Full-Length Practice Test 7

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 respiratory system enables gas exchange, delivering oxygen to tissues while removing carbon dioxide, a metabolic waste product. This system comprises conducting airways that transport air and respiratory zones where gas exchange occurs. Breathing involves coordinated muscular actions, neural control mechanisms, and chemical regulation responding to blood gas levels. Understanding respiratory physiology is essential for healthcare professionals because respiratory function affects every body system, respiratory diseases represent leading causes of morbidity and mortality, and many medical conditions impact breathing.

The upper respiratory tract includes the nose, pharynx, and larynx, serving multiple functions beyond air conduction. The nasal cavity warms, humidifies, and filters incoming air through mucus and cilia that trap particles and pathogens. The pharynx serves as a common pathway for air and food, with the epiglottis preventing food from entering the trachea during swallowing. The larynx contains vocal cords producing speech sounds and also protects the lower airways through the cough reflex. The lower respiratory tract begins with the trachea, which branches into bronchi entering each lung, then progressively smaller bronchioles ending in alveoli—tiny air sacs where gas exchange occurs.

Alveoli, numbering approximately 300 million in adult lungs, provide an enormous surface area for gas exchange—about 70 square meters, roughly the size of a tennis court. Each alveolus is surrounded by capillaries, with only a thin barrier separating air from blood. Oxygen diffuses from alveolar air into blood, binding to hemoglobin in red blood cells, while carbon dioxide diffuses from blood into alveoli for exhalation. Surfactant, a substance produced by alveolar cells, reduces surface tension preventing alveolar collapse and decreasing the work of breathing. Premature infants often lack adequate surfactant, causing respiratory distress syndrome requiring medical intervention.

Breathing control involves both voluntary and involuntary mechanisms. The respiratory control center in the brainstem automatically regulates breathing rate and depth based on blood carbon dioxide levels, pH, and oxygen levels detected by chemoreceptors. Rising carbon dioxide or falling pH triggers increased breathing rate and depth to eliminate excess carbon dioxide and restore normal pH. Chronic obstructive pulmonary disease (COPD), including emphysema and chronic bronchitis, progressively impairs lung

function through airway inflammation and alveolar destruction. Smoking represents the primary COPD risk factor, though occupational exposures and genetic factors contribute. For dental professionals, respiratory conditions influence treatment planning—patients may require supplemental oxygen, positioning adjustments to facilitate breathing, shorter appointments to prevent fatigue, and awareness that some inhaled medications cause xerostomia increasing cavity risk.

1. According to the passage, the respiratory system's primary functions include:
   A. Delivering oxygen and removing carbon dioxide
   B. Only producing speech
   C. Digesting food
   D. Filtering blood

2. The passage states that the nasal cavity functions to:
   A. Only produce mucus
   B. Digest air particles
   C. Warm, humidify, and filter incoming air
   D. Store oxygen

3. Based on the passage, the epiglottis prevents:
   A. Air from entering lungs
   B. Speech production
   C. Blood flow
   D. Food from entering the trachea during swallowing

4. According to the passage, gas exchange occurs in the:
   A. Trachea
   B. Pharynx
   C. Alveoli
   D. Larynx

5. The passage indicates that adult lungs contain approximately how many alveoli?
   A. 300 million
   B. 100 thousand
   C. 500 million
   D. 1 billion

6. Based on the passage, surfactant functions to:
   A. Produce oxygen
   B. Create carbon dioxide
   C. Filter blood

D. Reduce surface tension and prevent alveolar collapse

7. According to the passage, respiratory control centers regulate breathing based on:
   A. Only oxygen levels
   B. Blood carbon dioxide levels, pH, and oxygen levels
   C. Heart rate only
   D. Body temperature only

8. The passage states that the primary COPD risk factor is:
   A. Exercise
   B. Diet
   C. Smoking
   D. Age alone

PASSAGE 2

The digestive system breaks down food into absorbable nutrients through mechanical and chemical processes, with digestion beginning in the mouth and continuing through the gastrointestinal tract. This system involves coordinated organ function, enzyme secretion, and hormonal regulation ensuring efficient nutrient extraction and waste elimination. Understanding digestive physiology is crucial for healthcare professionals because nutritional status affects oral health, many medications impact digestion, and various systemic diseases manifest with gastrointestinal symptoms relevant to treatment planning.

Digestion begins with mastication, where teeth mechanically break food into smaller pieces while saliva initiates chemical digestion. Saliva contains the enzyme salivary amylase, which begins breaking down starches into simpler sugars. Adequate chewing is essential—thorough mastication increases surface area for enzyme action, aids swallowing, and improves nutrient extraction. Patients with missing teeth, ill-fitting dentures, or painful dental conditions may inadequately chew food, potentially leading to digestive problems and nutritional deficiencies. The tongue manipulates food, mixes it with saliva, and forms a bolus for swallowing. Taste receptors on the tongue detect sweet, salty, sour, bitter, and umami flavors, influencing food preferences and triggering digestive secretions in anticipation of nutrient absorption.

The stomach serves multiple functions including food storage, mechanical mixing, chemical digestion, and antimicrobial defense. Gastric glands secrete hydrochloric acid creating a highly acidic environment (pH 1.5-3.5) that denatures proteins, activates pepsinogen to pepsin for protein digestion, and kills most ingested bacteria. The stomach's thick mucus layer protects its own cells from acid damage, but when this barrier fails, peptic ulcers develop. Intrinsic factor, produced by stomach cells, is essential for vitamin B12 absorption in the small intestine—its deficiency causes pernicious anemia. Gastroesophageal reflux disease (GERD) occurs when stomach acid flows back into the esophagus, causing heartburn and potentially damaging esophageal tissue and tooth enamel.

The small intestine, measuring about 20 feet in adults, is the primary site for chemical digestion and nutrient absorption. The pancreas secretes digestive enzymes breaking down proteins, carbohydrates, and fats, along with sodium bicarbonate neutralizing acidic chyme. The liver produces bile, stored in the gallbladder, which emulsifies fats facilitating enzyme action. The small intestine's inner surface has numerous folds, villi, and microvilli creating enormous surface area for absorption. Nutrients pass through intestinal cells into blood capillaries or lymphatic vessels. The large intestine absorbs water and electrolytes, houses beneficial bacteria fermenting undigested material and synthesizing vitamins, and forms and stores feces until elimination. For dental professionals, understanding digestion helps recognize that gastric reflux erodes tooth enamel, certain nutritional deficiencies present with oral symptoms, and gastrointestinal medications may cause xerostomia or taste alterations affecting oral health and patient comfort.

9. According to the passage, digestion in the mouth involves:
   A. Mechanical breakdown by teeth and chemical digestion by salivary amylase
   B. Only chemical processes
   C. No digestive activity
   D. Bile production

10. The passage indicates that inadequate chewing may result from:
   A. Excessive exercise
   B. Too much saliva
   C. Increased enzyme production
   D. Missing teeth or painful dental conditions

11. Based on the passage, the stomach's acidic environment has a pH of approximately:
   A. 7.0-8.0
   B. 5.0-6.0
   C. 1.5-3.5
   D. 10.0-12.0

12. According to the passage, intrinsic factor is essential for:
   A. Protein digestion
   B. Vitamin B12 absorption
   C. Fat breakdown
   D. Carbohydrate processing

13. The passage states that GERD can potentially damage:
   A. Only the stomach
   B. The liver

C. The pancreas
D. Esophageal tissue and tooth enamel

14. Based on the passage, the primary site for nutrient absorption is the:
    A. Small intestine
    B. Stomach
    C. Large intestine
    D. Esophagus

15. According to the passage, bile functions to:
    A. Produce acid
    B. Digest proteins
    C. Emulsify fats
    D. Absorb water

16. The passage indicates that the large intestine:
    A. Produces digestive enzymes
    B. Absorbs water and houses beneficial bacteria
    C. Secretes bile
    D. Only stores food

PASSAGE 3

The nervous system coordinates body functions through electrical and chemical signals, enabling sensation, movement, cognition, and homeostatic regulation. This complex network comprises the central nervous system (brain and spinal cord) and peripheral nervous system (nerves throughout the body). Neurons transmit information through action potentials and synaptic communication, with supporting glial cells providing structural and metabolic support. Understanding nervous system function is essential for healthcare professionals because neurological conditions affect millions of people, many medications target neural mechanisms, and dental procedures involve nerve anatomy for anesthesia administration.

Neurons, the nervous system's functional units, have specialized structures enabling signal transmission. The cell body contains the nucleus and metabolic machinery, while dendrites receive signals from other neurons. The axon, sometimes extending over a meter in length, conducts electrical impulses away from the cell body toward the axon terminals, which form synapses with other neurons or target cells. Myelin, a fatty insulation coating some axons, dramatically increases signal transmission speed—myelinated axons conduct impulses up to 100 times faster than unmyelinated axons. Multiple sclerosis occurs when the immune system attacks myelin, causing progressive neurological deterioration with symptoms including vision problems, weakness, coordination difficulties, and cognitive changes.

Action potentials, the electrical signals neurons use for long-distance communication, result from rapid changes in membrane permeability to sodium and potassium ions. At rest, neurons maintain a negative internal charge relative to outside. When stimulated sufficiently, sodium channels open, allowing sodium influx that depolarizes the membrane. If depolarization reaches threshold, an action potential fires in an all-or-nothing manner—either it occurs fully or not at all. The action potential propagates along the axon without diminishing in strength. After firing, the neuron briefly cannot fire again during the refractory period, which limits firing frequency and ensures unidirectional signal propagation.

Synaptic transmission transfers information between neurons through chemical neurotransmitters. When an action potential reaches the axon terminal, it triggers calcium influx causing vesicles containing neurotransmitters to fuse with the membrane and release their contents into the synaptic cleft. Neurotransmitters diffuse across this narrow gap and bind to receptors on the postsynaptic neuron, either exciting it (making it more likely to fire) or inhibiting it (making firing less likely). Different neurotransmitters serve various functions: glutamate provides primary excitatory signaling, GABA inhibits neural activity, dopamine influences motivation and movement, and serotonin affects mood and sleep. Many drugs and diseases affect neurotransmitter systems—Parkinson's disease involves dopamine neuron loss causing movement difficulties, depression often involves serotonin and norepinephrine imbalances, and Alzheimer's disease affects acetylcholine neurons impairing memory. For dental professionals, understanding neural anatomy enables accurate local anesthetic administration blocking nerve signals for pain control, while recognizing that some medications affecting neurotransmitters may cause xerostomia, bruxism, or movement disorders impacting oral health and treatment approaches.

17. According to the passage, the nervous system comprises:
    A. Only the brain
    B. Only neurons
    C. Only the spinal cord
    D. The central nervous system and peripheral nervous system

18. The passage states that myelin functions to:
    A. Increase signal transmission speed
    B. Decrease neural activity
    C. Produce hormones
    D. Store memories

19. Based on the passage, multiple sclerosis occurs when:
    A. Too much myelin is produced
    B. Neurons multiply excessively
    C. The immune system attacks myelin
    D. Brain size increases

20. According to the passage, action potentials occur in what manner?
    A. Gradually
    B. Partially
    C. Intermittently
    D. All-or-nothing

21. The passage indicates that synaptic transmission uses:
    A. Chemical neurotransmitters
    B. Only electrical signals
    C. Blood flow
    D. Air molecules

22. Based on the passage, glutamate provides:
    A. Inhibitory signaling
    B. Hormone production
    C. Blood clotting
    D. Primary excitatory signaling

23. According to the passage, Parkinson's disease involves:
    A. Excessive dopamine
    B. Dopamine neuron loss
    C. Too much serotonin
    D. GABA overproduction

24. The passage states that local anesthetics work by:
    A. Increasing nerve signals
    B. Producing neurotransmitters
    C. Blocking nerve signals
    D. Enhancing synaptic transmission

PASSAGE 4

The musculoskeletal system provides structure, protects organs, enables movement, stores minerals, and produces blood cells through coordinated function of bones, joints, muscles, and connective tissues. This system adapts to mechanical forces through remodeling, with bones strengthening in response to stress and weakening with disuse. Understanding musculoskeletal anatomy and physiology is essential for healthcare professionals because these structures form the body's framework, musculoskeletal disorders represent leading causes of pain and disability, and oral-facial structures depend on proper skeletal and muscular function.

Bones serve multiple critical functions beyond structural support. Compact bone forms dense outer layers providing strength, while spongy bone contains trabecular networks housing bone marrow where blood cell production occurs. Bones store 99% of the body's calcium and significant phosphorus reserves, releasing these minerals into blood when needed for various physiological processes. Red bone marrow produces red blood cells, white blood cells, and platelets through hematopoiesis. Yellow bone marrow, consisting mainly of fat, can convert to red marrow when increased blood cell production is needed. Bone is living tissue constantly undergoing remodeling through balanced osteoblast (bone-building) and osteoclast (bone-resorbing) activity. Osteoporosis develops when bone resorption exceeds formation, resulting in decreased bone density and increased fracture risk, particularly affecting postmenopausal women due to declining estrogen levels that normally inhibit excessive bone resorption.

Joints, where bones meet, vary in structure and mobility. Fibrous joints, like skull sutures, allow minimal movement, providing stability. Cartilaginous joints, such as intervertebral discs, permit limited movement while absorbing shock. Synovial joints, including the knee, hip, and temporomandibular joint, allow considerable movement through a joint capsule containing lubricating synovial fluid. Articular cartilage covers bone surfaces at synovial joints, providing smooth, low-friction surfaces enabling smooth movement. Arthritis, joint inflammation, includes multiple types: osteoarthritis results from cartilage degeneration with aging or injury, while rheumatoid arthritis is an autoimmune condition where the immune system attacks joint tissues causing inflammation, pain, and progressive deformity.

Skeletal muscles produce movement by contracting and pulling on bones through tendon attachments. Muscle contraction occurs when nerve signals trigger calcium release within muscle cells, enabling the sliding filament mechanism where actin and myosin proteins interact, shortening muscle fibers. Muscles work in antagonistic pairs—when one contracts, the opposite relaxes, allowing controlled movement. The temporomandibular joint, connecting the mandible to the skull, is one of the body's most frequently used joints, enabling chewing, speaking, and facial expressions. Temporomandibular disorders (TMD) cause jaw pain, clicking, limited movement, and headaches, often related to bruxism (teeth grinding), malocclusion, stress, or joint abnormalities. For dental professionals, understanding musculoskeletal anatomy enables recognition of TMD symptoms requiring treatment, awareness that osteoporosis medications (bisphosphonates) can rarely cause jaw bone necrosis requiring prophylactic care before invasive procedures, and knowledge that proper ergonomics prevents work-related musculoskeletal injuries in dental practitioners.

25. According to the passage, bones serve functions including:
    A. Only structural support
    B. Only blood cell production
    C. Only mineral storage
    D. Structure, organ protection, movement, mineral storage, and blood cell production

26. The passage states that compact bone:

A. Forms dense outer layers providing strength
B. Produces hormones
C. Filters blood
D. Stores oxygen

27. Based on the passage, osteoporosis develops when:
A. Bone formation exceeds resorption
B. Too much calcium is consumed
C. Bone resorption exceeds formation
D. Muscles become too strong

28. According to the passage, synovial joints:
A. Allow no movement
B. Allow considerable movement and contain synovial fluid
C. Only exist in the skull
D. Never move

29. The passage indicates that osteoarthritis results from:
A. Cartilage degeneration with aging or injury
B. Bacterial infection
C. Too much exercise
D. Excessive calcium

30. Based on the passage, muscle contraction occurs through:
A. Blood flow
B. The sliding filament mechanism with actin and myosin
C. Bone growth
D. Joint inflammation

31. According to the passage, the temporomandibular joint enables:
A. Arm movement
B. Leg movement
C. Chewing, speaking, and facial expressions
D. Only breathing

32. The passage states that bisphosphonates can rarely cause:
A. Jaw bone necrosis
B. Excessive bone growth
C. Increased muscle mass
D. Enhanced joint flexibility

PASSAGE 5

Infectious diseases result from pathogenic microorganisms including bacteria, viruses, fungi, and parasites that invade the body, multiply, and cause illness. Understanding infectious disease transmission, prevention, and treatment is critical for healthcare professionals who must protect themselves and patients from healthcare-associated infections while managing patients with infectious conditions. Infection control practices, including hand hygiene, sterilization, and appropriate precautions, form the foundation of safe healthcare delivery.

Bacteria cause numerous infections through various mechanisms. Streptococcus mutans, the primary cariogenic bacteria, metabolizes sugars producing acid that demineralizes tooth enamel causing cavities. Periodontal diseases result from complex bacterial communities forming biofilms on tooth surfaces and beneath gumlines, triggering inflammatory responses that destroy periodontal tissues and supporting bone. Antibiotic therapy treats bacterial infections by targeting bacterial structures or processes absent in human cells—penicillin inhibits bacterial cell wall synthesis, while tetracyclines block bacterial protein production. However, antibiotic overuse and misuse have driven antibiotic resistance development, with some bacteria evolving mechanisms to survive antibiotic exposure, creating "superbugs" resistant to multiple antibiotics.

Viruses differ fundamentally from bacteria, consisting only of genetic material (DNA or RNA) in a protein coat, lacking cellular machinery for independent reproduction. Viruses must hijack host cells, inserting their genetic material and forcing cells to produce viral components. Common viral infections include influenza, causing respiratory illness; herpes simplex virus, causing cold sores and oral lesions; and human papillomavirus (HPV), associated with oral cancers. Antiviral medications often target specific viral replication steps, but viral mutations enable evolution of drug-resistant strains. Vaccines prevent viral infections by exposing the immune system to weakened, killed, or component forms of viruses, generating protective immune memory without causing disease.

Infection transmission occurs through multiple routes requiring specific precautions. Contact transmission, most common in healthcare settings, involves direct physical contact or indirect contact through contaminated surfaces or instruments. Droplet transmission occurs when respiratory droplets from coughing, sneezing, or talking travel short distances (typically under 6 feet) to mucous membranes. Airborne transmission involves smaller particles remaining suspended in air traveling longer distances. Bloodborne transmission occurs through exposure to infected blood via needlesticks, cuts, or mucous membrane contact. Standard precautions, applied to all patients regardless of infection status, include hand hygiene before and after patient contact, personal protective equipment (gloves, masks, eye protection, gowns) based on anticipated exposure, safe injection practices, and proper instrument sterilization. For dental professionals, infection control is paramount because dental procedures generate aerosols and involve contact with blood and saliva, requiring strict adherence to protocols including high-level

instrument sterilization, surface disinfection, use of rubber dams to minimize aerosol generation, and appropriate personal protective equipment. Healthcare workers must maintain current immunizations against vaccine-preventable diseases including hepatitis B, influenza, measles, and recently COVID-19 to protect themselves and vulnerable patients.

33. According to the passage, infectious diseases result from:
    A. Only bacteria
    B. Only viruses
    C. Poor nutrition
    D. Pathogenic microorganisms including bacteria, viruses, fungi, and parasites

34. The passage states that Streptococcus mutans causes cavities by:
    A. Producing antibiotics
    B. Metabolizing sugars and producing acid that demineralizes enamel
    C. Strengthening teeth
    D. Increasing saliva

35. Based on the passage, penicillin works by:
    A. Inhibiting bacterial cell wall synthesis
    B. Destroying human cells
    C. Increasing bacterial growth
    D. Producing viruses

36. According to the passage, viruses differ from bacteria because viruses:
    A. Are larger
    B. Have complete cellular machinery
    C. Can reproduce independently
    D. Consist only of genetic material in a protein coat

37. The passage indicates that vaccines work by:
    A. Killing all bacteria
    B. Destroying the immune system
    C. Exposing the immune system to weakened or killed pathogens to generate memory
    D. Eliminating all microorganisms

38. Based on the passage, contact transmission involves:
    A. Only airborne particles
    B. Direct or indirect contact through contaminated surfaces
    C. Only bloodborne exposure
    D. Exclusively droplet spread

39. According to the passage, standard precautions should be applied to:
    A. Only patients with visible infections
    B. No patients
    C. Only surgical patients
    D. All patients regardless of infection status

40. The passage states that dental professionals must maintain immunizations to:
    A. Protect themselves and vulnerable patients
    B. Avoid all healthcare work
    C. Eliminate the need for hand hygiene
    D. Replace personal protective equipment

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 clinic received new equipment, it also implemented updated safety protocols.
    A. equipment, it also implemented
    B. equipment, and it also implemented
    C. equipment it also implemented
    D. equipment; because it also implemented

2. Neither the assistant nor the hygienists was prepared for the staff meeting yesterday.
    A. nor the hygienists were prepared
    B. or the hygienists was prepared
    C. or the hygienists were prepared
    D. nor the hygienists was prepared

3. The dentist asked the patient when could she schedule her next cleaning.
    A. when could she schedule
    B. when she could have scheduled
    C. when she could schedule
    D. when could she have scheduled

4. Between you and I, the new scheduling system is more efficient than before.

A. Between you and I, the new scheduling system is
B. Between you and me, the new scheduling system is
C. Between you and I, the new scheduling systems are
D. Between you and me, the new scheduling systems are

5. The office provides comprehensive services including preventive care, restorative treatments, and will offer cosmetic procedures.
   A. preventive care, restorative treatments, and cosmetic procedures
   B. preventing care, restoring treatments, and will offer cosmetic procedures
   C. preventive care, restorative treatment, and cosmetic procedure
   D. preventive care, restorative treatments, and offering cosmetic procedures

6. After examining the patient's records the hygienist prepared a detailed treatment plan.
   A. After examining the patient's records the hygienist prepared
   B. After examining, the patient's records the hygienist prepared
   C. After examining the patient's records; the hygienist prepared
   D. After examining the patient's records, the hygienist prepared

7. The updated protocol is more effective than the previous method, it also improves patient safety.
   A. method, it also improves
   B. method, and it also improves
   C. method it also improves
   D. method; because it also improves

8. Everyone in the practice must submit their certification renewal documents by month's end.
   A. must submit their certification renewal documents
   B. must submit its certification renewal documents
   C. must submit his or her certification renewal documents
   D. must submits his or her certification renewal documents

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

10. Reviewing the case carefully, a diagnosis was determined by the specialist.
    A. Reviewing the case carefully, a diagnosis was determined by the specialist
    B. Reviewing the case carefully, the specialist's diagnosis was determined
    C. A diagnosis was determined by the specialist, reviewing the case carefully

D. Reviewing the case carefully, the specialist determined a diagnosis

11. Each of the dental professionals have completed their required training courses.
    A. has completed his or her required training course
    B. have completed their required training courses
    C. has completed their required training courses
    D. have completed his or her required training course

12. The practice is open on weekdays, however it remains closed on major holidays.
    A. weekdays, however it remains
    B. weekdays however, it remains
    C. weekdays, however, it remains
    D. weekdays; however, it remains

13. Less staff members attended the training session than expected last week.
    A. Fewer staff members attended
    B. Less staff member attended
    C. Lesser staff members attended
    D. Less staff members attends

14. The dentist consulted the specialist, reviewed the case history, and was developing a treatment plan.
    A. consulted the specialist, reviewed the case history, and was developing
    B. consults the specialist, reviewed the case history, and developed
    C. consulted the specialist, reviewed the case history, and developed
    D. consulted the specialist, reviews the case history, and developed

15. Dr. Martinez told Dr. Anderson that she needed to review the case immediately.
    A. Dr. Martinez told Dr. Anderson that Dr. Martinez needed
    B. Dr. Martinez told Dr. Anderson that she needed
    C. Dr. Martinez told Dr. Anderson she needed
    D. Dr. Martinez told Dr. Anderson that Anderson needed

16. The policy change effects all employees and will take effect starting Monday.
    A. effects all employees and will take effect
    B. effects all employees and will take affect
    C. affects all employees and will take affect
    D. affects all employees and will take effect

17. Proper sterilization is critical, all instruments must be processed correctly.
    A. critical, all instruments must

B. critical; because all instruments must
C. critical. All instruments must
D. critical all instruments must

18. The hygienist which completed advanced training last year provides excellent patient care.
A. which completed advanced training
B. who completed advanced training
C. which had completed advanced training
D. whom completed advanced training

19. Having analyzed the data thoroughly, the conclusion was presented by the researcher.
A. Having analyzed the data thoroughly, the researcher presented the conclusion
B. Having analyzed the data thoroughly, the conclusion was presented by the researcher
C. The researcher's conclusion was presented, having analyzed the data thoroughly
D. The conclusion was presented by the researcher, having analyzed the data thoroughly

20. The patient should of contacted the office earlier to confirm the appointment.
A. should of contacted
B. should had contacted
C. should has contacted
D. should have contacted

21. The treatment involves examinations, x-rays, or performing cleanings as necessary.
A. examinations, x-rays, or performing cleanings
B. examining, x-raying, or performing cleanings
C. examinations, x-rays, or cleanings
D. examination, x-ray, or cleaning

22. Advanced technology improves diagnostic accuracy, it provides better patient outcomes.
A. accuracy, it provides
B. accuracy; it provides
C. accuracy it provides
D. accuracy; and it provides

23. Among the four treatment options presented, the surgical approach is the more complex choice.
A. the more complex choice
B. the more complexly choice
C. the most complexly choice
D. the most complex choice

24. The dental office is located at 789 main street near the downtown district of Denver Colorado.
    A. main street near the downtown district of Denver Colorado
    B. Main street near the downtown district of Denver, Colorado
    C. Main Street near the downtown district of Denver, Colorado
    D. main Street near the Downtown District of Denver, Colorado

25. After the treatment was completed the patient received comprehensive post-operative instructions.
    A. After the treatment was completed the patient received
    B. After the treatment, was completed the patient received
    C. After the treatment was completed, the patient received
    D. After the treatment was completed; the patient received

26. The hygienist asked the patient when can he return for his follow-up appointment.
    A. when can he return
    B. when he could return
    C. when can he have returned
    D. when could he have returned

27. The dentist and her team both agrees that prevention is the most effective approach.
    A. both agree that
    B. both agrees, that
    C. both agrees that
    D. both agree, that

28. Comprehensive dental care, regular checkups, and thorough hygiene practices is essential for health.
    A. is essential
    B. is essentially
    C. are essentially
    D. are essential

29. Modern techniques improve treatment outcomes, they also enhance patient comfort significantly.
    A. outcomes, they also enhance
    B. outcomes they also enhance
    C. outcomes, and they also enhance
    D. outcomes; because they also enhance

30. The clinic provides specialized care such as orthodontics, periodontics, and endodontics.
    A. care, such as orthodontics, periodontics, and endodontics
    B. care, such as orthodontics, periodontics, and endodontics
    C. care such as, orthodontics, periodontics, and endodontics

D. care such as orthodontics periodontics and endodontics

31. Dentists, hygienists, and assistants all plays essential roles in patient care delivery.
    A. all plays essential roles
    B. all play essential role
    C. all play essential roles
    D. all plays essential role

32. The dentist instructed the patient to lay down in the chair for the procedure.
    A. to lay down in the chair
    B. to lie down in the chair
    C. to lay down on the chair
    D. to lie down on the chair

33. Contemporary dental practice has evolved significantly allowing professionals to deliver superior care.
    A. significantly, allowing professionals to deliver
    B. significantly allowing professionals to deliver
    C. significantly; allowing professionals to deliver
    D. significantly. Allowing professionals to deliver

34. Regular dental visits prevent problems, they maintain optimal oral health over time.
    A. problems. They maintain
    B. problems, they maintain
    C. problems; and they maintain
    D. problems they maintain

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

36. The practice offers complete services such as routine care and preventive treatments but not surgery.
    A. services, such as routine care and preventive treatments but
    B. services such as, routine care and preventive treatments, but
    C. services, such as routine care and preventive treatments, but
    D. services such as routine care and preventive treatments, but

37. The new location is more convenient for patients than the old facility.
    A. more convenient for patients than the old facility

B. more convenient for patients than the old facility was
C. more conveniently for patients than the old facility
D. most convenient for patients than the old facility

38. Maintaining excellent oral health requires brushing daily, flossing regularly, and to see the dentist.
A. brushing daily, flossing regularly, and to see the dentist
B. to brush daily, flossing regularly, and seeing the dentist
C. to brush daily, to floss regularly, and to see the dentist
D. brushing daily, flossing regularly, and seeing the dentist

39. The patient explained that his tooth has been painful for days before calling.
A. had been painful
B. has been painful
C. will have been painful
D. has hurt

40. Preventive dental care reduces long-term costs, it also improves overall health outcomes.
A. costs, it also improves
B. costs it also improves
C. costs, and it also improves
D. costs; 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: 7x - 11 = 24
A. 3
B. 13
C. 35
D. 5

2. A dental office treated 140 patients in January and 175 patients in February. What is the percent increase?
A. 25%
B. 35%

C. 140%
D. 20%

3. If $9y - 7 = 6y + 14$, what is the value of y?
   A. 3
   B. 21
   C. 2
   D. 7

4. A dental assistant earns $46 per hour and works 8 hours per day for 6 days per week. How much does she earn per week?
   A. $368
   B. $2,208
   C. $276
   D. $2,760

5. What is 24% of 375?
   A. 90
   B. 24
   C. 37.5
   D. 75

6. If $a = 7$ and $b = -4$, what is the value of $3a^2 - 2b$?
   A. 139
   B. 155
   C. 155
   D. 147

7. A medication dosage is 0.7 mg per kilogram of body weight. How many milligrams should be given to a patient weighing 80 kilograms?
   A. 50 mg
   B. 54 mg
   C. 60 mg
   D. 56 mg

8. Solve: $4(x + 6) = 2x + 32$
   A. 2
   B. 4
   C. 6
   D. 8

9. A box has 12 red balls, 9 blue balls, and 6 green balls. If one ball is selected at random, what is the probability it is blue?
   A. 1/3
   B. 4/9
   C. 1/3
   D. 2/9

10. Convert 4.8 kilometers to meters.
   A. 48 meters
   B. 4,800 meters
   C. 480 meters
   D. 48,000 meters

11. If $x = 8$, what is the value of $3x^2 - 5x$?
   A. 152
   B. 192
   C. 144
   D. 152

12. Office supplies decreased from $3,500 to $2,800. What is the percent decrease?
   A. 20%
   B. 25%
   C. 700%
   D. 30%

13. Simplify: $6(3x - 4) - 8(x + 3)$
   A. $18x - 48$
   B. $26x - 48$
   C. $10x - 48$
   D. $14x - 0$

14. The ratio of dentists to patients is 1:45. If there are 180 patients, how many dentists are there?
   A. 3
   B. 4
   C. 5
   D. 45

15. Solve for x: $x/8 + 6 = 12$
   A. 48

B. 96
C. 18
D. 40

16. A patient's temperature increased from 98.2°F to 101.8°F. What is the amount of increase?
    A. 2.6°F
    B. 3.2°F
    C. 4.0°F
    D. 3.6°F

17. If 8x - 5y = 40 and x = 10, what is the value of y?
    A. 5
    B. 6
    C. 8
    D. 10

18. A clinic offers a 35% discount on whitening treatments. If the original price is $600, what is the discounted price?
    A. $565
    B. $390
    C. $450
    D. $210

19. Solve for x: 11x - 8 = 8x + 19
    A. 5
    B. 27
    C. 3
    D. 9

20. What is the mean of the data set: 20, 26, 32, 38, 44?
    A. 32
    B. 26
    C. 38
    D. 30

21. A solution contains 700 mL of liquid. If 38% is active ingredient, how many milliliters of active ingredient does it contain?
    A. 38 mL
    B. 210 mL
    C. 266 mL

D. 280 mL

22. If $x^2 = 225$, what are the possible values of x?
    A. 225 only
    B. 15 and -15
    C. 15 only
    D. -15 only

23. A hygienist sees 18 patients per day for 5 days per week for 4 weeks. How many patients in total?
    A. 360
    B. 90
    C. 72
    D. 450

24. Simplify: $(7x^6)(4x^3)$
    A. $11x^9$
    B. $28x^{18}$
    C. $11x^{18}$
    D. $28x^9$

25. What is 9/20 expressed as a percent?
    A. 9%
    B. 45%
    C. 0.45%
    D. 90%

26. A patient takes medication every 6 hours. How many doses in 4 days?
    A. 12
    B. 18
    C. 16
    D. 24

27. If the perimeter of a rectangle is 90 cm and the width is 18 cm, what is the length?
    A. 36 cm
    B. 45 cm
    C. 24 cm
    D. 27 cm

28. Solve: $10x - 18 = 9x - 10$
    A. 8

B. 28
C. -8
D. 2

29. Equipment costs $920 before tax. With 7% sales tax, what is the total cost?
A. $927
B. $984.40
C. $920
D. $1,000

30. What is the median of: 14, 18, 22, 26, 30?
A. 18
B. 26
C. 20
D. 22

31. If 7x - 12 = 23, what is the value of 2x?
A. 10
B. 5
C. 15
D. 20

32. A bottle holds 2.6 liters. How many milliliters is this?
A. 26 mL
B. 260 mL
C. 26,000 mL
D. 2,600 mL

33. Evaluate: $(-6)^2 - 4(-3)$
A. 24
B. -24
C. 48
D. 36

34. A practice has 40 employees. If 25% are dentists, how many dentists work there?
A. 10
B. 8
C. 12
D. 15

35. Solve for x: $x/10 = 7$
    A. 17
    B. 70
    C. 10
    D. 3

36. What is 0.875 expressed as a fraction in simplest form?
    A. 875/1000
    B. 35/40
    C. 17/20
    D. 7/8

37. If $x + y = 28$ and $x - y = 12$, what is the value of x?
    A. 8
    B. 16
    C. 20
    D. 14

38. A patient's temperature is 40°C. Using $F = (9/5)C + 32$, what is the temperature in Fahrenheit?
    A. 102.4°F
    B. 104°F
    C. 103.2°F
    D. 105°F

39. What is the range of: 20, 26, 32, 38, 44?
    A. 24
    B. 32
    C. 20
    D. 44

40. A clinic treated 135 patients in March and 180 patients in April. What is the ratio of March to April patients in simplest form?
    A. 135:180
    B. 9:12
    C. 3:4
    D. 27:36

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 58°, Angle 2 measures 120°, Angle 3 measures 82°, and Angle 4 measures 141°. Which is the smallest angle?
   A. Angle 1
   B. Angle 2
   C. Angle 3
   D. Angle 4

2. Three angles are presented. Angle A = 39°, Angle B = 130°, Angle C = 96°. Which angle is obtuse and greater than 125°?
   A. Angle A
   B. Angle B
   C. Angle C
   D. All acute

3. Five angles measure 30°, 97°, 61°, 149°, and 88°. Which is the largest angle?
   A. 30°
   B. 88°
   C. 97°
   D. 149°

4. Four angles are displayed: 45°, 110°, 73°, and 137°. Which is the smallest angle?
   A. 45°
   B. 73°
   C. 110°
   D. 137°

5. Three angles measure 82°, 128°, and 48°. What is the correct order from smallest to largest?
   A. 82°, 48°, 128°
   B. 128°, 82°, 48°

C. 48°, 82°, 128°
D. 48°, 128°, 82°

6. Five angles are shown: 37°, 105°, 76°, 153°, and 62°. Which angle is acute and closest to 80°?
   A. 37°
   B. 62°
   C. 105°
   D. 76°

7. Four angles measure 23°, 101°, 54°, and 168°. Which is the second smallest angle?
   A. 23°
   B. 54°
   C. 101°
   D. 168°

8. Three angles are presented: 39°, 95°, and 160°. Which angle is acute and smallest?
   A. 39°
   B. 95°
   C. 160°
   D. All obtuse

9. Five angles measure 46°, 109°, 72°, 142°, and 55°. Which angle measures closest to 70°?
   A. 46°
   B. 55°
   C. 72°
   D. 109°

10. Four angles are shown: 70°, 133°, 35°, and 96°. Which is the largest angle?
    A. 35°
    B. 70°
    C. 96°
    D. 133°

11. Three acute angles measure 44°, 77°, and 65°. Which is the second largest?
    A. 44°
    B. 65°
    C. 77°
    D. All equal

12. Five angles measure 120°, 91°, 56°, 171°, and 79°. Which is the third largest?

A. 56°
B. 79°
C. 120°
D. 171°

13. Four angles are displayed: 27°, 106°, 78°, and 147°. Which angle is closest to 25°?
    A. 27°
    B. 78°
    C. 106°
    D. 147°

14. Three angles measure 123°, 50°, and 90°. Which is obtuse and greater than 115°?
    A. 50°
    B. 90°
    C. All acute
    D. 123°

15. Five angles are shown: 42°, 111°, 68°, 155°, and 86°. Which lists the two smallest in order?
    A. 155°, 111°
    B. 42°, 68°
    C. 68°, 86°
    D. 111°, 86°

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 8 cm × 12 cm × 14 cm. Which aperture allows the largest face to pass through?
    A. A rectangle 12 cm × 14 cm
    B. A circle 12 cm diameter
    C. A square 12 cm × 12 cm
    D. A triangle 14 cm base

17. A cylinder with diameter 12 cm and height 18 cm is shown. When entering circular end first, what aperture is needed?
    A. A rectangle 12 cm × 18 cm
    B. A square 18 cm × 18 cm
    C. A circle with at least 12 cm diameter
    D. A triangle 12 cm sides

18. A pyramid with square base 12 cm × 12 cm is presented. Which aperture accommodates the base?
    A. A circle 12 cm diameter
    B. A rectangle 10 cm × 12 cm
    C. A triangle 12 cm sides
    D. A square 12 cm × 12 cm or larger

19. A cube measuring 11 cm per side is shown. What is the smallest square aperture needed?
    A. 9 cm × 9 cm
    B. 11 cm × 11 cm
    C. 13 cm × 13 cm
    D. 22 cm × 22 cm

20. A triangular prism has base 10 cm per side and length 16 cm. Which aperture allows triangle-first passage?
    A. A square 10 cm × 10 cm
    B. A circle 16 cm diameter
    C. An equilateral triangle 10 cm sides
    D. A rectangle 10 cm × 16 cm

21. An L-shaped object measures 10 cm wide and 13 cm tall overall. Which aperture accommodates it?
    A. A rectangle 10 cm × 13 cm or larger
    B. A square 10 cm × 10 cm
    C. A circle 11 cm diameter
    D. A triangle 13 cm base

22. A sphere with diameter 15 cm is presented. What aperture is required?
    A. A square 13 cm × 13 cm
    B. A rectangle 14 cm × 16 cm
    C. A triangle 15 cm sides
    D. A circle with at least 15 cm diameter

23. A rectangular block 10 cm × 12 cm × 8 cm is shown. When oriented with 10 cm × 12 cm face forward, what aperture?
    A. A circle 12 cm diameter
    B. A rectangle 10 cm × 12 cm
    C. A square 12 cm × 12 cm
    D. A rectangle 8 cm × 10 cm

24. A hexagonal prism with 10 cm wide base and 17 cm length is displayed. Which aperture for hexagon-first entry?
    A. A hexagon approximately 10 cm across
    B. A circle 9 cm diameter
    C. A rectangle 10 cm × 17 cm
    D. A square 10 cm × 10 cm

25. A T-shaped object measures 14 cm wide and 16 cm tall. What minimum aperture?
    A. A rectangle 12 cm × 14 cm
    B. A square 14 cm × 14 cm
    C. A rectangle 14 cm × 16 cm
    D. A circle 16 cm diameter

26. An ellipsoid measures 11 cm × 14 cm × 9 cm. When oriented with 11 cm × 14 cm face forward, which aperture?
    A. An ellipse or rectangle 11 cm × 14 cm
    B. A circle 14 cm diameter
    C. A square 14 cm × 14 cm
    D. A rectangle 9 cm × 11 cm

27. A cross-shaped object has arms extending 12 cm in each direction. What aperture for face-first passage?
    A. A square 10 cm × 10 cm
    B. A circle 12 cm diameter
    C. A rectangle 12 cm × 14 cm
    D. A square 12 cm × 12 cm or larger

28. A cone with base diameter 14 cm is shown. Which aperture fits the base?
    A. A square 12 cm × 12 cm
    B. A circle with at least 14 cm diameter
    C. A rectangle 11 cm × 14 cm
    D. A triangle 14 cm sides

29. A rectangular block with rounded ends measures 10 cm × 12 cm × 16 cm with 2 cm radius curves. Which aperture for curved end?
    A. A rounded rectangle approximately 10 cm × 12 cm
    B. A rectangle 9 cm × 11 cm
    C. A circle 12 cm diameter
    D. A square 12 cm × 12 cm

30. An irregular object with dimensions 11 cm × 13 cm × 9 cm is shown. When oriented with smallest face forward, which aperture?
    A. A square 11 cm × 11 cm
    B. A circle 11 cm diameter
    C. A rectangle 11 cm × 9 cm
    D. A rectangle 13 cm × 9 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 rectangle, front view shows three rectangles stacked, end view shows rectangle. What is the object?
    A. A cylinder
    B. A cube
    C. A pyramid
    D. Three rectangular prisms stacked

32. Top view shows pentagon, front view shows rectangle, end view shows pentagon. What is the object?
    A. A pyramid
    B. A pentagonal prism
    C. A cube
    D. Five rectangular prisms

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

34. Top view is octagon, front view is octagon, end view is rectangle. What is the object?
    A. An octagonal pyramid
    B. A cube
    C. Eight rectangular prisms
    D. An octagonal prism oriented on its end

35. Top view shows triangle, front view shows triangle, end view shows rectangle. What is the object?
    A. A triangular prism oriented on its end
    B. A pyramid
    C. A rectangular prism

D. A cone

36. Top view shows square with X through it, front view shows four triangles, end view shows square with X. What does this represent?
    A. A solid cube
    B. A pyramid
    C. Four triangular prisms forming a square cross-section
    D. One prism

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

38. Top view shows triangle with line, front view shows two rectangles, end view shows triangle with line. What is the object?
    A. A cube
    B. Two triangular sections with a dividing feature
    C. A sphere
    D. A cylinder

39. Top view shows M-shape, front view shows rectangle, end view shows M-shape. What is the object?
    A. An M-shaped pyramid
    B. Two rectangular prisms
    C. An M-shaped prism
    D. A T-shape

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

41. Top view shows decagon, front view shows rectangle, end view shows decagon. What is the object?
    A. A decagonal pyramid
    B. Ten rectangular prisms
    C. A cube
    D. A decagonal prism

42. Top view shows oval, front view shows oval, end view shows rectangle. What is the object?
    A. An elliptical cylinder oriented on its end
    B. A sphere
    C. A cone
    D. A cube

43. Top view shows hexagon, front view shows hexagon, end view shows rectangle. What is the object?
    A. A hexagonal pyramid
    B. A cube
    C. A hexagonal prism oriented on its end
    D. Six prisms

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

45. Top view shows V-shape, front view shows rectangle, end view shows V-shape. What is the object?
    A. A V-shaped prism
    B. A V-shaped pyramid
    C. Two separate cubes
    D. A T-shaped beam

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 5 layers arranged 3 × 3 × 5. How many total cubes?
    A. 15
    B. 27
    C. 30
    D. 45

47. In a 6 × 6 × 6 cube, how many cubes are on the surface (have at least one face exposed)?
    A. 216
    B. 64
    C. 152

D. 200

48. A 3 × 5 × 7 structure is built. How many total cubes?
    A. 105
    B. 15
    C. 35
    D. 75

49. In a 9 × 9 × 9 cube where all faces are painted, how many cubes have exactly three painted faces?
    A. 27
    B. 8
    C. 12
    D. 64

50. A structure has 8 layers with 7 cubes per layer arranged 1 × 7. How many total cubes?
    A. 28
    B. 49
    C. 42
    D. 56

51. In a 3 × 6 × 7 structure, how many cubes are on corners?
    A. 8
    B. 12
    C. 24
    D. 6

52. A structure is 9 cubes high, 8 cubes wide, 7 cubes deep. How many total cubes?
    A. 24
    B. 360
    C. 504
    D. 210

53. In an L-shaped structure with 11 cubes on one arm and 10 on the other (sharing 1 corner), how many total cubes?
    A. 21
    B. 20
    C. 11
    D. 19

54. A 9 × 9 × 1 flat structure has all faces painted. How many cubes have exactly two painted faces?

A. 4
B. 36
C. 81
D. 32

55. A staircase has 6 cubes on first step, 8 on second, 10 on third. How many total cubes?
A. 10
B. 18
C. 24
D. 30

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

57. In an 11 × 1 × 1 structure (11 cubes in row), if all surfaces painted, how many cubes have exactly four painted faces?
A. 2
B. 11
C. 4
D. 9

58. A pyramid has layers: bottom 8 × 8 = 64 cubes, next 6 × 6 = 36 cubes, next 4 × 4 = 16 cubes, next 2 × 2 = 4 cubes, top 1 cube. How many total?
A. 64
B. 121
C. 100
D. 110

59. In an 8 × 8 × 8 cube with four corner cubes removed, how many cubes remain?
A. 512
B. 508
C. 508
D. 504

60. A plus-shaped structure uses 9 cubes for vertical arm and 9 for horizontal (sharing 1 center). How many total?
A. 17

B. 18
C. 9
D. 16

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 cell membrane?
   A. DNA storage
   B. Protein production
   C. Waste elimination
   D. Selective permeability and regulation of substances

2. Which organelle is responsible for protein synthesis?
   A. Mitochondrion
   B. Ribosome
   C. Lysosome
   D. Nucleus

3. During which phase of mitosis do sister chromatids separate and move to opposite poles?
   A. Prophase
   B. Metaphase
   C. Anaphase
   D. Telophase

4. What type of transport moves substances against their concentration gradient?
   A. Active transport
   B. Diffusion
   C. Osmosis
   D. Facilitated diffusion

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

6. How many chromosomes do human somatic cells contain?
   A. 23
   B. 46
   C. 92
   D. 48

7. In RNA, which base pairs with adenine?
   A. Uracil
   B. Thymine
   C. Guanine
   D. Cytosine

8. What type of inheritance involves traits carried on sex chromosomes?
   A. Complete dominance
   B. Sex-linked inheritance
   C. Codominance
   D. Incomplete dominance

9. During which phase of meiosis does crossing over occur?
   A. Metaphase II
   B. Anaphase I
   C. Prophase I
   D. Telophase II

10. Which blood component is responsible for clotting?
    A. Platelets
    B. Red blood cells
    C. White blood cells
    D. Plasma

11. What is the primary function of the large intestine?
    A. Nutrient digestion
    B. Enzyme production
    C. Bile secretion
    D. Water absorption and waste formation

12. Which tissue type connects and supports other tissues?
    A. Epithelial tissue
    B. Nervous tissue

C. Connective tissue
D. Muscle tissue

13. In a cross between Bb and Bb, what percentage of offspring will be homozygous dominant?
A. 50%
B. 25%
C. 75%
D. 100%

14. Which cell division process produces haploid 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. Stores DNA
D. Forms the structure of ribosomes

16. Which blood component transports oxygen?
A. Platelets
B. White blood cells
C. Red blood cells
D. Plasma proteins

17. What type of muscle is found in the walls of hollow organs?
A. Skeletal muscle
B. Smooth muscle
C. Cardiac muscle
D. Voluntary muscle

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

19. Which organelle contains digestive enzymes?

A. Lysosome
B. Mitochondrion
C. Ribosome
D. Golgi apparatus

20. What is the function of osteoblasts?
A. Break down bone
B. Store minerals
C. Build new bone
D. Produce blood cells

21. What type of cells are bacteria classified as?
A. Eukaryotic
B. Prokaryotic
C. Multicellular
D. Complex

22. What are the products of cellular respiration?
A. ATP, carbon dioxide, and water
B. Glucose and oxygen
C. Only carbon dioxide
D. Only water

23. Which system regulates body functions through chemical messengers?
A. Nervous system
B. Digestive system
C. Respiratory system
D. Endocrine system

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

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

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

27. What term describes the genetic makeup of an organism?
    A. Genotype
    B. Phenotype
    C. Allele
    D. Trait

28. During which phase of the cell cycle does the cell grow and prepare for division?
    A. M phase
    B. Interphase
    C. Prophase
    D. Cytokinesis

29. What are the main components of the peripheral nervous system?
    A. Only the brain
    B. Only the spinal cord
    C. Nerves throughout the body
    D. Only sensory organs

30. What distinguishes eukaryotic cells from prokaryotic cells?
    A. Presence of ribosomes
    B. Presence of cytoplasm
    C. Ability to divide
    D. Presence of a membrane-bound nucleus

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 mass number of an element?
    A. Number of protons only

B. Sum of protons and neutrons
C. Number of electrons
D. Number of neutrons only

2. Which subatomic particle is found in the nucleus and has no charge?
   A. Electron
   B. Proton
   C. Neutron
   D. Ion

3. What type of bond forms when one atom transfers electrons to another?
   A. Ionic bond
   B. Covalent bond
   C. Metallic bond
   D. Hydrogen bond

4. How many electrons can the first energy level hold?
   A. 2
   B. 8
   C. 18
   D. 32

5. What is produced when a strong acid reacts with a strong base?
   A. Only hydrogen gas
   B. Salt and water
   C. Only oxygen
   D. Only carbon dioxide

6. What is the molar mass of carbon dioxide (CO_2)? (C = 12 g/mol, O = 16 g/mol)
   A. 28 g/mol
   B. 32 g/mol
   C. 44 g/mol
   D. 40 g/mol

7. Which pH value indicates an acidic solution?
   A. 3
   B. 7
   C. 11
   D. 14

8. In the equation $N_2 + 3H_2 \rightarrow 2NH_3$, what is the coefficient of NH_3?
   A. 1
   B. 3
   C. 4
   D. 2

9. Atoms of the same element with different numbers of neutrons are called:
   A. Ions
   B. Isotopes
   C. Molecules
   D. Compounds

10. According to Boyle's Law, if pressure increases at constant temperature, what happens to volume?
   A. Volume increases
   B. Volume stays constant
   C. Volume decreases
   D. Volume becomes zero

11. When two atoms share electrons, what type of bond forms?
   A. Ionic bond
   B. Metallic bond
   C. Hydrogen bond
   D. Covalent bond

12. How many moles are in 24 grams of carbon (C)? (Atomic mass = 12 g/mol)
   A. 2 moles
   B. 12 moles
   C. 24 moles
   D. 36 moles

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

14. Which characteristic describes acids?
   A. Taste bitter
   B. Taste sour and turn litmus red
   C. Feel slippery

D. Have pH greater than 7

15. Which state of matter has a definite shape and volume?
    A. Solid
    B. Liquid
    C. Gas
    D. Plasma

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

17. How many hydrogen atoms are in $2Ca(OH)_2$?
    A. 2
    B. 4
    C. 8
    D. 1

18. What is the pH of a neutral solution at 25°C?
    A. 0
    B. 14
    C. 7
    D. 1

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

20. What type of reaction is $2H_2O \rightarrow 2H_2 + O_2$?
    A. Synthesis
    B. Single replacement
    C. Double replacement
    D. Decomposition

21. How many times more acidic is pH 1 compared to pH 4?
    A. 3 times

B. 10 times
C. 1000 times
D. 100 times

22. What charge does an electron have?
A. Positive
B. Negative
C. Neutral
D. Variable

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

24. What principle states that mass is conserved during chemical reactions?
A. Law of Multiple Proportions
B. Law of Definite Proportions
C. Boyle's Law
D. Law of Conservation of Mass

25. A 5 M solution is diluted from 20 mL to 100 mL. What is the new concentration?
A. 5 M
B. 2.5 M
C. 1 M
D. 0.5 M

26. What do acids produce in water according to the Arrhenius definition?
A. OH^- ions
B. H^+ ions
C. Na^+ 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 to volume when temperature decreases at constant pressure?
    A. Volume decreases
    B. Volume increases
    C. Volume stays constant
    D. Volume becomes infinite

29. A neutral nitrogen atom (atomic number = 7) has how many electrons?
    A. 6
    B. 8
    C. 7
    D. 14

30. According to Gay-Lussac's Law, what happens to pressure when temperature decreases at constant volume?
    A. Pressure increases
    B. Pressure stays constant
    C. Pressure becomes zero
    D. Pressure decreases

Answer Explanations - Practice Test 7

Reading Comprehension

1. Correct Answer: A (Delivering oxygen and removing carbon dioxide)

The passage states that "the respiratory system enables gas exchange, delivering oxygen to tissues while removing carbon dioxide, a metabolic waste product." These are the primary functions mentioned at the beginning of the passage.

2. Correct Answer: C (Warm, humidify, and filter incoming air)

The passage explicitly states that "the nasal cavity warms, humidifies, and filters incoming air through mucus and cilia that trap particles and pathogens." All three functions are mentioned together.

3. Correct Answer: D (Food from entering the trachea during swallowing)

The passage states that "the pharynx serves as a common pathway for air and food, with the epiglottis preventing food from entering the trachea during swallowing." This is the specific protective function of the epiglottis.

4. Correct Answer: C (Alveoli)

The passage clearly states that "progressively smaller bronchioles ending in alveoli—tiny air sacs where gas exchange occurs." Alveoli are identified as the specific site of gas exchange.

5. Correct Answer: A (300 million)

The passage states that "alveoli, numbering approximately 300 million in adult lungs, provide an enormous surface area for gas exchange." This specific number is provided.

6. Correct Answer: D (Reduce surface tension and prevent alveolar collapse)

The passage states that "surfactant, a substance produced by alveolar cells, reduces surface tension preventing alveolar collapse and decreasing the work of breathing." Both functions are mentioned.

7. Correct Answer: B (Blood carbon dioxide levels, pH, and oxygen levels)

The passage states that "the respiratory control center in the brainstem automatically regulates breathing rate and depth based on blood carbon dioxide levels, pH, and oxygen levels detected by chemoreceptors." All three factors are listed.

8. Correct Answer: C (Smoking)

The passage states that "smoking represents the primary COPD risk factor, though occupational exposures and genetic factors contribute." Smoking is specifically identified as the primary risk factor.

9. Correct Answer: A (Mechanical breakdown by teeth and chemical digestion by salivary amylase)

The passage states that "digestion begins with mastication, where teeth mechanically break food into smaller pieces while saliva initiates chemical digestion. Saliva contains the enzyme salivary amylase." Both mechanical and chemical processes are described.

10. Correct Answer: D (Missing teeth or painful dental conditions)

The passage states that "patients with missing teeth, ill-fitting dentures, or painful dental conditions may inadequately chew food, potentially leading to digestive problems and nutritional deficiencies." These are the causes of inadequate chewing mentioned.

11. Correct Answer: C (1.5-3.5)

The passage states that "gastric glands secrete hydrochloric acid creating a highly acidic environment (pH 1.5-3.5)." This specific pH range is provided.

12. Correct Answer: B (Vitamin B12 absorption)

The passage states that "intrinsic factor, produced by stomach cells, is essential for vitamin B12 absorption in the small intestine—its deficiency causes pernicious anemia." Vitamin B12 absorption is the essential function mentioned.

13. Correct Answer: D (Esophageal tissue and tooth enamel)

The passage states that "gastroesophageal reflux disease (GERD) occurs when stomach acid flows back into the esophagus, causing heartburn and potentially damaging esophageal tissue and tooth enamel." Both tissues are mentioned as potentially damaged.

14. Correct Answer: A (Small intestine)

The passage states that "the small intestine, measuring about 20 feet in adults, is the primary site for chemical digestion and nutrient absorption." It is explicitly identified as the primary site for nutrient absorption.

15. Correct Answer: C (Emulsify fats)

The passage states that "the liver produces bile, stored in the gallbladder, which emulsifies fats facilitating enzyme action." Emulsifying fats is the specific function of bile mentioned.

16. Correct Answer: B (Absorbs water and houses beneficial bacteria)

The passage states that "the large intestine absorbs water and electrolytes, houses beneficial bacteria fermenting undigested material and synthesizing vitamins." Both water absorption and housing bacteria are mentioned.

17. Correct Answer: D (The central nervous system and peripheral nervous system)

The passage states that "this complex network comprises the central nervous system (brain and spinal cord) and peripheral nervous system (nerves throughout the body)." Both components are mentioned together.

18. Correct Answer: A (Increase signal transmission speed)

The passage states that "myelin, a fatty insulation coating some axons, dramatically increases signal transmission speed—myelinated axons conduct impulses up to 100 times faster than unmyelinated axons." Increasing speed is the primary function.

19. Correct Answer: C (The immune system attacks myelin)

The passage states that "multiple sclerosis occurs when the immune system attacks myelin, causing progressive neurological deterioration." This is the specific mechanism described.

20. Correct Answer: D (All-or-nothing)

The passage states that "if depolarization reaches threshold, an action potential fires in an all-or-nothing manner—either it occurs fully or not at all." This describes how action potentials occur.

21. Correct Answer: A (Chemical neurotransmitters)

The passage states that "synaptic transmission transfers information between neurons through chemical neurotransmitters." Chemical neurotransmitters are the means of synaptic transmission.

22. Correct Answer: D (Primary excitatory signaling)

The passage states that "different neurotransmitters serve various functions: glutamate provides primary excitatory signaling." This is glutamate's specific function.

23. Correct Answer: B (Dopamine neuron loss)

The passage states that "Parkinson's disease involves dopamine neuron loss causing movement difficulties." Loss of dopamine neurons is the specific mechanism mentioned.

24. Correct Answer: C (Blocking nerve signals)

The passage states that "understanding neural anatomy enables accurate local anesthetic administration blocking nerve signals for pain control." Blocking nerve signals is how local anesthetics work.

25. Correct Answer: D (Structure, organ protection, movement, mineral storage, and blood cell production)

The passage states that "the musculoskeletal system provides structure, protects organs, enables movement, stores minerals, and produces blood cells." All five functions are listed together.

26. Correct Answer: A (Forms dense outer layers providing strength)

The passage states that "compact bone forms dense outer layers providing strength." This is the specific description of compact bone's function.

27. Correct Answer: C (Bone resorption exceeds formation)

The passage states that "osteoporosis develops when bone resorption exceeds formation, resulting in decreased bone density and increased fracture risk." This is the specific mechanism of osteoporosis development.

28. Correct Answer: B (Allow considerable movement and contain synovial fluid)

The passage states that "synovial joints, including the knee, hip, and temporomandibular joint, allow considerable movement through a joint capsule containing lubricating synovial fluid." Both characteristics are mentioned.

29. Correct Answer: A (Cartilage degeneration with aging or injury)

The passage states that "osteoarthritis results from cartilage degeneration with aging or injury." This is the specific cause mentioned for osteoarthritis.

30. Correct Answer: B (The sliding filament mechanism with actin and myosin)

The passage states that "muscle contraction occurs when nerve signals trigger calcium release within muscle cells, enabling the sliding filament mechanism where actin and myosin proteins interact, shortening muscle fibers." The sliding filament mechanism is the specific process described.

31. Correct Answer: C (Chewing, speaking, and facial expressions)

The passage states that "the temporomandibular joint, connecting the mandible to the skull, is one of the body's most frequently used joints, enabling chewing, speaking, and facial expressions." All three functions are listed.

32. Correct Answer: A (Jaw bone necrosis)

The passage states that "osteoporosis medications (bisphosphonates) can rarely cause jaw bone necrosis requiring prophylactic care before invasive procedures." Jaw bone necrosis is the specific rare complication mentioned.

33. Correct Answer: D (Pathogenic microorganisms including bacteria, viruses, fungi, and parasites)

The passage states that "infectious diseases result from pathogenic microorganisms including bacteria, viruses, fungi, and parasites that invade the body, multiply, and cause illness." All four types are mentioned.

34. Correct Answer: B (Metabolizing sugars and producing acid that demineralizes enamel)

The passage states that "Streptococcus mutans, the primary cariogenic bacteria, metabolizes sugars producing acid that demineralizes tooth enamel causing cavities." This is the complete mechanism described.

35. Correct Answer: A (Inhibiting bacterial cell wall synthesis)

The passage states that "penicillin inhibits bacterial cell wall synthesis." This is the specific mechanism by which penicillin works.

36. Correct Answer: D (Consist only of genetic material in a protein coat)

The passage states that "viruses differ fundamentally from bacteria, consisting only of genetic material (DNA or RNA) in a protein coat, lacking cellular machinery for independent reproduction." This is the key difference described.

37. Correct Answer: C (Exposing the immune system to weakened or killed pathogens to generate memory)

The passage states that "vaccines prevent viral infections by exposing the immune system to weakened, killed, or component forms of viruses, generating protective immune memory without causing disease." This describes how vaccines work.

38. Correct Answer: B (Direct or indirect contact through contaminated surfaces)

The passage states that "contact transmission, most common in healthcare settings, involves direct physical contact or indirect contact through contaminated surfaces or instruments." Both direct and indirect contact are mentioned.

39. Correct Answer: D (All patients regardless of infection status)

The passage states that "standard precautions, applied to all patients regardless of infection status, include hand hygiene before and after patient contact." The key point is that they apply to all patients.

40. Correct Answer: A (Protect themselves and vulnerable patients)

The passage states that "healthcare workers must maintain current immunizations against vaccine-preventable diseases including hepatitis B, influenza, measles, and recently COVID-19 to protect themselves and vulnerable patients." Both groups are mentioned as needing protection.

Language Usage

1. Correct Answer: B (equipment, and it also implemented)

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

2. Correct Answer: A (nor the hygienists were prepared)

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

3. Correct Answer: C (when she could schedule)

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

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

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

5. Correct Answer: A (preventive care, restorative treatments, and cosmetic procedures)

The sentence requires parallel structure. The original uses two nouns and then a verb phrase ("will offer cosmetic procedures"), which is not parallel. Option A maintains parallel structure by using three nouns: "preventive care, restorative treatments, and cosmetic procedures."

6. Correct Answer: D (After examining the patient's records, the hygienist prepared)

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

7. Correct Answer: B (method, and it also improves)

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

8. Correct Answer: C (must submit his or her certification renewal documents)

"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 C uses the correct singular forms.

9. Correct Answer: B (recommended that the assistant submit the report)

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: D (Reviewing the case carefully, the specialist determined a diagnosis)

The original sentence contains a dangling modifier. "Reviewing the case carefully" must modify a subject that can logically review—the specialist, not the diagnosis. Option D correctly places "the specialist" as the subject being modified.

11. Correct Answer: A (has completed his or her required training course)

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

12. Correct Answer: D (weekdays; however, it remains)

"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 D uses the correct punctuation.

13. Correct Answer: A (Fewer staff members attended)

"Less" is used with uncountable nouns, while "fewer" is used with countable nouns. "Staff members" is countable, so "fewer" is correct. Option A properly uses "fewer staff members."

14. Correct Answer: C (consulted the specialist, reviewed the case history, and developed)

The original sentence lacks parallel structure. The first two verbs are in simple past tense ("consulted," "reviewed"), but the third uses past progressive ("was developing"). Option C maintains parallel structure by using three simple past tense verbs.

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

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

16. Correct Answer: D (affect all employees and will take effect)

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

17. Correct Answer: C (critical. All instruments must)

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

18. Correct Answer: B (who completed advanced training)

"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 B makes this correction.

19. Correct Answer: A (Having analyzed the data thoroughly, the researcher presented the conclusion)

The original sentence contains a dangling modifier. The phrase "Having analyzed the data thoroughly" must modify "the researcher" (who did the analyzing), not "the conclusion." Option A correctly places "the researcher" immediately after the modifying phrase.

20. Correct Answer: D (should have contacted)

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

21. Correct Answer: C (examinations, x-rays, or cleanings)

The original sentence lacks parallel structure with a gerund phrase at the end. Option C maintains parallel structure by using three noun forms: "examinations, x-rays, or cleanings." All three are in parallel grammatical form.

22. Correct Answer: B (accuracy; it provides)

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

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

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

24. Correct Answer: C (Main Street near the downtown district of Denver, Colorado)

Street names should be capitalized ("Main Street," not "main 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: C (After the treatment was completed, the patient received)

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

26. Correct Answer: B (when he 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 B uses correct word order and appropriate tense.

27. Correct Answer: A (both agree that)

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

28. Correct Answer: D (are essential)

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

29. Correct Answer: C (outcomes, and they also enhance)

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

30. Correct Answer: B (care, such as orthodontics, periodontics, and endodontics)

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 B correctly uses the comma before "such as."

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

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

32. Correct Answer: B (to lie down in the chair)

"Lie" means to recline or rest in a horizontal position (intransitive verb). "Lay" means to place or put something down (transitive verb requiring an object). Since the patient is reclining, "lie" is correct. Option B correctly uses "lie down in the chair."

33. Correct Answer: B (significantly allowing professionals to deliver)

The participial phrase "allowing professionals to deliver superior care" modifies the main clause. A comma is needed to separate this modifying phrase from the main clause. Option B correctly places the comma before the participial phrase.

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

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

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

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

36. Correct Answer: C (services, such as routine care and preventive treatments, but)

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

37. Correct Answer: B (more convenient for patients than the old facility was)

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

38. Correct Answer: D (brushing daily, flossing regularly, and seeing the dentist)

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

39. Correct Answer: A (had been painful)

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

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

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

Quantitative Reasoning

1. Correct Answer: D (5)

To solve 7x - 11 = 24, first add 11 to both sides: 7x = 35. Then divide both sides by 7: x = 5. Verification: 7(5) - 11 = 35 - 11 = 24 ✓

2. Correct Answer: A (25%)

Percent increase formula: (New - Old)/Old × 100. Calculate: (175 - 140)/140 × 100 = 35/140 × 100 = 0.25 × 100 = 25%. Patient visits increased by 25%.

3. Correct Answer: D (7)

To solve 9y - 7 = 6y + 14, subtract 6y from both sides: 3y - 7 = 14. Add 7 to both sides: 3y = 21. Divide by 3: y = 7. Verification: 9(7) - 7 = 63 - 7 = 56, and 6(7) + 14 = 42 + 14 = 56 ✓

4. Correct Answer: B ($2,208)

Calculate weekly earnings: $46/hour × 8 hours/day × 6 days/week = $2,208 per week. Break it down: Daily earnings = $46 × 8 = $368; Weekly earnings = $368 × 6 = $2,208.

5. Correct Answer: A (90)

To find 24% of 375, multiply: 0.24 × 375 = 90. Alternatively, 24% is the same as 24/100, so (24/100) × 375 = 9,000/100 = 90.

6. Correct Answer: C (155)

Substitute a = 7 and b = -4 into $3a^2 - 2b$. Calculate: $3(7)^2 - 2(-4) = 3(49) - (-8) = 147 + 8 = 155$.

7. Correct Answer: D (56 mg)

Multiply the dosage rate by body weight: 0.7 mg/kg × 80 kg = 56 mg. The units of kilograms cancel out, leaving milligrams as the answer.

8. Correct Answer: B (4)

Expand the left side: $4(x + 6) = 4x + 24$. Set equal to right side: $4x + 24 = 2x + 32$. Subtract $2x$ from both sides: $2x + 24 = 32$. Subtract 24: $2x = 8$. Divide by 2: $x = 4$.

9. Correct Answer: C (1/3)

Total balls = 12 + 9 + 6 = 27 balls. Blue balls = 9. Probability of selecting blue = 9/27 = 1/3 (simplified by dividing numerator and denominator by 9).

10. Correct Answer: B (4,800 meters)

To convert kilometers to meters, multiply by 1,000 (since 1 km = 1,000 m): 4.8 km × 1,000 m/km = 4,800 meters. This is a standard metric conversion.

11. Correct Answer: D (152)

Substitute $x = 8$ into $3x^2 - 5x$: $3(8)^2 - 5(8) = 3(64) - 40 = 192 - 40 = 152$. Follow the order of operations: exponents first, then multiplication, then subtraction.

12. Correct Answer: A (20%)

Percent decrease = (Old - New)/Old × 100 = (3,500 - 2,800)/3,500 × 100 = 700/3,500 × 100 = 0.20 × 100 = 20%. The supplies decreased by 20%.

13. Correct Answer: C (10x - 48)

Distribute: $6(3x - 4) - 8(x + 3) = 18x - 24 - 8x - 24$. Combine like terms: $(18x - 8x) + (-24 - 24) = 10x - 48$. Remember to distribute the negative sign in $-8(x + 3)$.

14. Correct Answer: B (4)

If the ratio is 1:45 and there are 180 patients, find the number of dentists: 180 ÷ 45 = 4 dentists. This maintains the 1:45 ratio (4:180 = 1:45).

15. Correct Answer: A (48)

Solve $x/8 + 6 = 12$. First subtract 6 from both sides: $x/8 = 6$. Then multiply both sides by 8: $x = 48$. Verification: $48/8 + 6 = 6 + 6 = 12$ ✓

16. Correct Answer: D (3.6°F)

The increase is found by subtracting the original value from the new value: 101.8 - 98.2 = 3.6°F. This represents the amount of temperature increase.

17. Correct Answer: C (8)

Substitute x = 10 into 8x - 5y = 40: 8(10) - 5y = 40, which gives 80 - 5y = 40. Subtract 80 from both sides: -5y = -40. Divide by -5: y = 8.

18. Correct Answer: B ($390)

Calculate the 35% discount amount: 0.35 × $600 = $210. Subtract the discount from the original price: $600 - $210 = $390. The discounted price is $390.

19. Correct Answer: D (9)

Solve 11x - 8 = 8x + 19. Subtract 8x from both sides: 3x - 8 = 19. Add 8 to both sides: 3x = 27. Divide by 3: x = 9.

20. Correct Answer: A (32)

To find the mean, add all values and divide by the count: (20 + 26 + 32 + 38 + 44)/5 = 160/5 = 32. The mean is the arithmetic average of the data set.

21. Correct Answer: C (266 mL)

Calculate 38% of 700 mL: 0.38 × 700 = 266 mL. Alternatively, 38% is the same as 38/100, and 700 × 38/100 = 26,600/100 = 266 mL.

22. Correct Answer: B (15 and -15)

When $x^2 = 225$, take the square root of both sides. Remember that square roots have both positive and negative solutions: x = +15 or x = -15. Both values satisfy the equation: $(15)^2 = 225$ and $(-15)^2 = 225$.

23. Correct Answer: A (360)

Multiply: 18 patients/day × 5 days/week × 4 weeks = 360 patients total. Calculate step by step: 18 × 5 = 90 patients per week, then 90 × 4 = 360 patients in 4 weeks.

24. Correct Answer: D ($28x^9$)

When multiplying powers with the same base, multiply the coefficients and add the exponents: $(7x^6)(4x^3) = (7 \times 4)(x^{6+3}) = 28x^9$. Coefficient: 7 × 4 = 28. Exponent: 6 + 3 = 9.

25. Correct Answer: B (45%)

Convert the fraction to a decimal first: 9/20 = 0.45. Then multiply by 100 to get the percentage: 0.45 × 100 = 45%. Alternatively, 9/20 = 45/100 = 45%.

26. Correct Answer: C (16)

Calculate total hours in 4 days: 4 days × 24 hours/day = 96 hours. Divide by the dosing interval: 96 hours ÷ 6 hours/dose = 16 doses. The patient takes medication 4 times per day for 4 days.

27. Correct Answer: D (27 cm)

Perimeter formula for rectangle: P = 2L + 2W. Substitute known values: 90 = 2L + 2(18), which gives 90 = 2L + 36. Subtract 36: 54 = 2L. Divide by 2: L = 27 cm.

28. Correct Answer: A (8)

Solve 10x - 18 = 9x - 10. Subtract 9x from both sides: x - 18 = -10. Add 18 to both sides: x = 8. Verification: 10(8) - 18 = 80 - 18 = 62 and 9(8) - 10 = 72 - 10 = 62 ✓

29. Correct Answer: B ($984.40)

Calculate 7% tax on $920: 0.07 × $920 = $64.40. Add tax to original cost: $920 + $64.40 = $984.40. The total cost including sales tax is $984.40.

30. Correct Answer: D (22)

The median is the middle value when data is arranged in order. The data set 14, 18, 22, 26, 30 is already ordered. With 5 values, the middle (3rd) value is 22.

31. Correct Answer: A (10)

First solve for x: 7x - 12 = 23. Add 12 to both sides: 7x = 35. Divide by 7: x = 5. Then calculate 2x: 2(5) = 10.

32. Correct Answer: D (2,600 mL)

Convert liters to milliliters by multiplying by 1,000 (since 1 L = 1,000 mL): 2.6 L × 1,000 mL/L = 2,600 mL. This is a standard metric conversion.

33. Correct Answer: C (48)

Calculate step by step: $(-6)^2 - 4(-3)$. First, $(-6)^2 = 36$ (squaring a negative gives a positive). Second, -4(-3) = +12 (multiplying two negatives gives a positive). Finally, 36 + 12 = 48.

34. Correct Answer: A (10)

Calculate 25% of 40: 0.25 × 40 = 10 dentists. Alternatively, 25% is the same as 1/4, and 40 × 1/4 = 40/4 = 10 dentists work at the practice.

35. Correct Answer: B (70)

Solve x/10 = 7 by multiplying both sides by 10: x = 7 × 10 = 70. Verification: 70/10 = 7 ✓

36. Correct Answer: D (7/8)

Convert 0.875 to a fraction: 0.875 = 875/1000. Simplify by dividing both numerator and denominator by 125: 875/1000 = 7/8. This fraction is in simplest form since 7 and 8 share no common factors.

37. Correct Answer: C (20)

Use the elimination method. Add the two equations: (x + y) + (x - y) = 28 + 12, which gives 2x = 40. Divide by 2: x = 20. The y terms cancel when adding the equations.

38. Correct Answer: B (104°F)

Substitute C = 40 into F = (9/5)C + 32: F = (9/5)(40) + 32 = 1.8(40) + 32 = 72 + 32 = 104°F. This represents a high fever temperature.

39. Correct Answer: A (24)

The range is the difference between the maximum and minimum values: 44 - 20 = 24. Range measures the spread of the data from lowest to highest value.

40. Correct Answer: C (3:4)

Write the ratio: 135:180. Simplify by dividing both numbers by their GCF (45): 135/45 = 3 and 180/45 = 4. The simplest form of the ratio is 3:4.

Perceptual Ability

ANGLE DISCRIMINATION (Questions 1-15)

1. Correct Answer: A (Angle 1)

The angles measure: Angle 1 = 58°, Angle 2 = 120°, Angle 3 = 82°, Angle 4 = 141°. Comparing all measurements, 58° is the smallest angle shown.

2. Correct Answer: B (Angle B)

The three angles measure: Angle A = 39°, Angle B = 130°, Angle C = 96°. Obtuse angles measure between 90° and 180°. Only Angle B at 130° is both obtuse AND greater than 125°. Angle A is acute and Angle C is obtuse but less than 125°.

3. Correct Answer: D (149°)

The five angles measure 30°, 97°, 61°, 149°, and 88°. Comparing all measurements, 149° is the largest angle shown.

4. Correct Answer: A (45°)

The four angles measure 45°, 110°, 73°, and 137°. Comparing all measurements, 45° is the smallest angle shown.

5. Correct Answer: C (48°, 82°, 128°)

The three angles measure 82°, 128°, and 48°. Arranging from smallest to largest: 48°, 82°, 128°. This represents the correct ascending order.

6. Correct Answer: D (76°)

Acute angles measure less than 90°. From the five angles (37°, 105°, 76°, 153°, 62°), the acute angles are 37°, 76°, and 62°. Comparing distances from 80°: 37° is 43° away, 76° is 4° away, and 62° is 18° away. Angle 76° is closest to 80°.

7. Correct Answer: B (54°)

The four angles measure 23°, 101°, 54°, and 168°. Ordering from smallest to largest: 23°, 54°, 101°, 168°. The second smallest angle is 54°.

8. Correct Answer: A (39°)

Acute angles measure less than 90°. From the three angles (39°, 95°, 160°), only 39° is acute. Angles 95° and 160° are both obtuse. The acute and smallest angle is 39°.

9. Correct Answer: C (72°)

The five angles measure 46°, 109°, 72°, 142°, and 55°. Comparing distances from 70°: 46° is 24° away, 55° is 15° away, 72° is 2° away, 109° is 39° away, and 142° is 72° away. Angle 72° is closest to 70°.

10. Correct Answer: D (133°)

The four angles measure 70°, 133°, 35°, and 96°. Comparing all measurements, 133° is the largest angle shown.

11. Correct Answer: B (65°)

The three acute angles measure 44°, 77°, and 65°. Ordering from largest to smallest: 77°, 65°, 44°. The second largest angle is 65°.

12. Correct Answer: C (120°)

The five angles measure 120°, 91°, 56°, 171°, and 79°. Ordering from largest to smallest: 171°, 120°, 91°, 79°, 56°. The third largest angle is 120°.

13. Correct Answer: A (27°)

The four angles measure 27°, 106°, 78°, and 147°. Comparing distances from 25°: 27° is 2° away, 78° is 53° away, 106° is 81° away, and 147° is 122° away. Angle 27° is closest to 25°.

14. Correct Answer: D (123°)

Obtuse angles measure between 90° and 180°. From the three angles (123°, 50°, 90°), only 123° is both obtuse AND greater than 115°. Angle 50° is acute and 90° is right (not obtuse).

15. Correct Answer: B (42°, 68°)

The five angles measure 42°, 111°, 68°, 155°, and 86°. Ordering all angles from smallest to largest: 42°, 68°, 86°, 111°, 155°. The two smallest angles in order are 42°, 68°.

APERTURES (Questions 16-30)

16. Correct Answer: A (A rectangle 12 cm × 14 cm)

A rectangular prism measuring 8 cm × 12 cm × 14 cm has three possible face orientations. The largest face measures 12 cm × 14 cm. This rectangular aperture would accommodate the largest face when properly oriented.

17. Correct Answer: C (A circle with at least 12 cm diameter)

When a cylinder with diameter 12 cm is oriented with its circular end forward, the cross-section presented is circular with 12 cm diameter. The aperture must be a circle with at least 12 cm diameter to allow passage.

18. Correct Answer: D (A square 12 cm × 12 cm or larger)

A pyramid with a square base measuring 12 cm × 12 cm requires a square aperture of at least 12 cm × 12 cm to accommodate the base when oriented base-first.

19. Correct Answer: B (11 cm × 11 cm)

A cube measuring 11 cm on each side, when oriented face-first, presents a square cross-section of 11 cm × 11 cm. This is the exact size needed for the smallest square aperture through which it can pass.

20. Correct Answer: C (An equilateral triangle 10 cm sides)

A triangular prism with an equilateral triangular base measuring 10 cm on each side, when entering triangle-first, requires an aperture matching that triangular shape with 10 cm sides.

21. Correct Answer: A (A rectangle 10 cm × 13 cm or larger)

An L-shaped object with overall dimensions of 10 cm wide and 13 cm tall requires a rectangular aperture of at least 10 cm × 13 cm to accommodate the entire object's profile when passing through.

22. Correct Answer: D (A circle with at least 15 cm diameter)

A sphere with a 15 cm diameter requires a circular aperture of at least 15 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 10 cm × 12 cm)

A rectangular block measuring 10 cm × 12 cm × 8 cm, when oriented with the 10 cm × 12 cm face forward, requires a rectangular aperture of at least 10 cm × 12 cm to pass through.

24. Correct Answer: A (A hexagon approximately 10 cm across)

A hexagonal prism with a 10 cm wide hexagonal base, when entering hexagon-first, requires an aperture that matches the hexagonal shape, approximately 10 cm across at its widest point.

25. Correct Answer: C (A rectangle 14 cm × 16 cm)

A T-shaped object with overall dimensions of 14 cm wide and 16 cm tall requires a rectangular aperture of at least 14 cm × 16 cm to accommodate the entire T profile when passing through face-first.

26. Correct Answer: A (An ellipse or rectangle 11 cm × 14 cm)

An ellipsoid measuring 11 cm × 14 cm × 9 cm, when oriented with the 11 cm × 14 cm face forward, requires an elliptical or rectangular aperture of approximately 11 cm × 14 cm.

27. Correct Answer: D (A square 12 cm × 12 cm or larger)

A cross-shaped object with arms extending 12 cm in each direction requires a square aperture of at least 12 cm × 12 cm to accommodate the full width and height of the cross profile when entering face-first.

28. Correct Answer: B (A circle with at least 14 cm diameter)

A cone with a base diameter of 14 cm, when oriented base-first, presents a circular cross-section of 14 cm diameter. The aperture must be a circle with at least 14 cm diameter.

29. Correct Answer: A (A rounded rectangle approximately 10 cm × 12 cm)

A rectangular block measuring 10 cm × 12 cm × 16 cm with 2 cm radius curves on the ends requires a rounded rectangular aperture of approximately 10 cm × 12 cm to accommodate the curved end profile.

30. Correct Answer: C (A rectangle 11 cm × 9 cm)

An irregular object with maximum dimensions of 11 cm × 13 cm × 9 cm, when oriented with its smallest face (11 cm × 9 cm) forward, requires a rectangular aperture of at least 11 cm × 9 cm.

ORTHOGRAPHIC PROJECTIONS (Questions 31-45)

31. Correct Answer: D (Three rectangular prisms stacked)

A rectangular top view combined with a front view showing three rectangles stacked and a rectangular end view indicates three rectangular prisms (boxes) stacked vertically one on top of the others.

32. Correct Answer: B (A pentagonal prism)

Pentagonal (5-sided) top and end views combined with a rectangular front view indicates a pentagonal prism—an object with a uniform five-sided cross-section throughout its length.

33. Correct Answer: C (Front view only)

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

34. Correct Answer: D (An octagonal prism oriented on its end)

An octagonal top view, octagonal front view, and rectangular end view indicates an octagonal prism oriented on its end (standing vertically with the octagonal cross-section visible from the top and front).

35. Correct Answer: A (A triangular prism oriented on its end)

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

36. Correct Answer: C (Four triangular prisms forming a square cross-section)

A square with an X through it in the top and end views, combined with four triangles in the front view, suggests four triangular prisms arranged together to form a square cross-section with diagonal divisions when viewed from top or end.

37. Correct Answer: B (A star-shaped prism)

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

38. Correct Answer: B (Two triangular sections with a dividing feature)

A triangle with a line in both the top and end views, combined with two rectangles in the front view, suggests two triangular sections with a dividing feature or separation between them.

39. Correct Answer: C (An M-shaped prism)

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

40. Correct Answer: D (Six cubes in a row)

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

41. Correct Answer: D (A decagonal prism)

Decagonal (10-sided) top and end views combined with a rectangular front view indicates a decagonal prism—an object with a uniform ten-sided cross-section throughout its length.

42. Correct Answer: A (An elliptical cylinder oriented on its end)

Oval (ellipse) top and front views combined with a rectangular end view indicates an elliptical cylinder oriented on its end (standing vertically with the elliptical cross-section visible from the top and front).

43. Correct Answer: C (A hexagonal prism oriented on its end)

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

44. Correct Answer: B (Four cylinders arranged in square pattern)

Four circles in square pattern in the top view, four rectangles in the front view, and a circle in the end view suggests four cylindrical objects arranged in a square pattern.

45. Correct Answer: A (A V-shaped prism)

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

CUBE COUNTING (Questions 46-60)

46. Correct Answer: D (45)

A structure with 5 layers arranged 3 × 3 × 5 contains: 3 cubes wide × 3 cubes deep × 5 cubes high = 45 total cubes. Multiply the three dimensions to find the total count.

47. Correct Answer: C (152)

In a 6 × 6 × 6 cube structure containing 216 total cubes, only the interior cubes (4 × 4 × 4 = 64 cubes) have no faces exposed. Therefore, cubes on the surface with at least one face exposed = 216 - 64 = 152 cubes.

48. Correct Answer: A (105)

A 3 × 5 × 7 structure contains: 3 cubes × 5 cubes × 7 cubes = 105 total cubes. Multiply the three dimensions to find the total count.

49. Correct Answer: B (8)

In a 9 × 9 × 9 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: D (56)

With 8 layers and 7 cubes per layer arranged 1 × 7: Total cubes = 8 layers × 7 cubes per layer = 56 cubes. Alternatively, 1 × 7 × 8 = 56 cubes.

51. Correct Answer: A (8)

Any rectangular prism has exactly 8 corners (vertices). In a 3 × 6 × 7 structure, there are 8 corner cubes where three edges meet.

52. Correct Answer: C (504)

A structure 9 cubes high × 8 cubes wide × 7 cubes deep contains: 9 × 8 × 7 = 504 total cubes. Multiply the three dimensions to find the total count.

53. Correct Answer: B (20)

An L-shaped structure with 11 cubes on one arm and 10 on the other, sharing 1 corner cube: Total = 11 + 10 - 1 = 20 cubes. Subtract the shared corner cube to avoid counting it twice.

54. Correct Answer: D (32)

In a 9 × 9 × 1 flat structure, cubes with exactly two painted faces are the perimeter cubes excluding corners. Perimeter cubes = 9 + 9 + 9 + 9 - 4 corners = 36 - 4 = 32 cubes with two painted faces.

55. Correct Answer: C (24)

A staircase structure with 6 cubes on first step, 8 on second, and 10 on third contains: 6 + 8 + 10 = 24 total cubes. This is the sum of the arithmetic sequence.

56. Correct Answer: A (8)

Any rectangular prism has exactly 8 corners (vertices). In an 8 × 9 × 10 structure, there are 8 corner cubes where three faces meet at each corner position.

57. Correct Answer: D (9)

In an 11 × 1 × 1 structure (11 cubes in a row), the 2 end cubes have 5 faces painted, and the 9 middle cubes have exactly 4 faces painted (top, bottom, front, back—not the two sides touching adjacent cubes).

58. Correct Answer: B (121)

Bottom layer: 8 × 8 = 64 cubes. Next layer: 6 × 6 = 36 cubes. Next layer: 4 × 4 = 16 cubes. Next layer: 2 × 2 = 4 cubes. Top layer: 1 cube. Total = 64 + 36 + 16 + 4 + 1 = 121 cubes in this pyramid structure.

59. Correct Answer: C (508)

An 8 × 8 × 8 cube contains 512 total cubes. With four corner cubes removed: 512 - 4 = 508 cubes remain.

60. Correct Answer: A (17)

A plus-shaped structure with 9 cubes for vertical arm and 9 cubes for horizontal arm, sharing 1 center cube: Total = 9 + 9 - 1 = 17 cubes. The center cube where the arms intersect is counted only once.

Biology

1. Correct Answer: D (Selective permeability and regulation of substances)

The primary function of the cell membrane (plasma membrane) is selective permeability and regulation of substances entering and exiting the cell. It acts as a selective barrier, controlling the passage of materials to maintain proper internal conditions through selective permeability, allowing beneficial materials in while keeping harmful substances out and regulating what leaves the cell.

2. Correct Answer: B (Ribosome)

Ribosomes are the organelles responsible for protein synthesis. They translate the genetic information carried by mRNA into proteins by assembling amino acids in the correct sequence. Ribosomes can be found free in the cytoplasm or attached to the rough endoplasmic reticulum.

3. Correct Answer: C (Anaphase)

During anaphase of mitosis, sister chromatids separate and move to opposite poles of the cell. The spindle fibers shorten, pulling the sister chromatids apart toward opposite ends of the cell. This ensures each daughter cell will receive an identical set of chromosomes.

4. Correct Answer: A (Active transport)

Active transport is the process that moves substances against their concentration gradient (from low to high concentration). This process requires energy in the form of ATP because it moves substances in the opposite direction of their natural tendency to diffuse. Examples include the sodium-potassium pump.

5. Correct Answer: D (Brings amino acids to ribosomes during translation)

The primary function of transfer RNA (tRNA) is to bring specific amino acids to the ribosome during translation. Each tRNA molecule has an anticodon that matches a codon on the mRNA and carries the corresponding amino acid, ensuring that amino acids are added to the growing protein chain in the correct sequence specified by the genetic code.

6. Correct Answer: B (46)

Human somatic cells (body cells) contain 46 chromosomes, which is the diploid number (2n = 46). These consist of 23 pairs of chromosomes—22 pairs of autosomes and 1 pair of sex chromosomes. Gametes (sex cells) contain 23 chromosomes, the haploid number.

7. Correct Answer: A (Uracil)

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

8. Correct Answer: B (Sex-linked inheritance)

Sex-linked inheritance involves traits carried on sex chromosomes (X or Y chromosomes). Most sex-linked traits are X-linked, meaning the gene is located on the X chromosome. These traits affect males more frequently than females because males have only one X chromosome, while females have two.

9. Correct Answer: C (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: A (Platelets)

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

11. Correct Answer: D (Water absorption and waste formation)

The primary function of the large intestine is water absorption and waste formation. It absorbs water and electrolytes from the remaining indigestible food matter, consolidating it into feces. The large intestine also houses beneficial bacteria and stores waste until elimination.

12. Correct Answer: C (Connective tissue)

Connective tissue is the tissue type that connects and supports other tissues throughout the body. It includes various types such as loose connective tissue, dense connective tissue, cartilage, bone, blood, and adipose tissue. Connective tissue provides structural support, binds tissues together, and transports substances.

13. Correct Answer: B (25%)

In a cross between two heterozygous parents (Bb × Bb), the Punnett square produces: BB (25%), Bb (50%), and bb (25%). The homozygous dominant genotype (BB) appears in 25% or 1/4 of offspring.

14. Correct Answer: A (Meiosis)

Meiosis is the cell division process that produces haploid 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.

15. Correct Answer: D (Forms the structure of ribosomes)

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

16. Correct Answer: C (Red blood cells)

Red blood cells (erythrocytes) are the blood component responsible for transporting oxygen 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.

17. Correct Answer: B (Smooth muscle)

Smooth muscle is the type of muscle tissue that is involuntary and found in the walls of hollow organs. It lines the digestive tract, blood vessels, bladder, uterus, and other internal organs. Smooth muscle contracts slowly and rhythmically without conscious control to move substances through organs or regulate vessel diameter.

18. Correct Answer: D (Protein)

The end product of translation is a protein. During translation, ribosomes read the mRNA sequence and assemble amino acids in the specified order to create a polypeptide chain (protein). The ribosome catalyzes peptide bond formation between amino acids, producing the final protein product.

19. Correct Answer: A (Lysosome)

Lysosomes are membrane-bound organelles that contain digestive enzymes. These 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 through enzymatic digestion.

20. Correct Answer: C (Build new bone)

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

21. Correct Answer: B (Prokaryotic)

Bacteria are classified as prokaryotic cells. Prokaryotes lack a membrane-bound nucleus and other membrane-bound organelles. Their DNA is located in a nucleoid region rather than enclosed in a nuclear envelope, and they lack the complex internal membrane systems found in eukaryotic cells.

22. Correct Answer: A (ATP, carbon dioxide, and water)

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

23. Correct Answer: D (Endocrine system)

The endocrine system regulates body functions through chemical messengers called hormones. 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, and stress responses.

24. Correct Answer: C (UACG)

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

25. Correct Answer: B (Veins)

Veins are blood vessels that carry blood toward 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.

26. Correct Answer: D (Lipid synthesis)

The primary function of the smooth endoplasmic reticulum (smooth ER) is lipid synthesis. It produces lipids including phospholipids and cholesterol for cell membranes, and in some cells, it produces steroid hormones. The smooth ER also detoxifies certain drugs and harmful substances and stores calcium ions.

27. Correct Answer: A (Genotype)

Genotype is the term that describes the genetic makeup of an organism—the specific combination of alleles an organism possesses for a trait or for all its genes. This contrasts with phenotype, which describes the observable physical or biochemical characteristics that result from the genotype's interaction with the environment.

28. Correct Answer: B (Interphase)

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

29. Correct Answer: C (Nerves throughout the body)

The main components of the peripheral nervous system (PNS) are the nerves throughout the body that extend from the central nervous system. The PNS includes all the nerves outside the brain and spinal cord, consisting of sensory (afferent) nerves that carry signals to the CNS and motor (efferent) nerves that carry signals from the CNS to muscles and glands.

30. Correct Answer: D (Presence of a 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.

General Chemistry

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

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

2. Correct Answer: C (Neutron)

Neutrons are subatomic particles found in the nucleus 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 a positive charge, while electrons (found outside the nucleus) have a negative charge.

3. Correct Answer: A (Ionic bond)

An ionic bond forms when one atom transfers electrons completely to another atom. Typically, a metal atom loses electrons to become a positively charged cation, and a nonmetal atom gains those electrons to become a negatively charged anion. The electrostatic attraction between oppositely charged ions creates the ionic bond.

4. Correct Answer: A (2)

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

5. Correct Answer: B (Salt and water)

When a strong acid reacts with a strong 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, while the remaining ions form a salt.

6. Correct Answer: C (44 g/mol)

The molar mass of carbon dioxide (CO_2) is calculated by adding the atomic masses: 1 carbon atom (12 g/mol) + 2 oxygen atoms (2 × 16 g/mol = 32 g/mol) = 44 g/mol total.

7. Correct Answer: A (3)

The pH scale ranges from 0 to 14, with pH 7 being neutral. Acidic solutions have pH values less than 7. Among the options, pH 3 indicates an acidic solution. pH 7 is neutral, while pH 11 and 14 are basic.

8. Correct Answer: D (2)

In the balanced equation $N_2 + 3H_2 \rightarrow 2NH_3$, the coefficient of NH_3 is 2. This coefficient indicates that 2 molecules of ammonia are produced when 1 molecule of nitrogen gas reacts with 3 molecules of hydrogen gas.

9. Correct Answer: B (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 the same chemical properties. For example, carbon-12 and carbon-14 are isotopes with 6 protons but 6 and 8 neutrons respectively.

10. Correct Answer: C (Volume decreases)

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

11. Correct Answer: D (Covalent bond)

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

12. Correct Answer: A (2 moles)

To calculate moles, divide mass by molar mass: moles = 24 g ÷ 12 g/mol = 2 moles. This shows that 24 grams of carbon contains 2 moles of carbon atoms.

13. Correct Answer: C (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 (Taste sour and turn litmus red)

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

15. Correct Answer: A (Solid)

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

16. Correct Answer: D (Electrons are transferred forming charged 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: B (4)

The formula $2Ca(OH)_2$ represents 2 formula units of calcium hydroxide. Each $Ca(OH)_2$ contains 2 OH groups, and each OH group contains 1 hydrogen atom. Therefore: 2 formula units × 2 OH groups per unit × 1 hydrogen per OH = 4 hydrogen 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: A (Group 1)

The alkali metals are located in Group 1 of the periodic table and include lithium, sodium, potassium, rubidium, cesium, and francium. These highly reactive metals have 1 valence electron and readily form +1 ions by losing that electron.

20. Correct Answer: D (Decomposition)

The reaction $2H_2O \rightarrow 2H_2 + O_2$ represents a decomposition reaction, where a single compound breaks down into two or more simpler substances. This is the opposite of a synthesis reaction (A + B → AB). Water decomposes into hydrogen and oxygen.

21. Correct Answer: C (1000 times)

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

22. Correct Answer: B (Negative)

Electrons are subatomic particles that carry a negative electrical charge (-1). They are located outside the nucleus in electron shells or orbitals and have negligible mass compared to protons and neutrons. The movement of electrons is responsible for chemical bonding and electrical current.

23. Correct Answer: A (1)

Elements in Group 1 (the alkali metals) have 1 valence electron in their outermost energy level. This includes lithium, sodium, potassium, rubidium, cesium, and francium. Because they have only one valence electron, they are highly reactive and readily lose that electron to form +1 ions.

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: C (1 M)

Using the dilution formula $M_1V_1 = M_2V_2$: (5 M)(20 mL) = M_2(100 mL). Solving: $100 = 100M_2$, so M_2 = 1 M. Diluting from 20 mL to 100 mL (5-fold dilution) reduces the concentration from 5 M to 1 M.

26. Correct Answer: B (H^+ ions)

According to the Arrhenius definition, acids are substances that produce hydrogen ions (H^+) when dissolved in water. For example, HCl dissociates to produce H^+ and Cl^- ions. Bases, in contrast, produce OH^- 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: A (Volume decreases)

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

29. Correct Answer: C (7)

A neutral atom has equal numbers of protons and electrons, making the overall charge zero. Nitrogen has an atomic number of 7, meaning it has 7 protons. Therefore, a neutral nitrogen atom also has 7 electrons to balance the positive charge of the protons.

30. Correct Answer: D (Pressure decreases)

According to Gay-Lussac's Law, at constant volume, gas pressure is directly proportional to absolute temperature. When temperature decreases, gas molecules move slower and collide with container walls less frequently and with less force, causing pressure to decrease proportionally.