves as the heart's natural pacemaker, generating electrical impulses that spread through the atria causing atrial contraction. The impulse then travels to the atrioventricular (AV) node, which delays transmission briefly before sending signals through the bundle of His and Purkinje fibers, triggering ventricular contraction. This coordinated sequence ensures that atria contract before ventricles, maximizing blood flow efficiency. Heart valves prevent backflow—the tricuspid and mitral valves separate atria from ventricles, while the pulmonary and aortic valves control blood exiting the heart. Arrhythmias occur when electrical conduction becomes disrupted, potentially causing irregular heartbeats, reduced cardiac output, or life-threatening conditions requiring medical intervention.

Blood vessels form an extensive network enabling circulation. Arteries carry blood away from the heart under high pressure, with thick muscular walls allowing them to withstand and regulate pressure through vasoconstriction and vasodilation. The aorta, the body's largest artery, branches into smaller arteries supplying all body regions. Arterioles, small muscular vessels, control blood flow to capillary beds through constriction and dilation. Capillaries, with walls only one cell thick, enable exchange of oxygen, nutrients, and waste between blood and tissues through diffusion. Veins return blood to the heart under lower pressure, with thinner walls and valves preventing backflow. Venous return depends on skeletal muscle contraction, respiratory movements, and venous valves working together.

Blood pressure, the force blood exerts on vessel walls, is measured as systolic pressure during ventricular contraction and diastolic pressure during ventricular relaxation. Normal blood pressure is approximately 120/80 mmHg, though values vary with age, activity, and health status. Hypertension, consistently elevated blood pressure, damages blood vessels and increases heart workload, raising risks for heart attack, stroke, kidney disease, and other complications. Multiple factors contribute to hypertension including genetics, obesity, high sodium intake, physical inactivity, and stress. Hypotension, abnormally low blood pressure, can cause dizziness, fainting, and inadequate tissue perfusion. For dental professionals, understanding cardiovascular function is critical because dental procedures can stress the cardiovascular system, certain medications affect blood pressure and clotting, patients with cardiovascular disease require modified treatment approaches, and dental infections can potentially affect heart health, particularly in patients with valve abnormalities or previous endocarditis.

1. According to the passage, the cardiovascular system's functions include:
   A. Only pumping blood
   B. Only transporting oxygen
   C. Transporting oxygen, nutrients, hormones, and waste products
   D. Producing blood cells exclusively

2. The passage states that the sinoatrial (SA) node functions as:
   A. The heart's natural pacemaker
   B. A blood vessel
   C. A heart valve
   D. The largest chamber

3. Based on the passage, heart valves function to:
   A. Generate electrical impulses
   B. Increase blood pressure
   C. Produce hormones
   D. Prevent backflow of blood

4. According to the passage, capillaries enable exchange of substances through:
   A. Active pumping
   B. Diffusion
   C. Valve action
   D. Electrical signals

5. The passage indicates that blood pressure is measured as:
   A. Only systolic pressure
   B. Only diastolic pressure

C. Systolic pressure during contraction and diastolic pressure during relaxation
D. Venous pressure only

6. Based on the passage, hypertension can increase risks for:
   A. Heart attack, stroke, and kidney disease
   B. Only weight gain
   C. Improved circulation
   D. Enhanced tissue perfusion

7. According to the passage, venous return depends on:
   A. Only heart valves
   B. Only blood pressure
   C. Only arterial contraction
   D. Skeletal muscle contraction, respiratory movements, and venous valves

8. The passage states that dental professionals need cardiovascular knowledge because:
   A. Dentists only treat the heart
   B. Teeth are unrelated to circulation
   C. Dental procedures can stress the cardiovascular system
   D. Blood pressure is irrelevant to dental care

PASSAGE 2

Pharmacology, the study of drugs and their effects on living systems, encompasses drug composition, mechanisms of action, therapeutic uses, and adverse effects. Healthcare professionals must understand pharmacological principles to safely prescribe, administer, and monitor medications while recognizing drug interactions, contraindications, and individual patient responses. Drugs exert effects by interacting with specific receptors, enzymes, or cellular structures, producing desired therapeutic outcomes alongside potential side effects. Understanding pharmacokinetics (what the body does to drugs) and pharmacodynamics (what drugs do to the body) enables healthcare providers to optimize medication efficacy while minimizing risks.

Pharmacokinetics involves four processes: absorption, distribution, metabolism, and excretion, commonly abbreviated as ADME. Absorption describes drug movement from administration site into bloodstream, influenced by factors including drug formulation, administration route, and patient characteristics. Oral medications must survive stomach acid and first-pass metabolism in the liver before reaching systemic circulation, whereas intravenous drugs enter circulation directly. Distribution refers to drug transport throughout the body via bloodstream, with factors like blood flow, protein binding, and lipid solubility affecting tissue penetration. Metabolism, primarily occurring in the liver through cytochrome P450 enzymes, converts drugs into metabolites that are typically more water-soluble and easier to excrete.

Excretion eliminates drugs and metabolites from the body, predominantly through kidneys in urine, though some drugs are excreted in bile, feces, or expired air.

Pharmacodynamics examines drug mechanisms at molecular, cellular, and organ levels. Most drugs act by binding to specific receptors on cell surfaces or within cells, triggering or blocking biological responses. Agonists bind receptors and activate them, mimicking natural substances and producing effects—for example, morphine acts as an opioid receptor agonist producing pain relief. Antagonists bind receptors without activating them, blocking natural substances' effects—for instance, antihistamines block histamine receptors, preventing allergic response symptoms. Drug effects depend on factors including dose, receptor affinity, and individual patient variables. Therapeutic index, the ratio between toxic dose and effective dose, indicates drug safety—drugs with narrow therapeutic indices require careful monitoring to avoid toxicity while maintaining efficacy.

Adverse drug reactions represent unintended, harmful effects occurring at normal doses. Side effects, predictable reactions related to drug's known pharmacological actions, often occur but may not require discontinuation. Allergic reactions involve immune system responses ranging from mild rashes to life-threatening anaphylaxis requiring immediate treatment. Drug interactions occur when one drug affects another's action, either enhancing effects (synergism) or reducing effectiveness (antagonism). For dental professionals, pharmacological knowledge is essential because many patients take medications affecting dental treatment, dental procedures may require medication administration or adjustment, drug interactions must be avoided, medical emergencies may necessitate drug administration, and local anesthetics are drugs requiring proper selection, dosing, and monitoring for safe use. Understanding antibiotic prophylaxis protocols, pain management options, anticoagulant management, and drug effects on oral tissues ensures safe, effective dental care delivery.

9. According to the passage, pharmacology encompasses:
    A. Only drug composition
    B. Drug composition, mechanisms, therapeutic uses, and adverse effects
    C. Only therapeutic uses
    D. Only side effects

10. The passage states that pharmacokinetics involves:
    A. Only absorption
    B. Only metabolism
    C. Only excretion
    D. Absorption, distribution, metabolism, and excretion

11. Based on the passage, oral medications must:
    A. Survive stomach acid and first-pass metabolism
    B. Only be swallowed

C. Avoid the liver
D. Not enter bloodstream

12. According to the passage, agonists:
    A. Block receptors only
    B. Have no effect
    C. Bind and activate receptors
    D. Destroy cells

13. The passage indicates that therapeutic index measures:
    A. Drug color
    B. The ratio between toxic dose and effective dose
    C. Drug taste
    D. Patient age

14. Based on the passage, anaphylaxis is:
    A. A beneficial effect
    B. Unrelated to allergies
    C. Always mild
    D. A life-threatening allergic reaction

15. According to the passage, synergism occurs when:
    A. One drug enhances another's effects
    B. Drugs have no interaction
    C. Drugs are identical
    D. Drugs cancel completely

16. The passage states that dental professionals need pharmacological knowledge because:
    A. Dentists never use medications
    B. Patients never take medications
    C. Many patients take medications affecting dental treatment
    D. Pharmacology is unrelated to dentistry

PASSAGE 3

The renal system, comprising the kidneys, ureters, bladder, and urethra, maintains homeostasis by regulating fluid balance, electrolyte concentrations, acid-base balance, and blood pressure while eliminating metabolic waste products. The kidneys perform multiple vital functions including filtering blood, reabsorbing essential substances, secreting waste products and excess substances, producing

hormones regulating blood pressure and red blood cell production, and activating vitamin D for calcium absorption. Kidney failure severely impacts health, potentially requiring dialysis or transplantation, making understanding renal function essential for healthcare professionals who must recognize kidney disease signs, adjust medication dosing, and prevent kidney damage.

The nephron, the kidney's functional unit, contains approximately one million per kidney, each capable of forming urine. Blood enters the nephron through the afferent arteriole into the glomerulus, a specialized capillary network where filtration occurs. Glomerular filtration forces water and small solutes from blood into Bowman's capsule, beginning urine formation. This filtrate then flows through the proximal convoluted tubule, where approximately 65% of filtered water and sodium are reabsorbed along with glucose, amino acids, and other essential nutrients through active and passive transport mechanisms. The loop of Henle creates concentration gradients enabling water conservation through the descending limb's water reabsorption and the ascending limb's salt reabsorption. The distal convoluted tubule and collecting duct fine-tune urine composition through hormone-regulated water and electrolyte reabsorption.

Hormones regulate renal function and maintain homeostasis. Antidiuretic hormone (ADH), released from the pituitary gland in response to dehydration or increased blood osmolarity, increases water reabsorption in collecting ducts, concentrating urine and conserving body water. Aldosterone, secreted by adrenal glands, increases sodium reabsorption and potassium secretion in distal tubules and collecting ducts, helping regulate blood pressure and electrolyte balance. The renin-angiotensin-aldosterone system (RAAS) responds to decreased blood pressure or blood flow by releasing renin, which ultimately produces angiotensin II (a potent vasoconstrictor) and triggers aldosterone release, raising blood pressure. Atrial natriuretic peptide (ANP), released when atrial stretch indicates increased blood volume, promotes sodium and water excretion, lowering blood pressure.

Kidney disease significantly affects medication metabolism and clearance, requiring dose adjustments for many drugs including antibiotics, pain medications, and contrast dyes used in imaging. Chronic kidney disease (CKD) develops gradually, often from diabetes or hypertension, progressively reducing kidney function. Early stages may show no symptoms, but advanced disease causes fluid retention, electrolyte imbalances, anemia, bone disease, and uremia (waste accumulation in blood). Acute kidney injury involves sudden kidney function loss, potentially from dehydration, medications, infections, or obstruction, sometimes reversible with prompt treatment. For dental professionals, understanding renal function matters because kidney disease patients may have altered medication metabolism requiring dose adjustments, increased bleeding risk from platelet dysfunction, hypertension requiring monitoring, and oral manifestations including dry mouth, altered taste, and potential bone loss. Fluoride-containing products should be used cautiously in severe kidney disease, and some dental medications require dose modification or avoidance in renal impairment.

17. According to the passage, the renal system maintains homeostasis by:
    A. Only producing urine

B. Only filtering blood
C. Digesting food
D. Regulating fluid balance, electrolytes, acid-base balance, and blood pressure

18. The passage states that the nephron is:
    A. The kidney's functional unit
    B. A hormone
    C. A blood vessel only
    D. Located in the heart

19. Based on the passage, glomerular filtration:
    A. Occurs in the liver
    B. Produces hormones only
    C. Destroys blood cells
    D. Forces water and solutes from blood into Bowman's capsule

20. According to the passage, ADH (antidiuretic hormone):
    A. Decreases water reabsorption
    B. Increases water reabsorption to conserve body water
    C. Has no effect on urine
    D. Only affects bones

21. The passage indicates that the renin-angiotensin-aldosterone system:
    A. Lowers blood pressure only
    B. Has no cardiovascular effects
    C. Responds to decreased blood pressure by raising it
    D. Eliminates all hormones

22. Based on the passage, chronic kidney disease often results from:
    A. Exercise
    B. Proper hydration
    C. Normal aging only
    D. Diabetes or hypertension

23. According to the passage, kidney disease patients may have:
    A. Altered medication metabolism requiring dose adjustments
    B. Enhanced drug clearance
    C. No medication concerns
    D. Improved healing

24. The passage states that dental professionals should:
   A. Ignore kidney function
   B. Increase all medication doses
   C. Use fluoride cautiously in severe kidney disease
   D. Avoid all dental treatments for kidney patients

PASSAGE 4

The endocrine system regulates physiological processes through hormones secreted into the bloodstream by ductless glands located throughout the body. Unlike the nervous system's rapid electrical signals, hormonal regulation operates more slowly but produces longer-lasting effects on target tissues. Hormones control metabolism, growth and development, reproduction, stress responses, fluid and electrolyte balance, and numerous other functions essential for survival. Endocrine disorders result from hormone excess, deficiency, or resistance, causing widespread effects reflecting hormones' diverse roles. Healthcare professionals must understand endocrine function because many patients have endocrine conditions requiring special considerations during treatment.

The hypothalamus and pituitary gland form the endocrine system's control center, integrating nervous and hormonal regulation. The hypothalamus produces releasing and inhibiting hormones controlling anterior pituitary secretions. The anterior pituitary secretes tropic hormones regulating other endocrine glands: thyroid-stimulating hormone (TSH) controls thyroid function, adrenocorticotropic hormone (ACTH) regulates adrenal cortex activity, and gonadotropins control reproductive organ function. Growth hormone (GH), also from the anterior pituitary, promotes tissue growth throughout life, with excess causing acromegaly in adults. The posterior pituitary releases antidiuretic hormone (ADH) and oxytocin, which are actually produced in the hypothalamus and stored in the posterior pituitary.

The thyroid gland produces thyroid hormones (T3 and T4) regulating metabolism throughout the body. Hyperthyroidism results from excess thyroid hormone, causing increased metabolic rate, nervousness, weight loss despite increased appetite, heat intolerance, rapid heartbeat, and tremors. Graves' disease, an autoimmune condition, is the most common hyperthyroidism cause. Hypothyroidism results from insufficient thyroid hormone, causing decreased metabolism, fatigue, weight gain, cold intolerance, dry skin, and constipation. Thyroid disorders affect millions globally, with many requiring lifelong hormone replacement or suppression therapy. The thyroid also produces calcitonin, which lowers blood calcium levels by inhibiting bone resorption.

Diabetes mellitus represents the most common serious endocrine disorder, affecting insulin production or action. Type 1 diabetes results from autoimmune destruction of insulin-producing pancreatic beta cells, requiring lifelong insulin therapy. Type 2 diabetes involves insulin resistance and eventual beta cell dysfunction, initially managed with lifestyle modifications and oral medications, potentially progressing to insulin requirement. Uncontrolled diabetes causes acute complications including hypoglycemia

(dangerously low blood glucose) and hyperglycemia (elevated blood glucose potentially leading to diabetic ketoacidosis), along with chronic complications affecting eyes, kidneys, nerves, and blood vessels. For dental professionals, endocrine disorders present important considerations: diabetic patients require careful glucose monitoring, appointment timing to prevent hypoglycemia, and understanding that periodontal disease and diabetes influence each other bidirectionally. Thyroid disorder patients may have altered medication responses, cardiovascular changes requiring monitoring, and delayed healing. Patients taking corticosteroids for various conditions may have suppressed adrenal function requiring stress dose adjustments before extensive dental procedures. Understanding endocrine function enables dental professionals to provide safe, effective care while recognizing when medical consultation is necessary.

25. According to the passage, hormonal regulation:
    A. Works faster than nervous signals
    B. Operates more slowly but produces longer-lasting effects
    C. Has no lasting effects
    D. Only affects bones

26. The passage states that the hypothalamus:
    A. Produces releasing and inhibiting hormones
    B. Only filters blood
    C. Produces no hormones
    D. Is unrelated to the pituitary

27. Based on the passage, acromegaly results from:
    A. Hormone deficiency
    B. Excess growth hormone in adults
    C. Lack of calcium
    D. Thyroid removal

28. According to the passage, hyperthyroidism causes:
    A. Decreased metabolism
    B. Weight gain
    C. Increased metabolic rate and nervousness
    D. Slowed heart rate

29. The passage indicates that Type 1 diabetes:
    A. Results from autoimmune destruction of beta cells
    B. Never requires insulin
    C. Is not serious
    D. Only affects adults

30. Based on the passage, uncontrolled diabetes can cause:
    A. No complications
    B. Only weight changes
    C. Enhanced healing
    D. Acute and chronic complications affecting multiple organs

31. According to the passage, periodontal disease and diabetes:
    A. Are unrelated
    B. Influence each other bidirectionally
    C. Never occur together
    D. Only affect children

32. The passage states that patients taking corticosteroids may:
    A. Have suppressed adrenal function requiring stress dose adjustments
    B. Never need dental care
    C. Have enhanced healing
    D. Require no special considerations

PASSAGE 5

The immune system defends against pathogens, abnormal cells, and foreign substances through innate and adaptive immunity working together. Innate immunity provides immediate, nonspecific defense through physical barriers, chemical defenses, and cellular responses, while adaptive immunity develops specific, long-lasting protection through lymphocytes recognizing and remembering particular antigens. Immune system dysfunction underlies allergies, autoimmune diseases, immunodeficiency disorders, and affects vaccination responses, transplant success, and cancer development. Healthcare professionals must understand immunology to manage infectious diseases, recognize immune disorders, prevent disease transmission, and provide safe care for immunocompromised patients.

White blood cells (leukocytes) are the immune system's primary cellular components. Neutrophils, the most abundant white blood cells, are phagocytes that engulf and destroy bacteria and fungi, forming the first cellular response to infection. Monocytes differentiate into macrophages in tissues, performing phagocytosis and presenting antigens to lymphocytes, initiating adaptive immune responses. Eosinophils combat parasitic infections and participate in allergic responses. Basophils and mast cells release histamine and other mediators during allergic reactions and inflammation. Lymphocytes include B cells producing antibodies and T cells coordinating immune responses and directly killing infected cells.

Adaptive immunity provides specific, long-lasting protection through antigen recognition. B lymphocytes produce antibodies (immunoglobulins) that bind specific antigens, marking pathogens for destruction, neutralizing toxins, and preventing pathogen attachment to cells. Each B cell produces antibodies

recognizing one specific antigen; upon encountering its antigen, the B cell proliferates, producing plasma cells secreting large antibody quantities and memory B cells providing long-term immunity. T lymphocytes include helper T cells activating other immune cells through cytokine secretion and cytotoxic T cells directly killing virus-infected and cancerous cells by inducing apoptosis. Memory T cells, like memory B cells, persist after infection resolution, enabling rapid, vigorous responses upon re-exposure.

Immunological disorders significantly impact health and dental treatment. Allergies involve excessive immune responses to harmless substances, ranging from mild hay fever to life-threatening anaphylaxis requiring immediate epinephrine administration. Autoimmune diseases occur when the immune system attacks the body's own tissues, including conditions like rheumatoid arthritis, lupus, and Sjögren's syndrome (causing severe dry mouth relevant to dental care). Immunodeficiency, whether inherited or acquired (like HIV/AIDS), increases infection susceptibility and complicates treatment. Immunosuppressed patients, including organ transplant recipients and cancer patients undergoing chemotherapy, require modified dental treatment approaches, antibiotic prophylaxis consideration, and careful infection control. For dental professionals, immunology knowledge is essential because oral tissues constantly encounter microorganisms requiring immune surveillance, many systemic immune disorders have oral manifestations like ulcers or infections, immunocompromised patients require modified treatment and prophylactic antibiotics for some procedures, and healthcare workers must prevent disease transmission while protecting themselves through vaccinations and universal precautions. Understanding immune function enables recognition of when medical consultation is necessary before dental treatment and appropriate modification of care for immune-compromised patients.

33. According to the passage, innate immunity provides:
    A. Only long-term protection
    B. Only antibodies
    C. Specific memory
    D. Immediate, nonspecific defense

34. The passage states that neutrophils:
    A. Produce antibodies only
    B. Are rare blood cells
    C. Are phagocytes that destroy bacteria and fungi
    D. Form bone tissue

35. Based on the passage, B lymphocytes produce:
    A. Only red blood cells
    B. Antibodies
    C. Bone marrow
    D. Digestive enzymes

36. According to the passage, memory B cells provide:
    A. Immediate inflammation
    B. Temporary immunity
    C. No immune function
    D. Long-term immunity

37. The passage indicates that cytotoxic T cells:
    A. Directly kill virus-infected and cancerous cells
    B. Only produce antibodies
    C. Have no immune function
    D. Only respond to bacteria

38. Based on the passage, anaphylaxis:
    A. Is life-threatening and requires immediate epinephrine
    B. Is always mild
    C. Requires no treatment
    D. Only causes sneezing

39. According to the passage, Sjögren's syndrome:
    A. Increases saliva production
    B. Has no oral effects
    C. Causes severe dry mouth
    D. Only affects joints

40. The passage states that immunocompromised patients may require:
    A. No special dental considerations
    B. Increased infection risk
    C. Standard treatment only
    D. Modified treatment approaches and antibiotic prophylaxis consideration

Language Usage

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 practice installed new equipment, it also trained all staff members thoroughly.

A. equipment, it also trained
B. equipment it also trained
C. equipment; because it also trained
D. equipment, and it also trained

2. Neither the dentist nor the assistants was available for the emergency consultation.
   A. nor the assistants was available
   B. nor the assistants were available
   C. or the assistants was available
   D. or the assistants were available

3. The supervisor asked the staff when could they complete the required training.
   A. when could they complete
   B. when they could have completed
   C. when they could complete
   D. when could they have completed

4. Between you and I, the new facility is significantly better than the previous location.
   A. Between you and I, the new facility is
   B. Between you and me, the new facility is
   C. Between you and I, the new facilities are
   D. Between you and me, the new facilities are

5. The clinic offers various services including routine care, emergency treatments, and will provide surgical procedures.
   A. routine care, emergency treatments, and will provide surgical procedures
   B. routine care, emergency treatment, and surgical procedure
   C. routinely caring, emergency treatments, and will provide surgical procedures
   D. routine care, emergency treatments, and surgical procedures

6. After reviewing the patient's history the doctor developed a comprehensive treatment plan.
   A. After reviewing the patient's history, the doctor developed
   B. After reviewing, the patient's history the doctor developed
   C. After reviewing the patient's history; the doctor developed
   D. After reviewing the patient's history the doctor, developed

7. The new procedure is more efficient than the traditional approach, it also reduces recovery time.
   A. approach, it also reduces
   B. approach it also reduces
   C. approach; because it also reduces

D. approach, and it also reduces

8. Everyone in the department must complete their annual compliance training by Friday.
    A. must complete his or her annual compliance training
    B. must complete their annual compliance trainings
    C. must completes his or her annual compliance training
    D. must complete its annual compliance training

9. The director recommended that the assistant submits the documentation immediately.
    A. recommended that the assistant submits the documentation
    B. recommended that the assistant submitted the documentation
    C. recommended that the assistant submit the documentation
    D. recommends that the assistant submits the documentation

10. Having examined the data carefully, the conclusion was reached by the research team.
    A. Having examined the data carefully, the research team reached the conclusion
    B. Having examined the data carefully, the conclusion was reached by the research team
    C. The research team's conclusion was reached, having examined the data carefully
    D. The conclusion was reached by the research team, having examined the data carefully

11. Each of the healthcare professionals have completed their continuing education requirements.
    A. have completed their continuing education requirements
    B. have completed his or her continuing education requirements
    C. has completed their continuing education requirements
    D. has completed his or her continuing education requirement

12. The facility is open on weekends, however it closes on major holidays.
    A. weekends, however it closes
    B. weekends however, it closes
    C. weekends; however, it closes
    D. weekends, however, it closes

13. Less patients attended the health fair than expected this year.
    A. Less patients attended
    B. Fewer patients attended
    C. Lesser patients attended
    D. Less patient attended

14. The dentist examined the patient, documented the findings, and was creating a treatment plan.
    A. examined the patient, documented the findings, and created

B. examines the patient, documented the findings, and created
C. examined the patient, documents the findings, and created
D. examined the patient, documented the findings, and was creating

15. Dr. Johnson told Dr. Williams that she needed to review the case before proceeding.
    A. Dr. Johnson told Dr. Williams that she needed
    B. Dr. Johnson told Dr. Williams she needed
    C. Dr. Johnson told Dr. Williams that Williams needed
    D. Dr. Johnson told Dr. Williams that Dr. Johnson needed

16. The new regulation effects all practitioners and will take effect next month.
    A. effects all practitioners and will take effect
    B. effects all practitioners and will take affect
    C. affects all practitioners and will take effect
    D. affects all practitioners and will take affect

17. Maintaining high standards is crucial, all staff must follow established protocols.
    A. crucial, all staff must
    B. crucial. All staff must
    C. crucial; because all staff must
    D. crucial all staff must

18. The hygienist which completed the certification last month provides exceptional patient care.
    A. which completed the certification
    B. which had completed the certification
    C. whom completed the certification
    D. who completed the certification

19. After analyzing the results thoroughly, the findings were presented by the investigator.
    A. After analyzing the results thoroughly, the findings were presented by the investigator
    B. After analyzing the results thoroughly, the investigator's findings were presented
    C. After analyzing the results thoroughly, the investigator presented the findings
    D. The findings were presented by the investigator, after analyzing the results thoroughly

20. The patient should of scheduled the appointment sooner to avoid the delay.
    A. should of scheduled
    B. should had scheduled
    C. should have scheduled
    D. should has scheduled

21. The program includes screenings, consultations, or providing educational materials.
    A. screenings, consultations, or providing educational materials
    B. screenings, consultations, or educational materials
    C. screening, consulting, or providing educational materials
    D. screening, consultation, or educational material

22. Quality healthcare improves outcomes, it enhances patient satisfaction significantly.
    A. outcomes; it enhances
    B. outcomes, it enhances
    C. outcomes it enhances
    D. outcomes; and it enhances

23. Between the three available treatment options, the conservative approach is the more effective choice.
    A. the more effective choice
    B. the more effectively choice
    C. the most effectively choice
    D. the most effective choice

24. The medical office is located at 456 oak street near the medical center in Seattle Washington.
    A. oak street near the medical center in Seattle Washington
    B. Oak street near the medical center in Seattle, Washington
    C. Oak Street near the medical center in Seattle, Washington
    D. oak Street near the Medical Center in 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 doctor asked the patient when can she return for her follow-up examination.
    A. when can she return
    B. when she can return
    C. when she could return
    D. when can she have returned

27. The physician and her staff both agrees that preventive care is most important.
    A. both agrees that
    B. both agree that
    C. both agrees, that

D. both agree, that

28. Comprehensive medical care, regular checkups, and preventive measures is essential for health.
    A. is essential
    B. are essential
    C. is essentially
    D. are essentially

29. Advanced technology improves diagnoses, it also enhances treatment precision.
    A. diagnoses, and it also enhances
    B. diagnoses it also enhances
    C. diagnoses, it also enhances
    D. diagnoses; because it also enhances

30. The hospital provides specialized services such as cardiac care, neurology, and orthopedics.
    A. services, such as cardiac care, neurology, and orthopedics
    B. services such as, cardiac care, neurology, and orthopedics
    C. services, such as cardiac care, neurology, and orthopedics
    D. services, such as cardiac care, neurology, and orthopedics

31. Physicians, nurses, and technicians all plays important roles in patient care.
    A. all plays important roles
    B. all play important role
    C. all play important roles
    D. all plays important role

32. The doctor instructed the patient to lay down on the examination table.
    A. to lay down on the table
    B. to lie down on the table
    C. to lay down in the table
    D. to lie down in the table

33. The research study included participants from various backgrounds it provided comprehensive data.
    A. backgrounds, it provided
    B. backgrounds it provided
    C. backgrounds; because it provided
    D. backgrounds, and it provided

34. Regular medical checkups prevent problems, they help maintain excellent health.
    A. problems. They help

B. problems, they help
C. problems; and they help
D. problems they help

35. The residency program requires participants to complete clinical rotations before graduation.
    A. requires participants to complete clinical rotations, before graduation
    B. require participants to complete clinical rotations before graduation
    C. requires participants to complete clinical rotations before graduation
    D. requires participants to complete clinical rotations before, graduation

36. The hospital offers comprehensive services such as emergency care and intensive care but not outpatient surgery.
    A. services, such as emergency care and intensive care but
    B. services, such as emergency care and intensive care, but
    C. services such as, emergency care and intensive care, but
    D. services such as emergency care and intensive care, but

37. The updated protocol is more effective than the previous method.
    A. more effective than the previous method
    B. more effective than the previous method was
    C. more effectively than the previous method
    D. most effective than the previous method

38. Maintaining optimal health requires eating properly, exercising regularly, and to see the doctor.
    A. eating properly, exercising regularly, and to see the doctor
    B. to eat properly, exercising regularly, and seeing the doctor
    C. eating properly, exercising regularly, and seeing the doctor
    D. to eat properly, to exercise regularly, and to see the doctor

39. The patient mentioned that her symptoms has been present for weeks before calling.
    A. has been present
    B. had been present
    C. will have been present
    D. has lasted

40. Preventive healthcare reduces complications, it also improves long-term outcomes.
    A. complications, and it also improves
    B. complications it also improves
    C. complications, it also improves
    D. complications; because it also improves

Quantitative Reasoning

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: 8x - 13 = 27
   A. 5
   B. 14
   C. 40
   D. 3

2. A clinic treated 150 patients in May and 195 patients in June. What is the percent increase?
   A. 20%
   B. 25%
   C. 30%
   D. 45%

3. If 10y - 9 = 7y + 12, what is the value of y?
   A. 3
   B. 21
   C. 1
   D. 7

4. A nurse earns $52 per hour and works 9 hours per day for 5 days per week. How much does she earn per week?
   A. $468
   B. $2,340
   C. $260
   D. $2,600

5. What is 26% of 425?
   A. 26
   B. 85
   C. 110.5
   D. 42.5

6. If a = 9 and b = -5, what is the value of 4a² - 3b?
   A. 309
   B. 339
   C. 324
   D. 300

7. A medication dosage is 0.8 mg per kilogram of body weight. How many milligrams should be given to a patient weighing 85 kilograms?
   A. 60 mg
   B. 64 mg
   C. 70 mg
   D. 68 mg

8. Solve: 5(x + 8) = 3x + 48
   A. 4
   B. 6
   C. 8
   D. 10

9. A container has 14 red balls, 10 blue balls, and 6 green balls. If one ball is selected at random, what is the probability it is blue?
   A. 1/3
   B. 7/15
   C. 1/3
   D. 2/15

10. Convert 5.6 kilometers to meters.
    A. 56 meters
    B. 5,600 meters
    C. 560 meters
    D. 56,000 meters

11. If x = 9, what is the value of 4x² - 6x?
    A. 270
    B. 324
    C. 216
    D. 288

12. Supplies decreased from $4,200 to $3,150. What is the percent decrease?

A. 20%

B. 30%

C. 1,050%

D. 25%

13. Simplify: 7(4x - 5) - 9(x + 4)

   A. 28x - 71

   B. 37x - 71

   C. 19x - 71

   D. 16x - 1

14. The ratio of doctors to patients is 1:50. If there are 200 patients, how many doctors are there?

   A. 3

   B. 4

   C. 5

   D. 50

15. Solve for x: x/9 + 7 = 14

   A. 21

   B. 126

   C. 18

   D. 63

16. A patient's temperature increased from 98.6°F to 102.2°F. What is the amount of increase?

   A. 3.6°F

   B. 4.0°F

   C. 4.4°F

   D. 102.2°F

17. If 7x - 4y = 37 and x = 11, what is the value of y?

   A. 6

   B. 7

   C. 10

   D. 11

18. A hospital offers a 40% discount on wellness programs. If the original price is $650, what is the discounted price?

   A. $610

   B. $390

   C. $500

D. $260

19. Solve for x: 12x - 10 = 9x + 17
    A. 9
    B. 27
    C. 3
    D. 7

20. What is the mean of the data set: 22, 28, 34, 40, 46?
    A. 28
    B. 32
    C. 40
    D. 34

21. A solution contains 800 mL of liquid. If 42% is active ingredient, how many milliliters of active ingredient does it contain?
    A. 42 mL
    B. 336 mL
    C. 280 mL
    D. 320 mL

22. If $x^2 = 256$, what are the possible values of x?
    A. 256 only
    B. 128 only
    C. 16 and -16
    D. -16 only

23. A hygienist sees 20 patients per day for 6 days per week for 3 weeks. How many patients in total?
    A. 120
    B. 60
    C. 72
    D. 360

24. Simplify: $(8x^7)(5x^4)$
    A. $40x^{11}$
    B. $13x^{11}$
    C. $40x^{28}$
    D. $13x^{28}$

25. What is 11/25 expressed as a percent?

A. 11%

B. 44%

C. 0.44%

D. 25%

26. A patient takes medication every 8 hours. How many doses in 6 days?

    A. 8

    B. 12

    C. 16

    D. 18

27. If the perimeter of a rectangle is 100 cm and the width is 22 cm, what is the length?

    A. 28 cm

    B. 50 cm

    C. 30 cm

    D. 56 cm

28. Solve: 11x - 20 = 10x - 12

    A. 32

    B. -8

    C. -32

    D. 8

29. Equipment costs $1,050 before tax. With 6% sales tax, what is the total cost?

    A. $1,056

    B. $1,113

    C. $1,113

    D. $1,100

30. What is the median of: 16, 20, 24, 28, 32?

    A. 24

    B. 20

    C. 28

    D. 26

31. If 8x - 14 = 26, what is the value of 3x?

    A. 5

    B. 15

    C. 10

    D. 30

32. A bottle holds 3.2 liters. How many milliliters is this?
    A. 32 mL
    B. 320 mL
    C. 32,000 mL
    D. 3,200 mL

33. Evaluate: $(-7)^2 - 5(-4)$
    A. 29
    B. -29
    C. 69
    D. 49

34. A clinic has 50 employees. If 30% are nurses, how many nurses work there?
    A. 10
    B. 15
    C. 20
    D. 25

35. Solve for x: $x/12 = 9$
    A. 108
    B. 21
    C. 12
    D. 3

36. What is 0.625 expressed as a fraction in simplest form?
    A. 625/1000
    B. 25/40
    C. 5/8
    D. 15/24

37. If $x + y = 32$ and $x - y = 14$, what is the value of x?
    A. 9
    B. 18
    C. 14
    D. 23

38. A patient's temperature is 41°C. Using $F = (9/5)C + 32$, what is the temperature in Fahrenheit?
    A. 105.8°F
    B. 106.8°F

C. 104.8°F

D. 107.8°F

39. What is the range of: 22, 28, 34, 40, 46?

   A. 22

   B. 34

   C. 28

   D. 24

40. A clinic treated 150 patients in July and 210 patients in August. What is the ratio of July to August patients in simplest form?

   A. 150:210

   B. 5:7

   C. 10:14

   D. 30:42

Perceptual Ability

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.

1. Four angles are shown. Angle 1 measures 60°, Angle 2 measures 122°, Angle 3 measures 84°, and Angle 4 measures 143°. Which is the largest angle?

  A. Angle 1

  B. Angle 2

  C. Angle 3

  D. Angle 4

2. Three angles are presented. Angle A = 41°, Angle B = 132°, Angle C = 98°. Which angle is obtuse and greater than 130°?

  A. Angle A

  B. Angle B

  C. Angle C

D. All acute

3. Five angles measure 32°, 99°, 63°, 151°, and 90°. Which is the smallest angle?
   A. 32°
   B. 63°
   C. 90°
   D. 99°

4. Four angles are displayed: 47°, 112°, 75°, and 139°. Which is the second largest angle?
   A. 47°
   B. 75°
   C. 112°
   D. 139°

5. Three angles measure 84°, 130°, and 50°. What is the correct order from largest to smallest?
   A. 84°, 50°, 130°
   B. 130°, 50°, 84°
   C. 50°, 84°, 130°
   D. 130°, 84°, 50°

6. Five angles are shown: 39°, 107°, 78°, 155°, and 64°. Which angle is acute and closest to 75°?
   A. 39°
   B. 78°
   C. 64°
   D. 107°

7. Four angles measure 25°, 103°, 56°, and 170°. Which is the third largest angle?
   A. 25°
   B. 56°
   C. 103°
   D. 170°

8. Three angles are presented: 41°, 97°, and 162°. Which angle is acute and smallest?
   A. 41°
   B. 97°
   C. 162°
   D. All obtuse

9. Five angles measure 48°, 111°, 74°, 144°, and 57°. Which is the largest?
   A. 48°

B. 57°
C. 111°
D. 144°

10. Four angles are shown: 72°, 135°, 37°, and 98°. Which is the second smallest angle?
   A. 37°
   B. 72°
   C. 98°
   D. 135°

11. Three acute angles measure 46°, 79°, and 67°. Which is the smallest?
   A. 46°
   B. 67°
   C. 79°
   D. All equal

12. Five angles measure 122°, 93°, 58°, 173°, and 81°. Which is the third smallest?
   A. 58°
   B. 81°
   C. 93°
   D. 122°

13. Four angles are displayed: 29°, 108°, 80°, and 149°. Which is the largest angle?
   A. 29°
   B. 80°
   C. 108°
   D. 149°

14. Three angles measure 125°, 52°, and 92°. Which is obtuse and less than 100°?
   A. 52°
   B. 92°
   C. 125°
   D. None

15. Five angles are shown: 44°, 113°, 70°, 157°, and 88°. Which lists the two largest in order?
   A. 44°, 70°
   B. 88°, 113°
   C. 157°, 113°
   D. 113°, 88°

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 9 cm × 13 cm × 15 cm. Which aperture allows the largest face to pass through?
   A. A rectangle 13 cm × 15 cm
   B. A circle 13 cm diameter
   C. A square 13 cm × 13 cm
   D. A triangle 15 cm base

17. A cylinder with diameter 13 cm and height 19 cm is shown. When entering circular end first, what aperture is needed?
   A. A rectangle 13 cm × 19 cm
   B. A square 19 cm × 19 cm
   C. A triangle 13 cm sides
   D. A circle with at least 13 cm diameter

18. A pyramid with square base 13 cm × 13 cm is presented. Which aperture accommodates the base?
   A. A circle 13 cm diameter
   B. A square 13 cm × 13 cm or larger
   C. A triangle 13 cm sides
   D. A rectangle 10 cm × 13 cm

19. A cube measuring 12 cm per side is shown. What is the smallest square aperture needed?
   A. 12 cm × 12 cm
   B. 10 cm × 10 cm
   C. 14 cm × 14 cm
   D. 24 cm × 24 cm

20. A triangular prism has base 11 cm per side and length 17 cm. Which aperture allows triangle-first passage?
   A. A square 11 cm × 11 cm
   B. A circle 17 cm diameter
   C. An equilateral triangle 11 cm sides
   D. A rectangle 11 cm × 17 cm

21. An L-shaped object measures 11 cm wide and 14 cm tall overall. Which aperture accommodates it?
   A. A rectangle 11 cm × 14 cm or larger

B. A square 11 cm × 11 cm
C. A circle 12 cm diameter
D. A triangle 14 cm base

22. A sphere with diameter 16 cm is presented. What aperture is required?
   A. A square 14 cm × 14 cm
   B. A rectangle 15 cm × 17 cm
   C. A triangle 16 cm sides
   D. A circle with at least 16 cm diameter

23. A rectangular block 11 cm × 13 cm × 9 cm is shown. When oriented with 11 cm × 13 cm face forward, what aperture?
   A. A circle 13 cm diameter
   B. A rectangle 11 cm × 13 cm
   C. A square 13 cm × 13 cm
   D. A rectangle 9 cm × 11 cm

24. A hexagonal prism with 11 cm wide base and 18 cm length is displayed. Which aperture for hexagon-first entry?
   A. A hexagon approximately 11 cm across
   B. A circle 10 cm diameter
   C. A rectangle 11 cm × 18 cm
   D. A square 11 cm × 11 cm

25. A T-shaped object measures 15 cm wide and 17 cm tall. What minimum aperture?
   A. A rectangle 13 cm × 15 cm
   B. A square 15 cm × 15 cm
   C. A rectangle 15 cm × 17 cm
   D. A circle 17 cm diameter

26. An ellipsoid measures 12 cm × 15 cm × 10 cm. When oriented with 12 cm × 15 cm face forward, which aperture?
   A. A circle 15 cm diameter
   B. A square 15 cm × 15 cm
   C. A rectangle 10 cm × 12 cm
   D. An ellipse or rectangle 12 cm × 15 cm

27. A cross-shaped object has arms extending 13 cm in each direction. What aperture for face-first passage?
   A. A square 11 cm × 11 cm

B. A square 13 cm × 13 cm or larger
C. A circle 13 cm diameter
D. A triangle 13 cm sides

28. A cone with base diameter 15 cm is shown. Which aperture fits the base?
   A. A square 13 cm × 13 cm
   B. A rectangle 12 cm × 15 cm
   C. A circle with at least 15 cm diameter
   D. A triangle 15 cm sides

29. A rectangular block with rounded ends measures 11 cm × 13 cm × 17 cm with 2 cm radius curves. Which aperture for curved end?
   A. A rectangle 10 cm × 12 cm
   B. A circle 13 cm diameter
   C. A square 13 cm × 13 cm
   D. A rounded rectangle approximately 11 cm × 13 cm

30. An irregular object with dimensions 12 cm × 14 cm × 10 cm is shown. When oriented with smallest face forward, which aperture?
   A. A rectangle 12 cm × 10 cm
   B. A circle 12 cm diameter
   C. A rectangle 14 cm × 10 cm
   D. A square 12 cm × 12 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. Top view shows circle, front view shows circle, end view shows rectangle. What is the object?
   A. A cube
   B. A pyramid
   C. A cylinder oriented horizontally
   D. A sphere

32. Top view shows square, front view shows triangle, end view shows square. What is the object?
   A. A cube
   B. A square pyramid oriented on its base
   C. A rectangular prism
   D. A cone

33. A stepped object has six levels. Which view shows all six levels most clearly?
   A. Top view only
   B. Front view only
   C. End view only
   D. All three equally

34. Top view is heptagon, front view is heptagon, end view is rectangle. What is the object?
   A. A heptagonal pyramid
   B. A cube
   C. A heptagonal prism oriented on its end
   D. Seven prisms

35. Top view shows rectangle, front view shows two circles, end view shows rectangle. What is the object?
   A. A cube
   B. A pyramid
   C. A rectangular prism
   D. Two cylinders side by side

36. Top view shows rectangle with two lines, front view shows three rectangles, end view shows rectangle with two lines. What does this represent?
   A. A solid cube
   B. A pyramid
   C. One prism
   D. Three rectangular prisms with dividing features

37. Top view shows W-shape, front view shows rectangle, end view shows W-shape. What is the object?
   A. A W-shaped prism
   B. A W-shaped pyramid
   C. Multiple rectangular prisms
   D. A T-shape

38. Top view shows pentagon with diagonal, front view shows two triangles, end view shows pentagon with diagonal. What is the object?
   A. A cube
   B. A sphere
   C. Two pentagonal sections with a dividing feature
   D. A cylinder

39. Top view shows N-shape, front view shows rectangle, end view shows N-shape. What is the object?

A. An N-shaped pyramid
B. An N-shaped prism
C. Three separate cubes
D. A T-shaped beam

40. Top view shows seven squares in row, front view shows long rectangle, end view shows square. What is the object?
   A. Seven cubes in a row
   B. A pyramid
   C. An L-structure
   D. One long prism

41. Top view shows undecagon (11 sides), front view shows rectangle, end view shows undecagon. What is the object?
   A. An undecagonal pyramid
   B. Eleven rectangular prisms
   C. A cube
   D. An undecagonal prism

42. Top view shows circle with cross, front view shows four rectangles, end view shows circle with cross. What is the object?
   A. A sphere
   B. A cone
   C. Four cylindrical sections forming a circle with cross divisions
   D. A cube

43. Top view shows octagon, front view shows rectangle, end view shows octagon. What is the object?
   A. An octagonal prism
   B. An octagonal pyramid
   C. Eight prisms
   D. A cube

44. Top view shows five circles in pentagon pattern, front view shows five rectangles, end view shows circle. What is the object?
   A. Five spheres
   B. Five cylinders arranged in pentagon pattern
   C. A pyramid
   D. Five cones

45. Top view shows Y-shape, front view shows rectangle, end view shows Y-shape. What is the object?

A. A Y-shaped pyramid
B. A T-shaped beam
C. Three separate cubes
D. A Y-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 6 layers arranged 4 × 4 × 6. How many total cubes?
   A. 96
   B. 16
   C. 24
   D. 64

47. In a 7 × 7 × 7 cube, how many cubes are on the surface (have at least one face exposed)?
   A. 343
   B. 125
   C. 218
   D. 250

48. A 4 × 6 × 8 structure is built. How many total cubes?
   A. 18
   B. 192
   C. 48
   D. 96

49. In a 10 × 10 × 10 cube where all faces are painted, how many cubes have exactly three painted faces?
   A. 100
   B. 64
   C. 12
   D. 8

50. A structure has 9 layers with 8 cubes per layer arranged 2 × 4. How many total cubes?
   A. 32
   B. 56
   C. 72
   D. 64

51. In a 4 × 7 × 8 structure, how many cubes are on corners?
  A. 8
  B. 12
  C. 24
  D. 6

52. A structure is 10 cubes high, 9 cubes wide, 8 cubes deep. How many total cubes?
  A. 27
  B. 450
  C. 630
  D. 720

53. In an L-shaped structure with 12 cubes on one arm and 11 on the other (sharing 1 corner), how many total cubes?
  A. 23
  B. 22
  C. 12
  D. 21

54. A 10 × 10 × 1 flat structure has all faces painted. How many cubes have exactly two painted faces?
  A. 4
  B. 40
  C. 36
  D. 100

55. A staircase has 7 cubes on first step, 9 on second, 11 on third. How many total cubes?
  A. 27
  B. 21
  C. 18
  D. 33

56. A 9 × 10 × 11 structure is built. How many cubes are on corners?
  A. 8
  B. 12
  C. 6
  D. 24

57. In a 12 × 1 × 1 structure (12 cubes in row), if all surfaces painted, how many cubes have exactly four painted faces?
  A. 2

B. 10

C. 12

D. 8

58. A pyramid has layers: bottom $9 \times 9 = 81$ cubes, next $7 \times 7 = 49$ cubes, next $5 \times 5 = 25$ cubes, next $3 \times 3 = 9$ cubes, top 1 cube. How many total?

A. 81

B. 155

C. 125

D. 165

59. In a $9 \times 9 \times 9$ cube with five corner cubes removed, how many cubes remain?

A. 724

B. 729

C. 723

D. 720

60. A plus-shaped structure uses 10 cubes for vertical arm and 10 for horizontal (sharing 1 center). How many total?

A. 20

B. 18

C. 19

D. 17

Biology

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 nucleus?
   A. Energy production
   B. DNA storage and genetic control
   C. Protein synthesis
   D. Waste digestion

2. Which organelle modifies and packages proteins for secretion?
   A. Golgi apparatus
   B. Ribosome

C. Lysosome
D. Mitochondrion

3. During which phase of mitosis do chromosomes line up at the cell's equator?
   A. Prophase
   B. Metaphase
   C. Anaphase
   D. Telophase

4. What is the process by which water moves across a membrane?
   A. Active transport
   B. Endocytosis
   C. Osmosis
   D. Phagocytosis

5. What is the primary function of messenger RNA (mRNA)?
   A. Carries genetic instructions from DNA to ribosomes
   B. Stores genetic information permanently
   C. Forms ribosomal structure
   D. Brings amino acids to ribosomes

6. How many chromosomes are in human gametes?
   A. 46
   B. 92
   C. 22
   D. 23

7. In DNA, guanine pairs with which base?
   A. Adenine
   B. Thymine
   C. Cytosine
   D. Uracil

8. What is codominance?
   A. Complete dominance of one allele
   B. Both alleles fully expressed in heterozygotes
   C. Only one allele present
   D. Recessive traits only

9. During which phase does crossing over occur?

A. Prophase I
B. Metaphase II
C. Anaphase I
D. Telophase II

10. Which blood component fights infections?
    A. Red blood cells
    B. Platelets
    C. Plasma
    D. White blood cells

11. What is the primary function of the small intestine?
    A. Water storage
    B. Bile production
    C. Nutrient absorption
    D. Food storage

12. Which tissue type transmits electrical signals?
    A. Epithelial tissue
    B. Nervous tissue
    C. Connective tissue
    D. Muscle tissue

13. In a cross between Aa and Aa, what percentage will be heterozygous?
    A. 25%
    B. 75%
    C. 100%
    D. 50%

14. Which process produces gametes?
    A. Meiosis
    B. Mitosis
    C. Binary fission
    D. Budding

15. What is the primary role of ribosomal RNA (rRNA)?
    A. Carries genetic code
    B. Brings amino acids
    C. Forms ribosome structure
    D. Stores DNA

16. Which blood component is responsible for oxygen transport?
    A. White blood cells
    B. Red blood cells
    C. Platelets
    D. Plasma

17. What type of muscle is voluntary and attached to bones?
    A. Skeletal muscle
    B. Smooth muscle
    C. Cardiac muscle
    D. Involuntary muscle

18. What is the end product of transcription?
    A. DNA
    B. Protein
    C. tRNA
    D. mRNA

19. Which organelle contains enzymes for breaking down cellular waste?
    A. Ribosome
    B. Mitochondrion
    C. Lysosome
    D. Nucleus

20. What do osteoclasts do?
    A. Build new bone
    B. Break down bone tissue
    C. Store minerals
    D. Produce blood cells

21. What distinguishes eukaryotic cells?
    A. Lack of ribosomes
    B. Lack of cytoplasm
    C. Presence of cell wall
    D. Presence of membrane-bound nucleus

22. What are the reactants of cellular respiration?
    A. Glucose and oxygen
    B. Carbon dioxide and water

C. Only ATP
D. Only water

23. Which system uses hormones for regulation?
    A. Nervous system
    B. Endocrine system
    C. Digestive system
    D. Respiratory system

24. If DNA is TACG, what is the mRNA sequence?
    A. TACG
    B. ATGC
    C. AUGC
    D. UACG

25. Which vessels return blood to the heart?
    A. Arteries
    B. Capillaries
    C. Arterioles
    D. Veins

26. What is the function of the rough endoplasmic reticulum?
    A. Lipid synthesis
    B. ATP production
    C. DNA replication
    D. Protein synthesis

27. What describes the physical expression of genes?
    A. Genotype
    B. Phenotype
    C. Allele
    D. Chromosome

28. During which phase does DNA replication occur?
    A. G1 phase
    B. G2 phase
    C. S phase
    D. M phase

29. What are the main organs of the respiratory system?

A. Lungs and airways
B. Heart and blood vessels
C. Stomach and intestines
D. Kidneys and bladder

30. What distinguishes prokaryotic cells from eukaryotic cells?
    A. Presence of ribosomes
    B. Presence of cytoplasm
    C. Ability to reproduce
    D. Lack of membrane-bound organelles

General Chemistry

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 atomic number?
   A. Number of protons in the nucleus
   B. Number of neutrons only
   C. Number of electrons in outer shell
   D. Sum of protons and electrons

2. Which subatomic particle has a positive charge?
   A. Electron
   B. Proton
   C. Neutron
   D. Ion

3. What type of bond involves sharing electrons?
   A. Ionic bond
   B. Metallic bond
   C. Covalent 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 produced when an acid neutralizes a base?
   A. Only hydrogen
   B. Only oxygen
   C. Only carbon dioxide
   D. Salt and water

6. What is the molar mass of water (H_2O)? (H = 1 g/mol, O = 16 g/mol)
   A. 17 g/mol
   B. 18 g/mol
   C. 16 g/mol
   D. 20 g/mol

7. Which pH indicates a basic solution?
   A. 2
   B. 7
   C. 10
   D. 5

8. In the equation $2H_2 + O_2 \rightarrow 2H_2O$, what is the coefficient of H_2O?
   A. 1
   B. 3
   C. 4
   D. 2

9. Atoms with the same protons but different neutrons are:
   A. Isotopes
   B. Ions
   C. Molecules
   D. Compounds

10. According to Boyle's Law, if volume decreases at constant temperature, pressure:
    A. Stays constant
    B. Becomes zero
    C. Increases
    D. Decreases

11. What forms when atoms share electrons?
    A. Ionic bond
    B. Covalent bond
    C. Metallic bond
    D. No bond

12. How many moles are in 48 grams of oxygen (O_2)? (Molar mass = 32 g/mol)
    A. 1.5 moles
    B. 32 moles
    C. 48 moles
    D. 16 moles

13. What is the SI unit for amount of substance?
    A. Grams
    B. Liters
    C. Atoms
    D. Moles

14. Which characteristic describes bases?
    A. Taste sour
    B. Feel slippery and taste bitter
    C. Turn litmus red
    D. Have pH less than 7

15. Which state of matter has definite volume but not definite shape?
    A. Solid
    B. Gas
    C. Liquid
    D. Plasma

16. What happens during ionic bonding?
    A. Electrons are transferred forming ions
    B. Electrons are shared equally
    C. Atoms remain neutral
    D. No electron movement

17. How many nitrogen atoms are in $3Al(NO_3)_3$?
    A. 3
    B. 6
    C. 27

D. 9

18. What is the pH of a neutral solution?
    A. 0
    B. 14
    C. 7
    D. 1

19. Which group contains the alkaline earth metals?
    A. Group 1
    B. Group 2
    C. Group 17
    D. Group 18

20. What type of reaction is A + B → AB?
    A. Synthesis
    B. Decomposition
    C. Single replacement
    D. Double replacement

21. How many times more acidic is pH 2 compared to pH 5?
    A. 3 times
    B. 10 times
    C. 100 times
    D. 1000 times

22. What is the charge of a neutron?
    A. Positive
    B. Negative
    C. Neutral
    D. Variable

23. How many valence electrons does an element in Group 17 have?
    A. 1
    B. 7
    C. 2
    D. 8

24. What states that atoms are rearranged but not created or destroyed in reactions?
    A. Boyle's Law

B. Charles's Law

C. Dalton's Law

D. Law of Conservation of Mass

25. A 6 M solution is diluted from 25 mL to 150 mL. What is the new concentration?

A. 1 M

B. 2 M

C. 3 M

D. 6 M

26. What do bases produce in water?

A. H^+ ions

B. Na^+ ions

C. OH^- ions

D. Cl^- ions

27. What is Avogadro's number?

A. 1.66×10^{24}

B. 3.14×10^{23}

C. 1.00×10^{23}

D. 6.022×10^{23}

28. According to Charles's Law, what happens when temperature increases at constant pressure?

A. Volume decreases

B. Volume increases

C. Volume stays constant

D. Pressure changes

29. A neutral oxygen atom (atomic number = 8) has how many electrons?

A. 6

B. 10

C. 8

D. 16

30. What happens to pressure when volume increases at constant temperature?

A. Pressure decreases

B. Pressure increases

C. Pressure stays constant

D. Temperature changes

Answer Explanations - Practice Test 8

Reading Comprehension

1. Correct Answer: C (Transporting oxygen, nutrients, hormones, and waste products)

The passage states that the cardiovascular system works together "to transport oxygen, nutrients, hormones, and waste products throughout the body." All four transport functions are listed together in the opening sentence.

2. Correct Answer: A (The heart's natural pacemaker)

The passage explicitly states that "the sinoatrial (SA) node, located in the right atrium, serves as the heart's natural pacemaker, generating electrical impulses that spread through the atria."

3. Correct Answer: D (Prevent backflow of blood)

The passage states that "heart valves prevent backflow—the tricuspid and mitral valves separate atria from ventricles, while the pulmonary and aortic valves control blood exiting the heart." Prevention of backflow is the primary function described.

4. Correct Answer: B (Diffusion)

The passage states that "capillaries, with walls only one cell thick, enable exchange of oxygen, nutrients, and waste between blood and tissues through diffusion." Diffusion is specifically named as the mechanism.

5. Correct Answer: C (Systolic pressure during contraction and diastolic pressure during relaxation)

The passage states that "blood pressure, the force blood exerts on vessel walls, is measured as systolic pressure during ventricular contraction and diastolic pressure during ventricular relaxation." Both measurements are described.

6. Correct Answer: A (Heart attack, stroke, and kidney disease)

The passage states that hypertension "damages blood vessels and increases heart workload, raising risks for heart attack, stroke, kidney disease, and other complications." These three conditions are specifically listed.

7. Correct Answer: D (Skeletal muscle contraction, respiratory movements, and venous valves)

The passage states that "venous return depends on skeletal muscle contraction, respiratory movements, and venous valves working together." All three factors are mentioned.

8. Correct Answer: C (Dental procedures can stress the cardiovascular system)

The passage states that "understanding cardiovascular function is critical because dental procedures can stress the cardiovascular system, certain medications affect blood pressure and clotting, patients with cardiovascular disease require modified treatment approaches." The stress on the cardiovascular system is the first reason mentioned.

9. Correct Answer: B (Drug composition, mechanisms, therapeutic uses, and adverse effects)

The passage states that "pharmacology, the study of drugs and their effects on living systems, encompasses drug composition, mechanisms of action, therapeutic uses, and adverse effects." All four components are listed.

10. Correct Answer: D (Absorption, distribution, metabolism, and excretion)

The passage states that "pharmacokinetics involves four processes: absorption, distribution, metabolism, and excretion, commonly abbreviated as ADME." All four processes are explicitly named.

11. Correct Answer: A (Survive stomach acid and first-pass metabolism)

The passage states that "oral medications must survive stomach acid and first-pass metabolism in the liver before reaching systemic circulation." Both challenges are mentioned for oral medications.

12. Correct Answer: C (Bind and activate receptors)

The passage states that "agonists bind receptors and activate them, mimicking natural substances and producing effects." Both binding and activation are described.

13. Correct Answer: B (The ratio between toxic dose and effective dose)

The passage states that "therapeutic index, the ratio between toxic dose and effective dose, indicates drug safety." This is the definition provided.

14. Correct Answer: D (A life-threatening allergic reaction)

The passage states that "allergic reactions involve immune system responses ranging from mild rashes to life-threatening anaphylaxis requiring immediate treatment." Anaphylaxis is described as life-threatening.

15. Correct Answer: A (One drug enhances another's effects)

The passage states that "drug interactions occur when one drug affects another's action, either enhancing effects (synergism) or reducing effectiveness (antagonism)." Synergism is defined as enhancing effects.

16. Correct Answer: C (Many patients take medications affecting dental treatment)

The passage states that "for dental professionals, pharmacological knowledge is essential because many patients take medications affecting dental treatment, dental procedures may require medication administration or adjustment." The first reason given is that many patients take medications affecting treatment.

17. Correct Answer: D (Regulating fluid balance, electrolytes, acid-base balance, and blood pressure)

The passage states that the renal system "maintains homeostasis by regulating fluid balance, electrolyte concentrations, acid-base balance, and blood pressure while eliminating metabolic waste products." All four regulatory functions are listed.

18. Correct Answer: A (The kidney's functional unit)

The passage states that "the nephron, the kidney's functional unit, contains approximately one million per kidney, each capable of forming urine." The nephron is explicitly identified as the functional unit.

19. Correct Answer: D (Forces water and solutes from blood into Bowman's capsule)

The passage states that "glomerular filtration forces water and small solutes from blood into Bowman's capsule, beginning urine formation." This describes the specific action of glomerular filtration.

20. Correct Answer: B (Increases water reabsorption to conserve body water)

The passage states that "antidiuretic hormone (ADH), released from the pituitary gland in response to dehydration or increased blood osmolarity, increases water reabsorption in collecting ducts, concentrating urine and conserving body water." Increasing water reabsorption is the primary function.

21. Correct Answer: C (Responds to decreased blood pressure by raising it)

The passage states that "the renin-angiotensin-aldosterone system (RAAS) responds to decreased blood pressure or blood flow by releasing renin, which ultimately produces angiotensin II (a potent vasoconstrictor) and triggers aldosterone release, raising blood pressure." The system responds to low blood pressure by raising it.

22. Correct Answer: D (Diabetes or hypertension)

The passage states that "chronic kidney disease (CKD) develops gradually, often from diabetes or hypertension, progressively reducing kidney function." Both diabetes and hypertension are specifically named as common causes.

23. Correct Answer: A (Altered medication metabolism requiring dose adjustments)

The passage states that "kidney disease patients may have altered medication metabolism requiring dose adjustments, increased bleeding risk from platelet dysfunction, hypertension requiring monitoring." Altered medication metabolism is the first effect mentioned.

24. Correct Answer: C (Use fluoride cautiously in severe kidney disease)

The passage states that "fluoride-containing products should be used cautiously in severe kidney disease, and some dental medications require dose modification or avoidance in renal impairment." Cautious fluoride use is specifically mentioned.

25. Correct Answer: B (Operates more slowly but produces longer-lasting effects)

The passage states that "unlike the nervous system's rapid electrical signals, hormonal regulation operates more slowly but produces longer-lasting effects on target tissues." This comparison is made explicitly.

26. Correct Answer: A (Produces releasing and inhibiting hormones)

The passage states that "the hypothalamus produces releasing and inhibiting hormones controlling anterior pituitary secretions." This is the specific function described.

27. Correct Answer: B (Excess growth hormone in adults)

The passage states that "growth hormone (GH), also from the anterior pituitary, promotes tissue growth throughout life, with excess causing acromegaly in adults." Acromegaly results from excess growth hormone specifically in adults.

28. Correct Answer: C (Increased metabolic rate and nervousness)

The passage states that "hyperthyroidism results from excess thyroid hormone, causing increased metabolic rate, nervousness, weight loss despite increased appetite, heat intolerance, rapid heartbeat, and tremors." Increased metabolic rate and nervousness are the first symptoms listed.

29. Correct Answer: A (Results from autoimmune destruction of beta cells)

The passage states that "Type 1 diabetes results from autoimmune destruction of insulin-producing pancreatic beta cells, requiring lifelong insulin therapy." This is the specific cause of Type 1 diabetes.

30. Correct Answer: D (Acute and chronic complications affecting multiple organs)

The passage states that "uncontrolled diabetes causes acute complications including hypoglycemia (dangerously low blood glucose) and hyperglycemia (elevated blood glucose potentially leading to diabetic ketoacidosis), along with chronic complications affecting eyes, kidneys, nerves, and blood vessels." Both acute and chronic complications affecting multiple organs are described.

31. Correct Answer: B (Influence each other bidirectionally)

The passage states that "diabetic patients require careful glucose monitoring, appointment timing to prevent hypoglycemia, and understanding that periodontal disease and diabetes influence each other bidirectionally." The bidirectional influence is explicitly stated.

32. Correct Answer: A (Have suppressed adrenal function requiring stress dose adjustments)

The passage states that "patients taking corticosteroids for various conditions may have suppressed adrenal function requiring stress dose adjustments before extensive dental procedures." This is the specific concern mentioned.

33. Correct Answer: D (Immediate, nonspecific defense)

The passage states that "innate immunity provides immediate, nonspecific defense through physical barriers, chemical defenses, and cellular responses." Both immediate and nonspecific characteristics are described.

34. Correct Answer: C (Are phagocytes that destroy bacteria and fungi)

The passage states that "neutrophils, the most abundant white blood cells, are phagocytes that engulf and destroy bacteria and fungi, forming the first cellular response to infection." Both their phagocytic nature and targets are described.

35. Correct Answer: B (Antibodies)

The passage states that "B lymphocytes produce antibodies (immunoglobulins) that bind specific antigens, marking pathogens for destruction, neutralizing toxins, and preventing pathogen attachment to cells." Antibody production is the primary function of B cells.

36. Correct Answer: D (Long-term immunity)

The passage states that "each B cell produces antibodies recognizing one specific antigen; upon encountering its antigen, the B cell proliferates, producing plasma cells secreting large antibody quantities and memory B cells providing long-term immunity." Memory B cells specifically provide long-term immunity.

37. Correct Answer: A (Directly kill virus-infected and cancerous cells)

The passage states that "T lymphocytes include helper T cells activating other immune cells through cytokine secretion and cytotoxic T cells directly killing virus-infected and cancerous cells by inducing apoptosis." Direct killing is the function of cytotoxic T cells.

38. Correct Answer: A (Is life-threatening and requires immediate epinephrine)

The passage states that "allergies involve excessive immune responses to harmless substances, ranging from mild hay fever to life-threatening anaphylaxis requiring immediate epinephrine administration." Both the life-threatening nature and epinephrine requirement are mentioned.

39. Correct Answer: C (Causes severe dry mouth)

The passage states that "autoimmune diseases occur when the immune system attacks the body's own tissues, including conditions like rheumatoid arthritis, lupus, and Sjögren's syndrome (causing severe dry mouth relevant to dental care)." Severe dry mouth is the specific oral manifestation mentioned.

40. Correct Answer: D (Modified treatment approaches and antibiotic prophylaxis consideration)

The passage states that "immunosuppressed patients, including organ transplant recipients and cancer patients undergoing chemotherapy, require modified dental treatment approaches, antibiotic prophylaxis consideration, and careful infection control." Both modified approaches and antibiotic prophylaxis consideration are mentioned.

Language Usage

1. Correct Answer: D (equipment, and it also trained)

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.

2. Correct Answer: B (nor the assistants were available)

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

3. Correct Answer: C (when they could complete)

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 they." Option C correctly uses "when they could complete."

4. Correct Answer: B (Between you and me, the new facility is)

After the preposition "between," pronouns must be in the objective case. "Between" requires "me" (objective case), not "I" (subjective case). Additionally, "facility" (singular) requires the singular verb "is." Option B correctly uses both the objective case and singular verb.

5. Correct Answer: D (routine care, emergency treatments, and surgical procedures)

The sentence requires parallel structure. The original uses two nouns and then a verb phrase ("will provide surgical procedures"), which is not parallel. Option D maintains parallel structure by using three nouns: "routine care, emergency treatments, and surgical procedures."

6. Correct Answer: A (After reviewing the patient's history, the doctor developed)

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

7. Correct Answer: D (approach, and it also reduces)

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.

8. Correct Answer: A (must complete his or her annual compliance 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." Option A uses the correct singular forms.

9. Correct Answer: C (recommended that the assistant submit the documentation)

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

10. Correct Answer: A (Having examined the data carefully, the research team reached the conclusion)

The original sentence contains a dangling modifier. "Having examined the data carefully" must modify a subject that can logically examine—the research team, not the conclusion. Option A correctly places "the research team" as the subject being modified.

11. Correct Answer: D (has completed his or her continuing education requirement)

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

12. Correct Answer: C (weekends; however, it closes)

"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 C uses the correct punctuation.

13. Correct Answer: B (Fewer patients attended)

"Less" is used with uncountable nouns, while "fewer" is used with countable nouns. "Patients" is countable, so "fewer" is correct. Option B properly uses "fewer patients."

14. Correct Answer: A (examined the patient, documented the findings, and created)

The original sentence lacks parallel structure. The first two verbs are in simple past tense ("examined," "documented"), but the third uses past progressive ("was creating"). Option A maintains parallel structure by using three simple past tense verbs.

15. Correct Answer: D (Dr. Johnson told Dr. Williams that Dr. Johnson needed)

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

16. Correct Answer: C (affects all practitioners 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 "affect" to indicate that the regulation influences practitioners, followed by "take effect."

17. Correct Answer: B (crucial. All staff must)

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

18. Correct Answer: D (who completed the certification)

"Which" is used for things; "who" is used for people. Since "the hygienist" is a person, the correct relative pronoun is "who," not "which." Option D makes this correction.

19. Correct Answer: C (After analyzing the results thoroughly, the investigator presented the findings)

The original sentence contains a dangling modifier. The phrase "After analyzing the results thoroughly" must modify "the investigator" (who did the analyzing), not "the findings." Option C correctly places "the investigator" immediately after the modifying phrase.

20. Correct Answer: C (should have scheduled)

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

21. Correct Answer: B (screenings, consultations, or educational materials)

The original sentence lacks parallel structure with a gerund phrase at the end. Option B maintains parallel structure by using three noun forms: "screenings, consultations, or educational materials." All three are in parallel grammatical form.

22. Correct Answer: A (outcomes; it enhances)

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

23. Correct Answer: D (the most effective choice)

When comparing more than two items (three treatment options), use the superlative form ("most effective"), not the comparative form ("more effective"). Option D properly uses the superlative.

24. Correct Answer: C (Oak Street near the medical center in 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 C correctly capitalizes the street name and adds the necessary comma between city and state.

25. Correct Answer: B (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 B correctly includes the necessary comma after the introductory clause.

26. Correct Answer: C (when she could return)

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 C uses correct word order and appropriate tense.

27. Correct Answer: B (both agree that)

The compound subject "the physician and her staff" is plural (two entities), so the verb must be "agree" (plural), not "agrees" (singular). Option B correctly uses the plural verb form.

28. Correct Answer: B (are essential)

The compound subject consists of three items ("care," "checkups," and "measures") 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: A (diagnoses, and it also enhances)

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

30. Correct Answer: D (services, such as cardiac care, neurology, and orthopedics)

When "such as" introduces examples that are nonrestrictive (supplementary information), a comma is placed before "such as." Since the examples come at the end of the sentence, no closing comma is needed after the list. Option D correctly uses the comma before "such as" with no comma after "as."

31. Correct Answer: C (all play important roles)

The compound subject "physicians, nurses, and technicians" is plural, so the verb must be "play" (plural), not "plays" (singular). Additionally, "roles" (plural) is correct since multiple people play multiple roles. Option C uses correct subject-verb agreement.

32. Correct Answer: B (to lie down on the table)

"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. Option B correctly uses "lie down on the table."

33. Correct Answer: D (backgrounds, and it provided)

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.

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

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: C (requires participants to complete clinical rotations 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). Option C maintains the correct structure.

36. Correct Answer: B (services, such as emergency care and intensive care, but)

The phrase "such as emergency care and intensive care" is a nonrestrictive element providing examples, so it should be set off with commas on both sides. Option B correctly places commas before "such as" and after "care," with "but" properly positioned.

37. Correct Answer: A (more effective than the previous method)

The sentence correctly uses the comparative form "more effective" when comparing two items (the updated protocol and the previous method). The comparison is clear and grammatically correct as written. "Effective" is an adjective modifying "protocol," so the adverb form "effectively" would be incorrect. Option A maintains the proper comparative structure.

38. Correct Answer: C (eating properly, exercising regularly, and seeing the doctor)

The original sentence lacks parallel structure with an infinitive phrase at the end. Option C maintains parallel structure by using three gerunds: "eating, exercising, and seeing." All three verb forms are consistent.

39. Correct Answer: B (had been present)

The past perfect tense "had been present" is correct because the symptoms 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: A (complications, and it also improves)

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

Quantitative Reasoning

1. Correct Answer: A (5)

To solve 8x - 13 = 27, first add 13 to both sides: 8x = 40. Then divide both sides by 8: x = 5. Verification: 8(5) - 13 = 40 - 13 = 27 ✓

2. Correct Answer: C (30%)

Percent increase formula: (New - Old)/Old × 100. Calculate: (195 - 150)/150 × 100 = 45/150 × 100 = 0.30 × 100 = 30%. Patient visits increased by 30%.

3. Correct Answer: D (7)

To solve 10y - 9 = 7y + 12, subtract 7y from both sides: 3y - 9 = 12. Add 9 to both sides: 3y = 21. Divide by 3: y = 7. Verification: 10(7) - 9 = 70 - 9 = 61, and 7(7) + 12 = 49 + 12 = 61 ✓

4. Correct Answer: B ($2,340)

Calculate weekly earnings: $52/hour × 9 hours/day × 5 days/week = $2,340 per week. Break it down: Daily earnings = $52 × 9 = $468; Weekly earnings = $468 × 5 = $2,340.

5. Correct Answer: C (110.5)

To find 26% of 425, multiply: 0.26 × 425 = 110.5. Alternatively, 26% is the same as 26/100, so (26/100) × 425 = 11,050/100 = 110.5.

6. Correct Answer: B (339)

Substitute a = 9 and b = -5 into $4a^2$ - 3b. Calculate: $4(9)^2$ - 3(-5) = 4(81) - (-15) = 324 + 15 = 339.

7. Correct Answer: D (68 mg)

Multiply the dosage rate by body weight: 0.8 mg/kg × 85 kg = 68 mg. The units of kilograms cancel out, leaving milligrams as the answer.

8. Correct Answer: A (4)

Expand the left side: 5(x + 8) = 5x + 40. Set equal to right side: 5x + 40 = 3x + 48. Subtract 3x from both sides: 2x + 40 = 48. Subtract 40: 2x = 8. Divide by 2: x = 4.

9. Correct Answer: C (1/3)

Total balls = 14 + 10 + 6 = 30 balls. Blue balls = 10. Probability of selecting blue = 10/30 = 1/3 (simplified by dividing numerator and denominator by 10).

10. Correct Answer: B (5,600 meters)

To convert kilometers to meters, multiply by 1,000 (since 1 km = 1,000 m): 5.6 km × 1,000 m/km = 5,600 meters. This is a standard metric conversion.

11. Correct Answer: A (270)

Substitute x = 9 into 4x² - 6x: 4(9)² - 6(9) = 4(81) - 54 = 324 - 54 = 270. Follow the order of operations: exponents first, then multiplication, then subtraction.

12. Correct Answer: D (25%)

Percent decrease = (Old - New)/Old × 100 = (4,200 - 3,150)/4,200 × 100 = 1,050/4,200 × 100 = 0.25 × 100 = 25%. The supplies decreased by 25%.

13. Correct Answer: C (19x - 71)

Distribute: 7(4x - 5) - 9(x + 4) = 28x - 35 - 9x - 36. Combine like terms: (28x - 9x) + (-35 - 36) = 19x - 71. Remember to distribute the negative sign in -9(x + 4).

14. Correct Answer: B (4)

If the ratio is 1:50 and there are 200 patients, find the number of doctors: 200 ÷ 50 = 4 doctors. This maintains the 1:50 ratio (4:200 = 1:50).

15. Correct Answer: D (63)

Solve x/9 + 7 = 14. First subtract 7 from both sides: x/9 = 7. Then multiply both sides by 9: x = 63. Verification: 63/9 + 7 = 7 + 7 = 14 ✓

16. Correct Answer: A (3.6°F)

The increase is found by subtracting the original value from the new value: 102.2 - 98.6 = 3.6°F. This represents the amount of temperature increase.

17. Correct Answer: C (10)

Substitute x = 11 into 7x - 4y = 37: 7(11) - 4y = 37, which gives 77 - 4y = 37. Subtract 77 from both sides: -4y = -40. Divide by -4: y = 10. Verification: 7(11) - 4(10) = 77 - 40 = 37 ✓

18. Correct Answer: B ($390)

Calculate the 40% discount amount: 0.40 × $650 = $260. Subtract the discount from the original price: $650 - $260 = $390. The discounted price is $390.

19. Correct Answer: A (9)

Solve 12x - 10 = 9x + 17. Subtract 9x from both sides: 3x - 10 = 17. Add 10 to both sides: 3x = 27. Divide by 3: x = 9.

20. Correct Answer: D (34)

To find the mean, add all values and divide by the count: (22 + 28 + 34 + 40 + 46)/5 = 170/5 = 34. The mean is the arithmetic average of the data set.

21. Correct Answer: B (336 mL)

Calculate 42% of 800 mL: 0.42 × 800 = 336 mL. Alternatively, 42% is the same as 42/100, and 800 × 42/100 = 33,600/100 = 336 mL.

22. Correct Answer: C (16 and -16)

When x^2 = 256, take the square root of both sides. Remember that square roots have both positive and negative solutions: x = +16 or x = -16. Both values satisfy the equation: $(16)^2$ = 256 and $(-16)^2$ = 256.

23. Correct Answer: D (360)

Multiply: 20 patients/day × 6 days/week × 3 weeks = 360 patients total. Calculate step by step: 20 × 6 = 120 patients per week, then 120 × 3 = 360 patients in 3 weeks.

24. Correct Answer: A ($40x^{11}$)

When multiplying powers with the same base, multiply the coefficients and add the exponents: $(8x^7)(5x^4)$ = $(8 × 5)(x^{7+4})$ = $40x^{11}$. Coefficient: 8 × 5 = 40. Exponent: 7 + 4 = 11.

25. Correct Answer: B (44%)

Convert the fraction to a decimal first: 11/25 = 0.44. Then multiply by 100 to get the percentage: 0.44 × 100 = 44%. Alternatively, 11/25 = 44/100 = 44%.

26. Correct Answer: D (18)

Calculate total hours in 6 days: 6 days × 24 hours/day = 144 hours. Divide by the dosing interval: 144 hours ÷ 8 hours/dose = 18 doses. The patient takes medication 3 times per day for 6 days.

27. Correct Answer: A (28 cm)

Perimeter formula for rectangle: P = 2L + 2W. Substitute known values: 100 = 2L + 2(22), which gives 100 = 2L + 44. Subtract 44: 56 = 2L. Divide by 2: L = 28 cm.

28. Correct Answer: D (8)

Solve 11x - 20 = 10x - 12. Subtract 10x from both sides: x - 20 = -12. Add 20 to both sides: x = 8. Verification: 11(8) - 20 = 88 - 20 = 68 and 10(8) - 12 = 80 - 12 = 68 ✓

29. Correct Answer: C ($1,113)

Calculate 6% tax on $1,050: 0.06 × $1,050 = $63. Add tax to original cost: $1,050 + $63 = $1,113. The total cost including sales tax is $1,113.

30. Correct Answer: A (24)

The median is the middle value when data is arranged in order. The data set 16, 20, 24, 28, 32 is already ordered. With 5 values, the middle (3rd) value is 24.

31. Correct Answer: B (15)

First solve for x: 8x - 14 = 26. Add 14 to both sides: 8x = 40. Divide by 8: x = 5. Then calculate 3x: 3(5) = 15.

32. Correct Answer: D (3,200 mL)

Convert liters to milliliters by multiplying by 1,000 (since 1 L = 1,000 mL): 3.2 L × 1,000 mL/L = 3,200 mL. This is a standard metric conversion.

33. Correct Answer: C (69)

Calculate step by step: $(-7)^2$ - 5(-4). First, $(-7)^2$ = 49 (squaring a negative gives a positive). Second, -5(-4) = +20 (multiplying two negatives gives a positive). Finally, 49 + 20 = 69.

34. Correct Answer: B (15)

Calculate 30% of 50: 0.30 × 50 = 15 nurses. Alternatively, 30% is the same as 3/10, and 50 × 3/10 = 150/10 = 15 nurses work at the clinic.

35. Correct Answer: A (108)

Solve x/12 = 9 by multiplying both sides by 12: x = 9 × 12 = 108. Verification: 108/12 = 9 ✓

36. Correct Answer: C (5/8)

Convert 0.625 to a fraction: 0.625 = 625/1000. Simplify by dividing both numerator and denominator by 125: 625/1000 = 5/8. This fraction is in simplest form since 5 and 8 share no common factors.

37. Correct Answer: D (23)

Use the elimination method. Add the two equations: (x + y) + (x - y) = 32 + 14, which gives 2x = 46. Divide by 2: x = 23. The y terms cancel when adding the equations.

38. Correct Answer: A (105.8°F)

Substitute C = 41 into F = (9/5)C + 32: F = (9/5)(41) + 32 = 1.8(41) + 32 = 73.8 + 32 = 105.8°F. This represents a high fever temperature.

39. Correct Answer: D (24)

The range is the difference between the maximum and minimum values: 46 - 22 = 24. Range measures the spread of the data from lowest to highest value.

40. Correct Answer: B (5:7)

Write the ratio: 150:210. Simplify by dividing both numbers by their GCF (30): 150/30 = 5 and 210/30 = 7. The simplest form of the ratio is 5:7.

Perceptual Ability

ANGLE DISCRIMINATION (Questions 1-15)

1. Correct Answer: D (Angle 4)

The angles measure: Angle 1 = 60°, Angle 2 = 122°, Angle 3 = 84°, Angle 4 = 143°. Comparing all measurements, 143° is the largest angle shown.

2. Correct Answer: B (Angle B)

The three angles measure: Angle A = 41°, Angle B = 132°, Angle C = 98°. Obtuse angles measure between 90° and 180°. Only Angle B at 132° is both obtuse AND greater than 130°. Angles A is acute and C is obtuse but less than 130°.

3. Correct Answer: A (32°)

The five angles measure 32°, 99°, 63°, 151°, and 90°. Comparing all measurements, 32° is the smallest angle shown.

4. Correct Answer: C (112°)

The four angles measure 47°, 112°, 75°, and 139°. Ordering from largest to smallest: 139°, 112°, 75°, 47°. The second largest angle is 112°.

5. Correct Answer: D (130°, 84°, 50°)

The three angles measure 84°, 130°, and 50°. Arranging from largest to smallest: 130°, 84°, 50°. This represents the correct descending order.

6. Correct Answer: B (78°)

Acute angles measure less than 90°. From the five angles (39°, 107°, 78°, 155°, 64°), the acute angles are 39°, 78°, and 64°. Comparing distances from 75°: 39° is 36° away, 78° is 3° away, and 64° is 11° away. Angle 78° is closest to 75°.

7. Correct Answer: C (103°)

The four angles measure 25°, 103°, 56°, and 170°. Ordering from largest to smallest: 170°, 103°, 56°, 25°. The third largest angle is 103°.

8. Correct Answer: A (41°)

Acute angles measure less than 90°. From the three angles (41°, 97°, 162°), only 41° is acute. Angles 97° and 162° are both obtuse. The acute and smallest angle is 41°.

9. Correct Answer: D (144°)

The five angles measure 48°, 111°, 74°, 144°, and 57°. Comparing all measurements, 144° is the largest angle shown.

10. Correct Answer: B (72°)

The four angles measure 72°, 135°, 37°, and 98°. Ordering from smallest to largest: 37°, 72°, 98°, 135°. The second smallest angle is 72°.

11. Correct Answer: A (46°)

The three acute angles measure 46°, 79°, and 67°. Comparing all three, 46° is the smallest angle.

12. Correct Answer: C (93°)

The five angles measure 122°, 93°, 58°, 173°, and 81°. Ordering from smallest to largest: 58°, 81°, 93°, 122°, 173°. The third smallest angle is 93°.

13. Correct Answer: D (149°)

The four angles measure 29°, 108°, 80°, and 149°. Comparing all measurements, 149° is the largest angle shown.

14. Correct Answer: B (92°)

Obtuse angles measure between 90° and 180°. From the three angles (125°, 52°, 92°), angle 92° is obtuse and less than 100°. Angle 52° is acute and 125° is obtuse but greater than 100°.

15. Correct Answer: C (157°, 113°)

The five angles measure 44°, 113°, 70°, 157°, and 88°. Ordering all angles from largest to smallest: 157°, 113°, 88°, 70°, 44°. The two largest angles in order are 157°, 113°.

APERTURES (Questions 16-30)

16. Correct Answer: A (A rectangle 13 cm × 15 cm)

A rectangular prism measuring 9 cm × 13 cm × 15 cm has three possible face orientations. The largest face measures 13 cm × 15 cm. This rectangular aperture would accommodate the largest face when properly oriented.

17. Correct Answer: D (A circle with at least 13 cm diameter)

When a cylinder with diameter 13 cm is oriented with its circular end forward, the cross-section presented is circular with 13 cm diameter. The aperture must be a circle with at least 13 cm diameter to allow passage.

18. Correct Answer: B (A square 13 cm × 13 cm or larger)

A pyramid with a square base measuring 13 cm × 13 cm requires a square aperture of at least 13 cm × 13 cm to accommodate the base when oriented base-first.

19. Correct Answer: A (12 cm × 12 cm)

A cube measuring 12 cm on each side, when oriented face-first, presents a square cross-section of 12 cm × 12 cm. This is the exact size needed for the smallest square aperture through which it can pass.

20. Correct Answer: C (An equilateral triangle 11 cm sides)

A triangular prism with an equilateral triangular base measuring 11 cm on each side, when entering triangle-first, requires an aperture matching that triangular shape with 11 cm sides.

21. Correct Answer: A (A rectangle 11 cm × 14 cm or larger)

An L-shaped object with overall dimensions of 11 cm wide and 14 cm tall requires a rectangular aperture of at least 11 cm × 14 cm to accommodate the entire object's profile when passing through.

22. Correct Answer: D (A circle with at least 16 cm diameter)

A sphere with a 16 cm diameter requires a circular aperture of at least 16 cm diameter to pass through, regardless of orientation, since a sphere presents the same circular profile from any angle.

23. Correct Answer: B (A rectangle 11 cm × 13 cm)

A rectangular block measuring 11 cm × 13 cm × 9 cm, when oriented with the 11 cm × 13 cm face forward, requires a rectangular aperture of at least 11 cm × 13 cm to pass through.

24. Correct Answer: A (A hexagon approximately 11 cm across)

A hexagonal prism with an 11 cm wide hexagonal base, when entering hexagon-first, requires an aperture that matches the hexagonal shape, approximately 11 cm across at its widest point.

25. Correct Answer: C (A rectangle 15 cm × 17 cm)

A T-shaped object with overall dimensions of 15 cm wide and 17 cm tall requires a rectangular aperture of at least 15 cm × 17 cm to accommodate the entire T profile when passing through face-first.

26. Correct Answer: D (An ellipse or rectangle 12 cm × 15 cm)

An ellipsoid measuring 12 cm × 15 cm × 10 cm, when oriented with the 12 cm × 15 cm face forward, requires an elliptical or rectangular aperture of approximately 12 cm × 15 cm.

27. Correct Answer: B (A square 13 cm × 13 cm or larger)

A cross-shaped object with arms extending 13 cm in each direction requires a square aperture of at least 13 cm × 13 cm to accommodate the full width and height of the cross profile when entering face-first.

28. Correct Answer: C (A circle with at least 15 cm diameter)

A cone with a base diameter of 15 cm, when oriented base-first, presents a circular cross-section of 15 cm diameter. The aperture must be a circle with at least 15 cm diameter.

29. Correct Answer: D (A rounded rectangle approximately 11 cm × 13 cm)

A rectangular block measuring 11 cm × 13 cm × 17 cm with 2 cm radius curves on the ends requires a rounded rectangular aperture of approximately 11 cm × 13 cm to accommodate the curved end profile.

30. Correct Answer: A (A rectangle 12 cm × 10 cm)

An irregular object with maximum dimensions of 12 cm × 14 cm × 10 cm, when oriented with its smallest face (12 cm × 10 cm) forward, requires a rectangular aperture of at least 12 cm × 10 cm.

ORTHOGRAPHIC PROJECTIONS (Questions 31-45)

31. Correct Answer: C (A cylinder oriented horizontally)

A circular top view, circular front view, and rectangular end view indicates a cylinder oriented horizontally (lying on its side). The circular cross-section is visible from the top and front, while the end view shows the length as a rectangle.

32. Correct Answer: B (A square pyramid oriented on its base)

A square top view, triangular front view, and square end view indicates a square pyramid sitting on its base. The square base is visible from top and end views, while the triangular profile is visible from the front.

33. Correct Answer: B (Front view only)

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

34. Correct Answer: C (A heptagonal prism oriented on its end)

Heptagonal (7-sided) top and front views combined with a rectangular end view indicates a heptagonal prism oriented on its end (standing vertically with the heptagonal cross-section visible from the top and front).

35. Correct Answer: D (Two cylinders side by side)

A rectangular top view, two circles in the front view, and rectangular end view suggests two cylindrical objects positioned side by side horizontally.

36. Correct Answer: D (Three rectangular prisms with dividing features)

A rectangle with two lines in both the top and end views, combined with three rectangles in the front view, suggests three rectangular prisms with dividing features or separations between them.

37. Correct Answer: A (A W-shaped prism)

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

38. Correct Answer: C (Two pentagonal sections with a dividing feature)

A pentagon with a diagonal in both the top and end views, combined with two triangles in the front view, suggests two pentagonal sections with a dividing feature or diagonal separation between them.

39. Correct Answer: B (An N-shaped prism)

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

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

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

41. Correct Answer: D (An undecagonal prism)

Undecagonal (11-sided) top and end views combined with a rectangular front view indicates an undecagonal prism—an object with a uniform eleven-sided cross-section throughout its length.

42. Correct Answer: C (Four cylindrical sections forming a circle with cross divisions)

A circle with a cross in both the top and end views, combined with four rectangles in the front view, suggests four cylindrical sections arranged in a circular pattern with cross-shaped divisions.

43. Correct Answer: A (An octagonal prism)

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

44. Correct Answer: B (Five cylinders arranged in pentagon pattern)

Five circles in pentagon pattern in the top view, five rectangles in the front view, and a circle in the end view suggests five cylindrical objects arranged in a pentagonal pattern.

45. Correct Answer: D (A Y-shaped prism)

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

CUBE COUNTING (Questions 46-60)

46. Correct Answer: A (96)

A structure with 6 layers arranged 4 × 4 × 6 contains: 4 cubes wide × 4 cubes deep × 6 cubes high = 96 total cubes. Multiply the three dimensions to find the total count.

47. Correct Answer: C (218)

In a 7 × 7 × 7 cube structure containing 343 total cubes, only the interior cubes (5 × 5 × 5 = 125 cubes) have no faces exposed. Therefore, cubes on the surface with at least one face exposed = 343 - 125 = 218 cubes.

48. Correct Answer: B (192)

A 4 × 6 × 8 structure contains: 4 cubes × 6 cubes × 8 cubes = 192 total cubes. Multiply the three dimensions to find the total count.

49. Correct Answer: D (8)

In a 10 × 10 × 10 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 (72)

With 9 layers and 8 cubes per layer arranged 2 × 4: Total cubes = 9 layers × 8 cubes per layer = 72 cubes. Alternatively, 2 × 4 × 9 = 72 cubes.

51. Correct Answer: A (8)

Any rectangular prism has exactly 8 corners (vertices). In a 4 × 7 × 8 structure, there are 8 corner cubes where three edges meet.

52. Correct Answer: D (720)

A structure 10 cubes high × 9 cubes wide × 8 cubes deep contains: 10 × 9 × 8 = 720 total cubes. Multiply the three dimensions to find the total count.

53. Correct Answer: B (22)

An L-shaped structure with 12 cubes on one arm and 11 on the other, sharing 1 corner cube: Total = 12 + 11 - 1 = 22 cubes. Subtract the shared corner cube to avoid counting it twice.

54. Correct Answer: C (36)

In a 10 × 10 × 1 flat structure, cubes with exactly two painted faces are the perimeter cubes excluding corners. Perimeter cubes = 10 + 10 + 10 + 10 - 4 corners = 40 - 4 = 36 cubes with two painted faces.

55. Correct Answer: A (27)

A staircase structure with 7 cubes on first step, 9 on second, and 11 on third contains: 7 + 9 + 11 = 27 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 9 × 10 × 11 structure, there are 8 corner cubes where three faces meet at each corner position.

57. Correct Answer: B (10)

In a 12 × 1 × 1 structure (12 cubes in a row), the 2 end cubes have 5 faces painted, and the 10 middle cubes have exactly 4 faces painted (top, bottom, front, back—not the two sides touching adjacent cubes).

58. Correct Answer: D (165)

Bottom layer: 9 × 9 = 81 cubes. Next layer: 7 × 7 = 49 cubes. Next layer: 5 × 5 = 25 cubes. Next layer: 3 × 3 = 9 cubes. Top layer: 1 cube. Total = 81 + 49 + 25 + 9 + 1 = 165 cubes in this pyramid structure.

59. Correct Answer: A (724)

A 9 × 9 × 9 cube contains 729 total cubes. With five corner cubes removed: 729 - 5 = 724 cubes remain.

60. Correct Answer: C (19)

A plus-shaped structure with 10 cubes for vertical arm and 10 cubes for horizontal arm, sharing 1 center cube: Total = 10 + 10 - 1 = 19 cubes. The center cube where the arms intersect is counted only once.

Biology

1. Correct Answer: B (DNA storage and genetic control)

The primary function of the nucleus is DNA storage and genetic control. The nucleus contains the cell's genetic material (DNA) organized into chromosomes and controls gene expression by regulating which genes are transcribed. It serves as the cell's control center, directing cellular activities by determining which proteins are produced.

2. Correct Answer: A (Golgi apparatus)

The Golgi apparatus is the organelle responsible for modifying and packaging proteins for secretion. It receives proteins from the endoplasmic reticulum, modifies them by adding carbohydrate groups or other chemical modifications, sorts them based on their destinations, and packages them into vesicles for transport to their final locations either inside or outside the cell.

3. Correct Answer: B (Metaphase)

During metaphase of mitosis, chromosomes line up at the cell's equator (metaphase plate). The spindle fibers attach to the centromeres of chromosomes, and the chromosomes align in the middle of the cell in a single line before being pulled apart during anaphase. This alignment ensures equal distribution of genetic material to daughter cells.

4. Correct Answer: C (Osmosis)

Osmosis is the process by which water moves across a selectively permeable membrane. It is the passive diffusion of water molecules from an area of high water concentration (low solute concentration) to an area of low water concentration (high solute concentration) through a semipermeable membrane, moving down the concentration gradient without requiring energy.

5. Correct Answer: A (Carries genetic instructions from DNA to ribosomes)

The primary function 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 at the ribosomes, specifying the sequence of amino acids in the protein.

6. Correct Answer: D (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 in the resulting zygote.

7. Correct Answer: C (Cytosine)

In DNA structure, the base pairing rules are specific: guanine (G) pairs with cytosine (C), and adenine (A) pairs with thymine (T). These complementary base pairs are held together by hydrogen bonds—three bonds between G and C, and two bonds between A and T.

8. Correct Answer: B (Both alleles fully expressed in heterozygotes)

Codominance is the pattern of inheritance where both alleles are fully and equally expressed in heterozygotes. Neither allele is dominant over the other, so both phenotypes appear simultaneously

without blending. An example is the AB blood type, where both A and B alleles are expressed, resulting in both A and B antigens on red blood cells.

9. Correct Answer: A (Prophase I)

Crossing over (genetic recombination) occurs during prophase I of meiosis. During this phase, homologous chromosomes pair up in a process called synapsis and exchange genetic material at points called chiasmata. This creates genetic variation in gametes by producing new combinations of alleles on chromosomes.

10. Correct Answer: D (White blood cells)

White blood cells (leukocytes) are the blood component that fights infections. They are part of the immune system and defend the body against pathogens, foreign substances, and abnormal cells through various mechanisms including phagocytosis, antibody production, and direct cellular attack on infected or cancerous cells.

11. Correct Answer: C (Nutrient absorption)

The primary function of the small intestine is nutrient absorption. It is the main site where digested nutrients (amino acids, monosaccharides, fatty acids, vitamins, minerals) are absorbed into the bloodstream through the intestinal villi and microvilli that greatly increase surface area for efficient absorption.

12. Correct Answer: B (Nervous tissue)

Nervous tissue is the tissue type that 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 of body functions.

13. Correct Answer: D (50%)

In a cross between two heterozygous parents (Aa × Aa), the Punnett square produces: AA (25%), Aa (50%), and aa (25%). The heterozygous genotype (Aa) appears in 50% or 2/4 of offspring, combining the two middle squares of the Punnett square.

14. Correct Answer: A (Meiosis)

Meiosis is the 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 used in sexual reproduction. This ensures offspring receive half their genetic material from each parent.

15. Correct Answer: C (Forms ribosome structure)

The primary role of ribosomal RNA (rRNA) is to form the structure of ribosomes. Along with ribosomal proteins, rRNA makes up the ribosome's structural framework and also has catalytic functions in forming peptide bonds during protein synthesis. It is both a structural and functional component essential for translation.

16. Correct Answer: B (Red blood cells)

Red blood cells (erythrocytes) are the blood component 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. Red blood cells also help transport some carbon dioxide back to the lungs for exhalation.

17. Correct Answer: A (Skeletal muscle)

Skeletal muscle is the type of muscle tissue that is voluntary (under conscious control) and attached to bones. It enables body movement by contracting and pulling on bones through tendon attachments. Skeletal muscle is striated in appearance and contains multiple nuclei per cell.

18. Correct Answer: D (mRNA)

The end product of transcription is messenger RNA (mRNA). During transcription, the DNA sequence of a gene is copied into mRNA by RNA polymerase in the nucleus. This mRNA molecule then carries the genetic information to the ribosomes for protein synthesis during translation.

19. Correct Answer: C (Lysosome)

Lysosomes are membrane-bound organelles that contain enzymes for breaking down cellular waste. These digestive enzymes break down worn-out cell parts, damaged organelles, macromolecules, and foreign materials that enter the cell. Lysosomes function as the cell's recycling center and waste disposal system.

20. Correct Answer: B (Break down bone tissue)

Osteoclasts are large, multinucleated bone cells that break down bone tissue through resorption. They secrete acids and enzymes that dissolve the mineral matrix and digest the organic components of bone, creating cavities on bone surfaces. This contrasts with osteoblasts, which build new bone tissue.

21. Correct Answer: D (Presence of membrane-bound nucleus)

Eukaryotic cells are distinguished from prokaryotic cells primarily by the presence of a membrane-bound nucleus. Eukaryotic cells have their DNA enclosed within a nuclear envelope, along with other membrane-bound organelles like mitochondria, endoplasmic reticulum, and Golgi apparatus. Prokaryotic cells lack these membrane-bound structures.

22. Correct Answer: A (Glucose and oxygen)

The reactants of cellular respiration are glucose and oxygen. During cellular respiration, glucose ($C_6H_{12}O_6$) is broken down in the presence of oxygen (O_2) to produce ATP (energy), with carbon dioxide and water as waste products. The overall equation is: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$.

23. Correct Answer: B (Endocrine system)

The endocrine system uses hormones for regulation of 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, reproduction, stress responses, and fluid balance.

24. Correct Answer: C (AUGC)

If DNA sequence is TACG, the complementary mRNA sequence is AUGC. During transcription, DNA is read and complementary mRNA is formed using base pairing rules: DNA thymine pairs with RNA adenine (A), DNA adenine pairs with RNA uracil (U), DNA cytosine pairs with RNA guanine (G), and DNA guanine pairs with RNA cytosine (C).

25. Correct Answer: D (Veins)

Veins are blood vessels that return blood 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 of blood as it returns to the heart under lower pressure.

26. Correct Answer: D (Protein synthesis)

The function of the rough endoplasmic reticulum (rough ER) is protein synthesis. The rough ER has ribosomes attached to its surface, which synthesize proteins that are either secreted from the cell, incorporated into the cell membrane, or sent to other organelles. The ribosomes give the rough ER its "rough" appearance.

27. Correct Answer: B (Phenotype)

Phenotype describes the physical expression of genes—the observable traits or characteristics of an organism. It results from the interaction of the genotype (genetic makeup) with the environment and includes physical appearance, biochemical properties, physiological traits, and behavior—any characteristic that can be observed or measured.

28. Correct Answer: C (S phase)

DNA replication occurs during the S phase (synthesis phase) of interphase in the cell cycle. During this phase, the cell duplicates its entire genome so that each daughter cell will receive a complete copy of the genetic material during cell division. The S phase occurs between the G1 and G2 phases of interphase.

29. Correct Answer: A (Lungs and airways)

The main organs of the respiratory system are the lungs and airways (including the nose, pharynx, larynx, 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 (Lack of membrane-bound organelles)

Prokaryotic cells are distinguished from eukaryotic cells primarily because prokaryotes lack membrane-bound organelles. Their DNA is located in a nucleoid region rather than enclosed in a nuclear envelope, and they lack organelles like mitochondria, endoplasmic reticulum, Golgi apparatus, and lysosomes that are present in eukaryotic cells.

General Chemistry

1. Correct Answer: A (Number of protons in the nucleus)

The atomic number is defined as the number of protons in the nucleus of an atom. It uniquely identifies an element and determines the element's identity and chemical properties. For example, all atoms with atomic number 6 are carbon atoms, and all atoms with atomic number 8 are oxygen atoms, regardless of neutron count.

2. Correct Answer: B (Proton)

Protons are subatomic particles with a positive electrical charge (+1). They are located in the nucleus along with neutrons. The number of protons determines the atomic number and element identity. Electrons have negative charge (-1), while neutrons have no charge (neutral).

3. Correct Answer: C (Covalent bond)

A covalent bond forms when atoms share electrons. This type of bonding typically occurs between nonmetal atoms where each atom contributes electrons to form shared pairs that hold the atoms together, allowing both to achieve more stable electron configurations. Examples include H_2, O_2, and H_2O.

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. The second shell can hold 8, the third can hold 18, etc.

5. Correct Answer: D (Salt and water)

When an acid neutralizes a base, a neutralization reaction occurs producing salt and water. For example: $HCl + NaOH \rightarrow NaCl + H_2O$. The H^+ from the acid combines with the OH^- from the base to form water (H_2O), while the remaining ions form a salt (NaCl in this example).

6. Correct Answer: B (18 g/mol)

The molar mass of water (H_2O) is calculated by adding the atomic masses: 2 hydrogen atoms (2×1 g/mol = 2 g/mol) + 1 oxygen atom (16 g/mol) = 18 g/mol total.

7. Correct Answer: C (10)

The pH scale ranges from 0 to 14, with pH 7 being neutral. Basic (alkaline) solutions have pH values greater than 7. Among the options, pH 10 indicates a basic solution. pH values of 2 and 5 are acidic, while pH 7 is neutral.

8. Correct Answer: D (2)

In the balanced equation $2H_2 + O_2 \rightarrow 2H_2O$, the coefficient of H_2O is 2. This coefficient indicates that 2 molecules of water are produced when 2 molecules of hydrogen gas react with 1 molecule of oxygen gas.

9. Correct Answer: A (Isotopes)

Atoms of the same element that have the same number of protons (same atomic number) but different numbers of neutrons are called isotopes. They have different mass numbers but identical chemical properties. For example, carbon-12 and carbon-14 are isotopes with 6 protons but 6 and 8 neutrons respectively.

10. Correct Answer: C (Increases)

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

11. Correct Answer: B (Covalent bond)

A covalent bond forms when atoms share electrons. This type of bonding typically occurs between nonmetal atoms, where each atom contributes electrons to form shared pairs that hold the atoms together, allowing both to achieve more stable electron configurations.

12. Correct Answer: A (1.5 moles)

To calculate moles, divide mass by molar mass: moles = 48 g ÷ 32 g/mol = 1.5 moles. This shows that 48 grams of oxygen gas (O_2) contains 1.5 moles of O_2 molecules.

13. Correct Answer: D (Moles)

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

14. Correct Answer: B (Feel slippery and taste bitter)

Bases have characteristic properties including feeling slippery to the touch and tasting bitter. They also turn red litmus paper blue and have pH values greater than 7. Acids, in contrast, taste sour, turn blue litmus paper red, and have pH less than 7.

15. Correct Answer: C (Liquid)

Liquids have a definite volume but not a definite shape—they take the shape of their container. Their particles are close together but can move past each other. Solids have both definite shape and volume, while gases have neither definite shape nor definite volume.

16. Correct Answer: A (Electrons are transferred forming ions)

During ionic bonding, electrons are transferred completely from one atom to another, forming charged ions. One atom (typically a metal) loses electrons to become a positively charged cation, and another atom (typically a nonmetal) gains those electrons to become a negatively charged anion. The electrostatic attraction between oppositely charged ions creates the ionic bond.

17. Correct Answer: D (9)

The formula $3Al(NO_3)_3$ represents 3 formula units of aluminum nitrate. Each $Al(NO_3)_3$ contains 3 NO_3 groups, and each NO_3 group contains 1 nitrogen atom. Therefore: 3 formula units × 3 NO_3 groups per unit × 1 nitrogen per NO_3 = 9 nitrogen atoms total.

18. Correct Answer: C (7)

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

19. Correct Answer: B (Group 2)

The alkaline earth metals are located in Group 2 of the periodic table and include beryllium, magnesium, calcium, strontium, barium, and radium. These reactive metals have 2 valence electrons and readily form +2 ions by losing those electrons.

20. Correct Answer: A (Synthesis)

The reaction A + B → AB represents a synthesis (combination) reaction, where two or more simple substances combine to form a more complex product. This is the opposite of a decomposition reaction (AB → A + B). An example is $2H_2 + O_2 \rightarrow 2H_2O$.

21. Correct Answer: D (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 2 has 1000 times more H^+ ions than a solution with pH 5.

22. Correct Answer: C (Neutral)

Neutrons are subatomic particles that have no electrical charge—they are electrically neutral. They are located in the nucleus along with protons and contribute to the atom's mass. Protons have positive charge, while electrons have negative charge.

23. Correct Answer: B (7)

Elements in Group 17 (the halogens) have 7 valence electrons in their outermost energy level. This includes fluorine, chlorine, bromine, iodine, and astatine. Because they have 7 valence electrons, they readily gain 1 electron to form -1 ions and achieve stable octets.

24. Correct Answer: D (Law of Conservation of Mass)

The Law of Conservation of Mass states that 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, and the number and type of atoms remain constant.

25. Correct Answer: A (1 M)

Using the dilution formula $M_1V_1 = M_2V_2$: (6 M)(25 mL) = M_2(150 mL). Solving: $150 = 150M_2$, so M_2 = 1 M. Diluting from 25 mL to 150 mL (6-fold dilution) reduces the concentration from 6 M to 1 M.

26. Correct Answer: C (OH^- ions)

According to the Arrhenius definition, bases are substances that produce hydroxide ions (OH^-) when dissolved in water. For example, $NaOH$ dissociates to produce Na^+ and OH^- ions. Acids, in contrast, produce H^+ ions in water.

27. Correct Answer: D (6.022×10^{23})

Avogadro's number is 6.022×10^{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 increases)

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 increases, gas molecules move faster and require more space, causing volume to increase 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 occurs because gas molecules have more space to move in, colliding with container walls less frequently and with less collective force.