

Full-Length Practice Test 6

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 immune system serves as the body's defense network against pathogens, abnormal cells, and foreign substances. This complex system comprises innate immunity, providing immediate nonspecific defense, and adaptive immunity, offering targeted, long-lasting protection. The immune system distinguishes between self and non-self molecules, attacking invaders while normally tolerating the body's own tissues. Understanding immune function is crucial for healthcare professionals because immune dysfunction underlies allergies, autoimmune diseases, immunodeficiency disorders, and affects vaccination responses and transplant success.

Innate immunity provides the first line of defense through physical barriers, chemical defenses, and cellular responses. Physical barriers include skin and mucous membranes that prevent pathogen entry. Chemical defenses involve antimicrobial substances like stomach acid, enzymes in tears and saliva, and antimicrobial peptides in mucus. When pathogens breach these barriers, cellular innate responses activate immediately. Phagocytic cells like neutrophils and macrophages engulf and destroy pathogens, while natural killer cells detect and eliminate virus-infected or cancerous cells. The inflammatory response, characterized by redness, heat, swelling, and pain, recruits immune cells to infection sites and promotes healing.

Adaptive immunity develops more slowly but provides specific, long-lasting protection through lymphocytes. B lymphocytes produce antibodies—proteins that bind to specific antigens on pathogens, marking them for destruction and neutralizing toxins. Each B cell produces antibodies recognizing one specific antigen, and upon encountering that antigen, the B cell proliferates, producing plasma cells that secrete large quantities of antibodies and memory B cells that provide long-term immunity. T lymphocytes coordinate immune responses and directly kill infected cells. Helper T cells activate other immune cells, while cytotoxic T cells destroy virus-infected and cancerous cells by inducing apoptosis.

Immunological memory explains vaccine effectiveness and why people typically don't contract the same infectious disease twice. After initial exposure to an antigen, memory B and T cells persist for years or decades. Upon re-exposure, these memory cells respond rapidly and vigorously, often preventing illness entirely or reducing severity. Vaccines exploit this mechanism by exposing the immune system to

weakened or killed pathogens or pathogen components, generating memory without causing disease. For dental professionals, understanding immunity is essential because oral tissues constantly encounter microorganisms, immunocompromised patients require modified treatment approaches, and some dental conditions like periodontitis involve immune-mediated tissue destruction. Additionally, healthcare workers must maintain current vaccinations to protect themselves and vulnerable patients from preventable diseases.

1. According to the passage, the immune system's ability to distinguish between self and non-self molecules means it:
 - A. Always attacks the body's own tissues
 - B. Cannot recognize foreign substances
 - C. Prevents all infections
 - D. Attacks invaders while normally tolerating the body's tissues

2. The passage indicates that physical barriers in innate immunity include:
 - A. Antibodies only
 - B. T cells only
 - C. Skin and mucous membranes
 - D. Memory cells

3. Based on the passage, neutrophils and macrophages are classified as:
 - A. Antibodies
 - B. Phagocytic cells
 - C. T lymphocytes
 - D. Memory cells

4. According to the passage, the inflammatory response is characterized by:
 - A. Antibody production only
 - B. Memory cell formation
 - C. T cell activation only
 - D. Redness, heat, swelling, and pain

5. The passage states that B lymphocytes produce:
 - A. Antibodies
 - B. Cytotoxic cells
 - C. Phagocytes
 - D. Natural killer cells

6. Based on the passage, helper T cells function to:
 - A. Activate other immune cells

- B. Produce antibodies
 - C. Form physical barriers
 - D. Create mucus
7. According to the passage, memory B and T cells:
- A. Only last for days
 - B. Cannot respond to re-exposure
 - C. Persist for years or decades
 - D. Are destroyed after first exposure
8. The passage indicates that vaccines work by:
- A. Preventing all immune responses
 - B. Destroying memory cells
 - C. Eliminating innate immunity
 - D. Generating memory without causing disease

PASSAGE 2

Nutrition profoundly influences oral and systemic health, with dietary choices affecting tooth integrity, periodontal health, wound healing, and chronic disease risk. The relationship between nutrition and oral health operates bidirectionally—poor nutrition compromises oral tissues while oral disease impairs nutritional intake. Healthcare professionals must understand nutritional biochemistry, recognize nutritional deficiencies' oral manifestations, and provide evidence-based dietary counseling. Macronutrients (carbohydrates, proteins, and fats) provide energy and structural components, while micronutrients (vitamins and minerals) regulate metabolic processes essential for maintaining healthy oral and systemic tissues.

Carbohydrates, the body's primary energy source, include simple sugars and complex carbohydrates. Simple sugars, particularly sucrose, are highly cariogenic because oral bacteria rapidly ferment them into acids that demineralize tooth enamel. Frequency of sugar consumption matters more than total amount—constant snacking maintains an acidic oral environment, promoting cavity formation. Complex carbohydrates from whole grains, vegetables, and legumes break down more slowly, causing less dramatic pH drops. Dietary fiber from these sources may provide protective effects by stimulating saliva flow and requiring more chewing, which mechanically cleans teeth and buffers acids.

Proteins and specific amino acids are essential for tissue repair, immune function, and collagen synthesis. Collagen, the body's most abundant protein, provides structural support for gums, periodontal ligament, and oral mucosa. Vitamin C (ascorbic acid) is absolutely required for collagen synthesis—its deficiency causes scurvy, characterized by bleeding gums, tooth mobility, and poor wound healing. Adequate protein intake supports healing after dental procedures and maintains periodontal health. Calcium and phosphorus

are the primary minerals in tooth structure, comprising hydroxyapatite crystals in enamel and dentin. Vitamin D facilitates calcium absorption and bone metabolism, with deficiency causing rickets in children and osteomalacia in adults, both potentially affecting jaw bone and tooth development.

Iron deficiency, the world's most common nutritional deficiency, causes anemia that may present orally as glossitis (inflamed tongue), angular cheilitis (cracks at mouth corners), and increased infection susceptibility. B-complex vitamins support numerous metabolic processes, with deficiencies producing oral manifestations—B2 (riboflavin) deficiency causes glossitis and cheilitis, B3 (niacin) deficiency results in pellagra with characteristic oral ulcers and glossitis, and B12 or folate deficiency can cause megaloblastic anemia with oral symptoms including glossitis and aphthous ulcers. For dental professionals, nutritional assessment should be part of comprehensive patient care. Dietary counseling should emphasize limiting frequent sugar consumption, ensuring adequate vitamins and minerals through varied diet or supplementation when needed, and recognizing that certain oral conditions may indicate nutritional deficiencies requiring medical referral. Additionally, patients with poor dentition may select soft, processed foods lacking adequate nutrition, creating a cycle where oral disease compromises nutritional status, further impairing oral health.

9. According to the passage, the relationship between nutrition and oral health is described as:
- A. One-directional only
 - B. Having no connection
 - C. Bidirectional
 - D. Temporary
10. The passage states that simple sugars are highly cariogenic because:
- A. Oral bacteria ferment them into acids that demineralize enamel
 - B. They strengthen tooth enamel
 - C. They increase saliva production
 - D. They contain no calories
11. Based on the passage, what matters more than total sugar amount in cavity formation?
- A. Type of toothpaste used
 - B. Age of the patient
 - C. Color of the sugar
 - D. Frequency of sugar consumption
12. According to the passage, vitamin C deficiency causes:
- A. Enhanced collagen synthesis
 - B. Scurvy with bleeding gums and tooth mobility
 - C. Increased bone density
 - D. Improved wound healing

13. The passage indicates that calcium and phosphorus in teeth comprise:
- A. Simple sugars
 - B. Amino acids
 - C. Hydroxyapatite crystals
 - D. Antibodies
14. Based on the passage, iron deficiency may present orally as:
- A. Glossitis and angular cheilitis
 - B. Increased enamel strength
 - C. Enhanced saliva production
 - D. Improved gum health
15. According to the passage, B2 (riboflavin) deficiency causes:
- A. Enhanced metabolism
 - B. Increased calcium absorption
 - C. Improved collagen synthesis
 - D. Glossitis and cheilitis
16. The passage states that dietary counseling for dental patients should emphasize:
- A. Increasing sugar frequency
 - B. Avoiding all carbohydrates
 - C. Limiting frequent sugar consumption
 - D. Eliminating all fats

PASSAGE 3

Pain management represents a fundamental responsibility in healthcare, requiring understanding of pain physiology, pharmacological interventions, and non-pharmacological approaches. Pain serves as a protective mechanism, alerting the body to tissue damage or potential harm, but chronic or severe pain becomes pathological, diminishing quality of life and impairing function. Pain is a subjective experience influenced by physical, emotional, and psychological factors, making assessment and treatment complex. Healthcare professionals must balance effective pain relief with minimizing adverse effects and preventing substance misuse, particularly given the current opioid crisis affecting communities worldwide.

Pain classification helps guide treatment approaches. Acute pain results from tissue injury and typically resolves as healing occurs, serving a protective function. Chronic pain persists beyond normal healing time (typically over three months) and may continue without identifiable ongoing tissue damage. Nociceptive pain arises from activation of pain receptors by actual or potential tissue damage—somatic pain originates from skin, muscles, and joints, while visceral pain comes from internal organs. Neuropathic

pain results from nervous system damage or dysfunction, producing burning, shooting, or electric shock sensations and often proving more difficult to treat than nociceptive pain. Understanding pain type guides medication selection and helps set realistic treatment expectations.

Analgesics, medications that relieve pain, fall into several categories. Non-opioid analgesics include acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs). Acetaminophen reduces pain and fever through central nervous system mechanisms but lacks anti-inflammatory properties. NSAIDs like ibuprofen and aspirin reduce pain, inflammation, and fever by inhibiting cyclooxygenase (COX) enzymes, thereby decreasing prostaglandin production. However, NSAIDs can cause gastrointestinal irritation, bleeding risk, and kidney problems, particularly with prolonged use. Opioid analgesics, including morphine, oxycodone, and hydrocodone, bind to opioid receptors in the brain and spinal cord, providing powerful pain relief but carrying risks of respiratory depression, constipation, sedation, tolerance, and addiction.

Local anesthetics prevent pain by blocking sodium channels in nerve fibers, temporarily preventing signal transmission. Dental procedures commonly use local anesthetics like lidocaine and articaine, allowing pain-free treatment while patients remain conscious. Non-pharmacological pain management techniques complement medication and include physical methods (ice, heat, massage), psychological approaches (relaxation, cognitive-behavioral therapy), and interventional procedures (nerve blocks, trigger point injections). For dental professionals, pain management must consider patient-specific factors including medical history, current medications, allergy history, and substance use history. Postoperative pain management balances adequate relief with minimal side effects, typically starting with non-opioid analgesics and using opioids only when necessary and for the shortest effective duration. Patient education about realistic pain expectations, proper medication use, and when to seek additional care improves outcomes and patient satisfaction.

17. According to the passage, pain that persists beyond normal healing time is classified as:

- A. Acute pain
- B. Chronic pain
- C. Protective pain
- D. Temporary pain

18. The passage states that neuropathic pain results from:

- A. Normal tissue healing
- B. Protective mechanisms
- C. Muscle strengthening
- D. Nervous system damage or dysfunction

19. Based on the passage, acetaminophen differs from NSAIDs because it:

- A. Lacks anti-inflammatory properties

- B. Increases inflammation
 - C. Only works on bones
 - D. Causes addiction
20. According to the passage, NSAIDs reduce pain by:
- A. Increasing prostaglandin production
 - B. Blocking all nerve signals
 - C. Inhibiting COX enzymes and decreasing prostaglandin production
 - D. Eliminating all inflammation permanently
21. The passage indicates that opioid analgesics carry risks including:
- A. Enhanced alertness
 - B. Respiratory depression and addiction
 - C. Increased energy
 - D. Improved digestion
22. Based on the passage, local anesthetics work by:
- A. Increasing sodium channels
 - B. Enhancing nerve signals
 - C. Producing unconsciousness
 - D. Blocking sodium channels in nerve fibers
23. According to the passage, non-pharmacological pain management includes:
- A. Physical methods and psychological approaches
 - B. Only surgery
 - C. Increasing pain signals
 - D. Avoiding all treatment
24. The passage states that postoperative dental pain management should:
- A. Always use opioids first
 - B. Avoid all medications
 - C. Start with non-opioid analgesics
 - D. Ignore patient history

PASSAGE 4

The endocrine system regulates physiological processes through hormones—chemical messengers secreted by glands that travel through the bloodstream to target organs. This intricate system controls metabolism, growth, reproduction, stress responses, and maintains homeostasis. Unlike the nervous system's rapid electrical signals, hormonal responses develop more slowly but typically last longer.

Endocrine disorders, whether involving hormone excess or deficiency, can profoundly affect oral health and dental treatment planning. Healthcare professionals must recognize endocrine disorders' oral manifestations and understand how these conditions influence treatment approaches.

The hypothalamus and pituitary gland form the endocrine system's control center. The hypothalamus, located in the brain, integrates nervous and endocrine functions, producing releasing and inhibiting hormones that regulate the pituitary. The pituitary's anterior lobe secretes growth hormone, thyroid-stimulating hormone, adrenocorticotrophic hormone, and gonadotropins, while the posterior lobe releases antidiuretic hormone and oxytocin. Growth hormone promotes tissue growth throughout life, with excess causing gigantism in children or acromegaly in adults. Acromegaly produces distinctive features including enlarged jaw, spaced teeth, macroglossia (enlarged tongue), and temporomandibular joint problems, requiring dental professionals to recognize these signs for potential referral.

The thyroid gland regulates metabolism through thyroid hormones. Hyperthyroidism (excess thyroid hormone) accelerates metabolism, causing nervousness, weight loss, rapid heartbeat, and increased sensitivity to dental anesthetics containing epinephrine. Hypothyroidism (thyroid hormone deficiency) slows metabolism, producing fatigue, weight gain, cold intolerance, and potentially delayed wound healing after dental procedures. The pancreas produces insulin, which lowers blood glucose, and glucagon, which raises it. Diabetes mellitus results from insulin deficiency or resistance, causing persistently elevated blood glucose that damages blood vessels and nerves, impairs immune function and wound healing, and increases infection risk.

Diabetes has significant oral health implications. Poorly controlled diabetes increases periodontitis risk through impaired immune response and altered collagen metabolism. Diabetic patients face higher infection risks, delayed healing, and increased surgical complications. Xerostomia (dry mouth) from medications or autonomic neuropathy increases cavity and oral infection risk. The relationship is bidirectional—severe periodontal disease can worsen glycemic control by increasing systemic inflammation and insulin resistance. For dental professionals, managing diabetic patients requires monitoring blood glucose, scheduling morning appointments when blood sugar is typically stable, ensuring patients have eaten and taken medications appropriately, recognizing hypoglycemia signs (shakiness, sweating, confusion), and modifying treatment plans for patients with poor glycemic control. Effective diabetes management improves oral health outcomes, while controlling periodontal disease may improve glycemic control, demonstrating the importance of integrated medical-dental care.

25. According to the passage, hormones are best described as:

- A. Rapid electrical signals
- B. Only produced by the brain
- C. Mechanical forces
- D. Chemical messengers secreted by glands

26. The passage states that the hypothalamus functions to:
- A. Integrate nervous and endocrine functions
 - B. Only produce saliva
 - C. Eliminate hormones
 - D. Replace the kidneys
27. Based on the passage, acromegaly produces features including:
- A. Decreased bone density
 - B. Smaller jaw
 - C. Reduced tongue size
 - D. Enlarged jaw and macroglossia
28. According to the passage, hyperthyroidism can cause:
- A. Slowed metabolism
 - B. Increased sensitivity to dental anesthetics containing epinephrine
 - C. Decreased heart rate
 - D. Enhanced cold tolerance
29. The passage indicates that diabetes mellitus results from:
- A. Excess calcium
 - B. Too much vitamin D
 - C. Insulin deficiency or resistance
 - D. Increased saliva production
30. Based on the passage, poorly controlled diabetes increases periodontitis risk through:
- A. Enhanced immune function
 - B. Increased collagen production
 - C. Normal healing
 - D. Impaired immune response and altered collagen metabolism
31. According to the passage, the relationship between diabetes and periodontal disease is:
- A. Bidirectional
 - B. Nonexistent
 - C. One-way only
 - D. Temporary
32. The passage states that dental professionals should schedule diabetic patients:
- A. Only at night
 - B. Any time randomly
 - C. In the morning when blood sugar is typically stable

D. Only on weekends

PASSAGE 5

Anatomy and physiology of the head and neck are fundamental to dental practice, requiring detailed understanding of bones, muscles, nerves, blood vessels, and salivary glands. The skull comprises cranial bones protecting the brain and facial bones forming the face and oral cavity. Temporomandibular joints (TMJs) connect the mandible to the temporal bones, enabling jaw movements essential for chewing, speaking, and facial expressions. Nerves provide sensation and motor control, with the trigeminal nerve supplying sensation to the face and mouth while the facial nerve controls facial expressions and provides taste sensation to the anterior tongue.

The oral cavity contains multiple tissue types serving specialized functions. Teeth anchor in alveolar bone through the periodontal ligament, a specialized connective tissue that absorbs occlusal forces and provides proprioceptive feedback. The periodontium, comprising gingiva, periodontal ligament, cementum, and alveolar bone, supports and protects teeth. The tongue, composed of intrinsic and extrinsic muscles, manipulates food during chewing, initiates swallowing, and contains taste buds concentrated in papillae. The hard palate separates oral and nasal cavities, while the soft palate elevates during swallowing to prevent nasal regurgitation and produces speech sounds.

Salivary glands produce saliva essential for oral health. Major salivary glands include paired parotid glands (producing serous saliva), submandibular glands (mixed serous and mucous), and sublingual glands (primarily mucous). Hundreds of minor salivary glands throughout oral mucosa contribute additional secretions. Saliva contains enzymes beginning carbohydrate digestion, antimicrobial compounds protecting against pathogens, minerals that remineralize teeth, and buffers that neutralize acids. Saliva lubricates oral tissues, facilitating speech and swallowing, and its flow mechanically cleanses teeth and soft tissues. Xerostomia (dry mouth) from medications, radiation therapy, or systemic diseases dramatically increases cavity risk, oral infection susceptibility, and swallowing difficulties.

Blood supply to oral structures comes primarily from the external carotid artery's branches. The maxillary artery, the external carotid's largest branch, supplies upper teeth, maxilla, and associated soft tissues. The facial artery supplies lips, cheeks, and sublingual areas. Venous drainage generally parallels arterial supply, with veins accompanying arteries and draining into the internal jugular vein. Lymphatic drainage from oral structures flows to cervical lymph nodes, which may become palpable and tender during oral infections. For dental professionals, understanding head and neck anatomy enables accurate diagnosis, safe anesthetic administration without damaging vital structures, recognition of anatomical variations that complicate treatment, and identification of pathological changes such as enlarged lymph nodes or masses requiring medical referral. Knowledge of nerve pathways guides anesthetic techniques for effective pain control during procedures.

33. According to the passage, the temporomandibular joints connect the:
- A. Teeth to gums
 - B. Mandible to temporal bones
 - C. Tongue to floor of mouth
 - D. Lips together
34. The passage states that the periodontal ligament:
- A. Absorbs occlusal forces and provides proprioceptive feedback
 - B. Produces saliva
 - C. Forms tooth enamel
 - D. Creates blood cells
35. Based on the passage, the soft palate functions to:
- A. Form all teeth
 - B. Elevate during swallowing to prevent nasal regurgitation
 - C. Produce stomach acid
 - D. Filter blood
36. According to the passage, major salivary glands include:
- A. Heart and lungs
 - B. Kidneys and liver
 - C. Parotid, submandibular, and sublingual glands
 - D. Only the stomach
37. The passage indicates that saliva contains:
- A. Enzymes, antimicrobial compounds, and minerals
 - B. Only water
 - C. No functional components
 - D. Harmful bacteria only
38. Based on the passage, xerostomia dramatically increases risk of:
- A. Enhanced saliva flow
 - B. Improved oral health
 - C. Stronger teeth
 - D. Cavities and oral infections
39. According to the passage, the maxillary artery supplies:
- A. Only the feet
 - B. Upper teeth, maxilla, and associated soft tissues
 - C. The heart

D. The kidneys

40. The passage states that understanding head and neck anatomy enables dental professionals to:
- A. Administer anesthesia safely without damaging vital structures
 - B. Ignore patient symptoms
 - C. Avoid all treatment
 - D. Eliminate the need for diagnosis

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 dental clinic upgraded its technology, it also expanded the waiting area for patients.
 - A. technology, it also expanded
 - B. technology it also expanded
 - C. technology; because it also expanded
 - D. technology, and it also expanded
2. Neither the dentist nor the hygienists was available for the emergency appointment.
 - A. nor the hygienists was available
 - B. or the hygienists was available
 - C. nor the hygienists were available
 - D. or the hygienists were available
3. The receptionist asked the patient when could he return for the follow-up visit.
 - A. when could he return
 - B. when he could return
 - C. when he could have returned
 - D. when could he have returned
4. Between you and I, the new sterilization equipment is much more efficient than expected.
 - A. Between you and I, the new sterilization equipment is
 - B. Between you and me, the new sterilization equipment are
 - C. Between you and I, the new sterilization equipments are
 - D. Between you and me, the new sterilization equipment is

5. The practice provides various services including examinations, cleanings, and will perform root canals.
 - A. examinations, cleanings, and root canals
 - B. examining, cleaning, and will perform root canals
 - C. examinations, cleanings, and performing root canals
 - D. examination, cleaning, and root canal

6. After reviewing the patient's x-rays the dentist recommended a comprehensive treatment plan.
 - A. After reviewing the patient's x-rays the dentist recommended
 - B. After reviewing, the patient's x-rays the dentist recommended
 - C. After reviewing the patient's x-rays, the dentist recommended
 - D. After reviewing the patient's x-rays; the dentist recommended

7. The new procedure is more effective than the traditional method, it also reduces treatment time.
 - A. method, it also reduces
 - B. method, and it also reduces
 - C. method it also reduces
 - D. method; because it also reduces

8. Everyone in the dental office must complete their mandatory safety training by Friday.
 - A. must complete his or her mandatory safety training
 - B. must complete their mandatory safety trainings
 - C. must completes his or her mandatory safety training
 - D. must complete its mandatory safety training

9. The hygienist recommended that the patient flosses daily and uses mouthwash regularly.
 - A. recommended that the patient flosses daily
 - B. recommends that the patient flosses daily
 - C. recommended that the patient floss daily
 - D. recommended that the patient flossed daily

10. Having carefully examined the tooth, a treatment recommendation was made by the dentist.
 - A. Having carefully examined the tooth, a treatment recommendation was made by the dentist
 - B. Having carefully examined the tooth, the dentist made a treatment recommendation
 - C. A treatment recommendation was made by the dentist, having carefully examined the tooth
 - D. The dentist's treatment recommendation was made, having carefully examined the tooth

11. Each of the dental assistants have completed their required continuing education courses.
 - A. has completed his or her required continuing education course

- B. have completed their required continuing education courses
 - C. has completed their required continuing education courses
 - D. have completed his or her required continuing education course
12. The office is closed on holidays, however it remains open on weekends for emergencies.
- A. holidays, however it remains
 - B. holidays however, it remains
 - C. holidays, however, it remains
 - D. holidays; however, it remains
13. Less appointments were scheduled during the holiday season than in previous months.
- A. Less appointments were scheduled
 - B. Fewer appointments were scheduled
 - C. Lesser appointments were scheduled
 - D. Less appointment were scheduled
14. The dentist examined the patient, recorded the findings, and was preparing a treatment plan.
- A. examined the patient, recorded the findings, and was preparing
 - B. examines the patient, recorded the findings, and prepared
 - C. examined the patient, recorded the findings, and prepared
 - D. examined the patient, records the findings, and prepared
15. Dr. Johnson told Dr. Lee that she needed to review the case before proceeding.
- A. Dr. Johnson told Dr. Lee that she needed
 - B. Dr. Johnson told Dr. Lee that Dr. Johnson needed
 - C. Dr. Johnson told Dr. Lee she needed
 - D. Dr. Johnson told Dr. Lee that Lee needed
16. The new guidelines effects all staff members and will go into effect next month.
- A. effects all staff members and will go into effect
 - B. effects all staff members and will go into affect
 - C. affects all staff members and will go into affect
 - D. affect all staff members and will go into effect
17. Proper oral hygiene is essential, all patients should brush and floss daily.
- A. hygiene is essential. All patients should
 - B. hygiene is essential, all patients should
 - C. hygiene is essential; because all patients should
 - D. hygiene is essential all patients should

18. The assistant which graduated from the program last year has exceptional clinical skills.
- A. which graduated from the program
 - B. which had graduated from the program
 - C. whom graduated from the program
 - D. who graduated from the program
19. After studying the radiographs thoroughly, the diagnosis was confirmed by the specialist.
- A. After studying the radiographs thoroughly, the specialist confirmed the diagnosis
 - B. After studying the radiographs thoroughly, the diagnosis was confirmed by the specialist
 - C. The specialist's diagnosis was confirmed, after studying the radiographs thoroughly
 - D. The diagnosis was confirmed by the specialist, after studying the radiographs thoroughly
20. The patient should of scheduled the appointment earlier to avoid the long wait.
- A. should of scheduled
 - B. should had scheduled
 - C. should have scheduled
 - D. should has scheduled
21. The treatment includes extractions, fillings, or placing crowns as needed.
- A. extractions, fillings, or crowns
 - B. extracting, filling, or placing crowns
 - C. extraction, filling, or crown
 - D. extractions, fillings, or placing crowns
22. Dental implants provide excellent results, they offer long-term solutions for missing teeth.
- A. results, they offer
 - B. results they offer
 - C. results; because they offer
 - D. results; they offer
23. Between the three treatment options available, the surgical approach is the more complex procedure.
- A. the more complex procedure
 - B. the more complexly procedure
 - C. the most complex procedure
 - D. the most complexly procedure
24. The dental office is located at 456 maple street in the historic district of Boston Massachusetts.
- A. maple street in the historic district of Boston Massachusetts
 - B. Maple Street in the historic district of Boston, Massachusetts
 - C. Maple street in the historic district of Boston, Massachusetts

D. maple Street in the historic District of Boston, Massachusetts

25. After the consultation was completed the patient received instructions for post-operative care.

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

26. The dentist asked the patient when can she schedule her next cleaning appointment.

- A. when can she schedule
- B. when could she schedule
- C. when can she have scheduled
- D. when she could schedule

27. The hygienist and her assistant both agrees that preventive care is most important.

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

28. Regular dental visits, thorough brushing, and daily flossing is necessary for optimal health.

- A. is necessary
- B. are necessary
- C. is necessarily
- D. are necessarily

29. The advanced technology improves diagnostic accuracy, it also enhances patient comfort significantly.

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

30. The clinic treats patients with various needs such as routine care, cosmetic procedures, and emergencies.

- A. needs, such as routine care, cosmetic procedures, and emergencies
- B. needs such as, routine care, cosmetic procedures, and emergencies
- C. needs, such as routine care, cosmetic procedures, and emergencies
- D. needs such as routine care cosmetic procedures and emergencies

31. Dentists, hygienists, and assistants all plays important roles in comprehensive patient care.
- A. all plays important roles
 - B. all play important role
 - C. all play important roles
 - D. all plays important role
32. The dentist instructed the patient to lay back in the chair for the examination.
- A. to lay back in the chair
 - B. to lie back in the chair
 - C. to lay back on the chair
 - D. to lie back on the chair
33. Modern dentistry has advanced considerably allowing practitioners to provide superior care.
- A. considerably, allowing practitioners to provide
 - B. considerably; allowing practitioners to provide
 - C. considerably. Allowing practitioners to provide
 - D. considerably allowing practitioners to provide
34. Routine dental checkups prevent problems, they help maintain excellent oral health.
- A. problems, they help
 - B. problems they help
 - C. problems; and they help
 - D. problems. They help
35. The program requires all students to complete clinical training before they graduate.
- A. requires all students to complete clinical training, before they graduate
 - B. require all students to complete clinical training before they graduate
 - C. requires all students to complete clinical training before they graduate
 - D. requires all students to complete clinical training before, they graduate
36. The practice offers comprehensive services such as cleanings and examinations but not oral surgery.
- A. services, such as cleanings and examinations but
 - B. services, such as cleanings and examinations, but
 - C. services such as, cleanings and examinations, but
 - D. services such as cleanings and examinations, but
37. The new facility is more accessible to patients than the previous location.
- A. more accessible to patients than the previous location
 - B. more accessibly to patients than the previous location
 - C. more accessible to patients than the previous location was

D. most accessible to patients than the previous location

38. Maintaining good oral health requires brushing twice daily, flossing regularly, and to visit the dentist.

- A. brushing twice daily, flossing regularly, and to visit the dentist
- B. brushing twice daily, flossing regularly, and visiting the dentist
- C. to brush twice daily, flossing regularly, and visiting the dentist
- D. to brush twice daily, to floss regularly, and to visit the dentist

39. The patient mentioned that her tooth has been sensitive for weeks before calling.

- A. has been sensitive
- B. had been sensitive
- C. will have been sensitive
- D. has hurt

40. Comprehensive dental care improves overall health, it also enhances quality of life.

- A. health, and it also enhances
- B. health it also enhances
- C. health; because it also enhances
- D. health, it also enhances

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 : $6x - 9 = 21$

- A. 3
- B. 5
- C. 12
- D. 30

2. A practice treated 160 patients in March and 200 patients in April. What is the percent increase?

- A. 20%
- B. 40%
- C. 160%
- D. 25%

3. If $8y - 5 = 5y + 10$, what is the value of y ?
- A. 3
 - B. 15
 - C. 5
 - D. 2
4. A hygienist earns \$48 per hour and works 7 hours per day for 5 days per week. How much does she earn per week?
- A. \$336
 - B. \$1,680
 - C. \$240
 - D. \$2,400
5. What is 22% of 450?
- A. 99
 - B. 22
 - C. 45
 - D. 90
6. If $a = 6$ and $b = -3$, what is the value of $2a^2 - 3b$?
- A. 63
 - B. 81
 - C. 81
 - D. 54
7. A medication dosage is 0.6 mg per kilogram of body weight. How many milligrams should be given to a patient weighing 75 kilograms?
- A. 40 mg
 - B. 42 mg
 - C. 50 mg
 - D. 45 mg
8. Solve: $5(x + 3) = 3x + 23$
- A. 4
 - B. 6
 - C. 8
 - D. 10
9. A container has 10 red balls, 8 blue balls, and 6 green balls. If one ball is selected at random, what is the probability it is blue?

- A. $\frac{1}{3}$
- B. $\frac{5}{12}$
- C. $\frac{1}{4}$
- D. $\frac{1}{3}$

10. Convert 3.5 kilometers to meters.

- A. 35 meters
- B. 3,500 meters
- C. 350 meters
- D. 35,000 meters

11. If $x = 6$, what is the value of $5x^2 - 4x$?

- A. 156
- B. 180
- C. 144
- D. 168

12. Expenses decreased from \$4,000 to \$3,200. What is the percent decrease?

- A. 25%
- B. 800%
- C. 20%
- D. 30%

13. Simplify: $5(4x - 3) - 7(x + 2)$

- A. $20x - 29$
- B. $27x - 29$
- C. $12x - 1$
- D. $13x - 29$

14. The ratio of assistants to patients is 1:40. If there are 160 patients, how many assistants are there?

- A. 3
- B. 4
- C. 40
- D. 5

15. Solve for x : $\frac{x}{7} + 5 = 11$

- A. 16
- B. 77
- C. 42
- D. 35

16. A patient's pulse increased from 68 bpm to 85 bpm. What is the amount of increase?
- A. 15 bpm
 - B. 17 bpm
 - C. 20 bpm
 - D. 85 bpm
17. If $7x - 3y = 35$ and $x = 8$, what is the value of y ?
- A. 5
 - B. 6
 - C. 9
 - D. 7
18. A dental service offers a 30% discount on teeth whitening. If the original price is \$500, what is the discounted price?
- A. \$350
 - B. \$400
 - C. \$470
 - D. \$150
19. Solve for x : $10x - 6 = 7x + 21$
- A. 5
 - B. 15
 - C. 9
 - D. 3
20. What is the mean of the data set: 18, 24, 30, 36, 42?
- A. 24
 - B. 30
 - C. 36
 - D. 28
21. A solution contains 600 mL of liquid. If 35% is active ingredient, how many milliliters of active ingredient does it contain?
- A. 210 mL
 - B. 35 mL
 - C. 180 mL
 - D. 240 mL
22. If $x^2 = 196$, what are the possible values of x ?

- A. 196 only
- B. 98 only
- C. -14 only
- D. 14 and -14

23. A dentist sees 16 patients per day for 6 days per week for 3 weeks. How many patients in total?

- A. 96
- B. 48
- C. 288
- D. 192

24. Simplify: $(6x^5)(3x^4)$

- A. $9x^9$
- B. $18x^9$
- C. $18x^{20}$
- D. $9x^{20}$

25. What is $7/10$ expressed as a percent?

- A. 7%
- B. 0.7%
- C. 7.1%
- D. 70%

26. A patient takes medication every 8 hours. How many doses in 5 days?

- A. 15
- B. 8
- C. 24
- D. 40

27. If the perimeter of a rectangle is 80 cm and the width is 15 cm, what is the length?

- A. 20 cm
- B. 30 cm
- C. 25 cm
- D. 40 cm

28. Solve: $9x - 15 = 8x - 7$

- A. 22
- B. 8
- C. -8
- D. 2

29. Supplies cost \$850 before tax. With 8% sales tax, what is the total cost?
- A. \$918
 - B. \$858
 - C. \$850
 - D. \$900
30. What is the median of: 12, 16, 20, 24, 28?
- A. 16
 - B. 24
 - C. 18
 - D. 20
31. If $6x - 10 = 20$, what is the value of $3x$?
- A. 10
 - B. 15
 - C. 5
 - D. 30
32. A bottle holds 1.9 liters. How many milliliters is this?
- A. 19 mL
 - B. 190 mL
 - C. 1,900 mL
 - D. 19,000 mL
33. Evaluate: $(-4)^2 - 3(-2)$
- A. 10
 - B. -10
 - C. 28
 - D. 22
34. A clinic has 35 employees. If 20% are dentists, how many dentists work there?
- A. 7
 - B. 8
 - C. 6
 - D. 10
35. Solve for x : $x/9 = 8$
- A. 17
 - B. 72

- C. 9
- D. 1

36. What is 0.625 expressed as a fraction in simplest form?

- A. $\frac{625}{1000}$
- B. $\frac{25}{40}$
- C. $\frac{15}{24}$
- D. $\frac{5}{8}$

37. If $x - y = 10$ and $x + y = 26$, what is the value of x ?

- A. 18
- B. 8
- C. 10
- D. 16

38. A patient's temperature is 38°C . Using $F = \frac{9}{5}C + 32$, what is the temperature in Fahrenheit?

- A. 98.4°F
- B. 99.4°F
- C. 100.4°F
- D. 100.4°F

39. What is the range of: 18, 24, 30, 36, 42?

- A. 18
- B. 30
- C. 24
- D. 36

40. A clinic treated 120 patients in May and 180 patients in June. What is the ratio of May to June patients in simplest form?

- A. 2:3
- B. 3:2
- C. 4:6
- D. 1:2

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.

- Four angles are shown. Angle 1 measures 55° , Angle 2 measures 115° , Angle 3 measures 78° , and Angle 4 measures 138° . Which angle is closest to 120° ?
 - Angle 1
 - Angle 2
 - Angle 3
 - Angle 4
- Three angles are presented. Angle A = 32° , Angle B = 125° , Angle C = 90° . Which is the largest angle?
 - Angle A
 - Angle C
 - All equal
 - Angle B
- Five angles measure 28° , 95° , 59° , 147° , and 86° . Which is the third largest angle?
 - 28°
 - 59°
 - 86°
 - 95°
- Four angles are displayed: 43° , 108° , 71° , and 135° . Which is the smallest angle?
 - 43°
 - 71°
 - 108°
 - 135°
- Three angles measure 80° , 126° , and 46° . What is the correct order from largest to smallest?
 - 46° , 80° , 126°
 - 80° , 126° , 46°

- C. $126^\circ, 46^\circ, 80^\circ$
D. $126^\circ, 80^\circ, 46^\circ$
6. Five angles are shown: $35^\circ, 103^\circ, 74^\circ, 151^\circ,$ and 60° . Which angle is acute and closest to 65° ?
A. 35°
B. 60°
C. 74°
D. 103°
7. Four angles measure $21^\circ, 99^\circ, 52^\circ,$ and 166° . Which is the third smallest angle?
A. 21°
B. 52°
C. 99°
D. 166°
8. Three angles are presented: $37^\circ, 93^\circ,$ and 158° . Which angle is acute and smallest?
A. 37°
B. 93°
C. 158°
D. All obtuse
9. Five angles measure $44^\circ, 107^\circ, 70^\circ, 140^\circ,$ and 53° . Which angle measures closest to 50° ?
A. 53°
B. 44°
C. 70°
D. 107°
10. Four angles are shown: $68^\circ, 131^\circ, 33^\circ,$ and 94° . Which is the second largest angle?
A. 33°
B. 94°
C. 68°
D. 131°
11. Three acute angles measure $42^\circ, 75^\circ,$ and 63° . Which is the largest?
A. 42°
B. 63°
C. All equal
D. 75°
12. Five angles measure $118^\circ, 89^\circ, 54^\circ, 169^\circ,$ and 77° . Which is the smallest?

- A. 54°
- B. 77°
- C. 89°
- D. 118°

13. Four angles are displayed: 25° , 104° , 76° , and 145° . Which angle is closest to 75° ?

- A. 25°
- B. 104°
- C. 76°
- D. 145°

14. Three angles measure 121° , 48° , and 88° . Which is obtuse and greater than 100° ?

- A. 48°
- B. 88°
- C. All acute
- D. 121°

15. Five angles are shown: 40° , 109° , 66° , 153° , and 84° . Which lists the two largest in order?

- A. 40° , 66°
- B. 153° , 109°
- C. 66° , 84°
- D. 109° , 84°

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 $7\text{ cm} \times 11\text{ cm} \times 13\text{ cm}$. Which aperture allows the largest face to pass through?

- A. A rectangle $11\text{ cm} \times 13\text{ cm}$
- B. A circle 11 cm diameter
- C. A square $11\text{ cm} \times 11\text{ cm}$
- D. A triangle 13 cm base

17. A cylinder with diameter 11 cm and height 17 cm is shown. When entering circular end first, what aperture is needed?

- A. A rectangle $11\text{ cm} \times 17\text{ cm}$
- B. A square $17\text{ cm} \times 17\text{ cm}$
- C. A circle with at least 11 cm diameter
- D. A triangle 11 cm sides

18. A pyramid with square base $11\text{ cm} \times 11\text{ cm}$ is presented. Which aperture accommodates the base?
- A. A circle 11 cm diameter
 - B. A rectangle $9\text{ cm} \times 11\text{ cm}$
 - C. A triangle 11 cm sides
 - D. A square $11\text{ cm} \times 11\text{ cm}$ or larger
19. A cube measuring 10 cm per side is shown. What is the smallest square aperture needed?
- A. $8\text{ cm} \times 8\text{ cm}$
 - B. $10\text{ cm} \times 10\text{ cm}$
 - C. $12\text{ cm} \times 12\text{ cm}$
 - D. $20\text{ cm} \times 20\text{ cm}$
20. A triangular prism has base 9 cm per side and length 15 cm . Which aperture allows triangle-first passage?
- A. A square $9\text{ cm} \times 9\text{ cm}$
 - B. A circle 15 cm diameter
 - C. An equilateral triangle 9 cm sides
 - D. A rectangle $9\text{ cm} \times 15\text{ cm}$
21. An L-shaped object measures 9 cm wide and 12 cm tall overall. Which aperture accommodates it?
- A. A rectangle $9\text{ cm} \times 12\text{ cm}$ or larger
 - B. A square $9\text{ cm} \times 9\text{ cm}$
 - C. A circle 10 cm diameter
 - D. A triangle 12 cm base
22. A sphere with diameter 14 cm is presented. What aperture is required?
- A. A square $12\text{ cm} \times 12\text{ cm}$
 - B. A rectangle $13\text{ cm} \times 15\text{ cm}$
 - C. A triangle 14 cm sides
 - D. A circle with at least 14 cm diameter
23. A rectangular block $9\text{ cm} \times 11\text{ cm} \times 7\text{ cm}$ is shown. When oriented with $9\text{ cm} \times 11\text{ cm}$ face forward, what aperture?
- A. A circle 11 cm diameter
 - B. A rectangle $9\text{ cm} \times 11\text{ cm}$
 - C. A square $11\text{ cm} \times 11\text{ cm}$
 - D. A rectangle $7\text{ cm} \times 9\text{ cm}$

24. A hexagonal prism with 9 cm wide base and 16 cm length is displayed. Which aperture for hexagon-first entry?
- A. A hexagon approximately 9 cm across
 - B. A circle 8 cm diameter
 - C. A rectangle 9 cm \times 16 cm
 - D. A square 9 cm \times 9 cm
25. A T-shaped object measures 13 cm wide and 15 cm tall. What minimum aperture?
- A. A rectangle 11 cm \times 13 cm
 - B. A square 13 cm \times 13 cm
 - C. A rectangle 13 cm \times 15 cm
 - D. A circle 15 cm diameter
26. An ellipsoid measures 10 cm \times 13 cm \times 8 cm. When oriented with 10 cm \times 13 cm face forward, which aperture?
- A. A circle 13 cm diameter
 - B. A square 13 cm \times 13 cm
 - C. A rectangle 8 cm \times 10 cm
 - D. An ellipse or rectangle 10 cm \times 13 cm
27. A cross-shaped object has arms extending 11 cm in each direction. What aperture for face-first passage?
- A. A square 9 cm \times 9 cm
 - B. A square 11 cm \times 11 cm or larger
 - C. A circle 11 cm diameter
 - D. A triangle 11 cm sides
28. A cone with base diameter 13 cm is shown. Which aperture fits the base?
- A. A square 11 cm \times 11 cm
 - B. A rectangle 10 cm \times 13 cm
 - C. A circle with at least 13 cm diameter
 - D. A triangle 13 cm sides
29. A rectangular block with rounded ends measures 9 cm \times 11 cm \times 15 cm with 2 cm radius curves. Which aperture for curved end?
- A. A rounded rectangle approximately 9 cm \times 11 cm
 - B. A rectangle 8 cm \times 10 cm
 - C. A circle 11 cm diameter
 - D. A square 11 cm \times 11 cm

30. An irregular object with dimensions $10\text{ cm} \times 12\text{ cm} \times 8\text{ cm}$ is shown. When oriented with smallest face forward, which aperture?
- A. A square $10\text{ cm} \times 10\text{ cm}$
 - B. A circle 10 cm diameter
 - C. A rectangle $12\text{ cm} \times 8\text{ cm}$
 - D. A rectangle $10\text{ cm} \times 8\text{ cm}$

ORTHOGRAPHIC PROJECTIONS (Questions 31-45)

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

31. The top view shows a rectangle, front view shows two rectangles stacked, end view shows a rectangle. What is the object?
- A. A cylinder
 - B. Two rectangular prisms stacked
 - C. A cube
 - D. A pyramid
32. Top view shows a square, front view shows a square, end view shows a square. What is the object?
- A. A cube
 - B. A rectangular prism
 - C. A cylinder
 - D. A pyramid
33. A stepped object has four levels. Which view shows all four levels most clearly?
- A. Top view only
 - B. End view only
 - C. Front view only
 - D. All three equally
34. Top view is rectangle, front view is triangle, end view is rectangle. What is the object?
- A. A triangular prism oriented on its side
 - B. A pyramid
 - C. A rectangular prism
 - D. A cone
35. Top view shows hexagon, front view shows hexagon, end view shows rectangle. What is the object?
- A. A hexagonal pyramid
 - B. A cube
 - C. Six rectangular prisms

- D. A hexagonal prism oriented on its end
36. Top view shows rectangle with line, front view shows two rectangles, end view shows rectangle with line. What does this represent?
- A. A solid cube
 - B. Two rectangular prisms with a dividing feature
 - C. A pyramid
 - D. One prism
37. Top view shows plus sign, front view shows rectangle, end view shows plus sign. What is the object?
- A. A plus-shaped prism
 - B. Four rectangular prisms
 - C. A cross-shaped pyramid
 - D. A T-shape
38. Top view shows square with diagonal line, front view shows two triangles, end view shows square with diagonal line. What is the object?
- A. A cube
 - B. A sphere
 - C. Two triangular prisms forming a square cross-section
 - D. A cylinder
39. Top view shows U-shape, front view shows rectangle, end view shows U-shape. What is the object?
- A. A U-shaped pyramid
 - B. Two rectangular prisms
 - C. Three rectangular prisms
 - D. A U-shaped prism
40. Top view shows five squares in row, front view shows long rectangle, end view shows square. What is the object?
- A. One long rectangular prism
 - B. Five cubes in a row
 - C. A pyramid
 - D. An L-structure
41. Top view shows nonagon, front view shows rectangle, end view shows nonagon. What is the object?
- A. A nonagonal pyramid
 - B. Nine rectangular prisms
 - C. A nonagonal prism

D. A cube

42. Top view shows rectangle, front view shows rectangle, end view shows circle. What is the object?

A. A sphere

B. A rectangular prism

C. A cone

D. A cylinder oriented horizontally

43. Top view shows heptagon, front view shows rectangle, end view shows heptagon. What is the object?

A. A heptagonal prism

B. A heptagonal pyramid

C. Seven rectangular prisms

D. A cube

44. Top view shows three circles in triangle formation, front view shows three rectangles, end view shows circle. What is the object?

A. Three spheres

B. A pyramid

C. Three cylinders arranged in triangle pattern

D. Three cones

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

A. A Z-shaped pyramid

B. A Z-shaped prism

C. Three 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 4 layers arranged $2 \times 2 \times 4$. How many total cubes?

A. 8

B. 16

C. 12

D. 32

47. In a $5 \times 5 \times 5$ cube, how many cubes are on the surface (have at least one face exposed)?

A. 125

- B. 27
- C. 98
- D. 100

48. A $2 \times 4 \times 6$ structure is built. How many total cubes?

- A. 12
- B. 24
- C. 36
- D. 48

49. In an $8 \times 8 \times 8$ cube where all faces are painted, how many cubes have exactly three painted faces?

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

50. A structure has 7 layers with 6 cubes per layer arranged 2×3 . How many total cubes?

- A. 42
- B. 21
- C. 36
- D. 48

51. In a $2 \times 5 \times 6$ structure, how many cubes are on corners?

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

52. A structure is 8 cubes high, 7 cubes wide, 6 cubes deep. How many total cubes?

- A. 21
- B. 336
- C. 280
- D. 180

53. In an L-shaped structure with 10 cubes on one arm and 9 on the other (sharing 1 corner), how many total cubes?

- A. 18
- B. 19
- C. 10
- D. 17

54. An $8 \times 8 \times 1$ flat structure has all faces painted. How many cubes have exactly two painted faces?
- A. 4
 - B. 32
 - C. 64
 - D. 28
55. A staircase has 5 cubes on first step, 7 on second, 9 on third. How many total cubes?
- A. 9
 - B. 15
 - C. 21
 - D. 27
56. A $7 \times 8 \times 9$ structure is built. How many cubes are on corners?
- A. 8
 - B. 12
 - C. 6
 - D. 24
57. In a $10 \times 1 \times 1$ structure (10 cubes in row), if all surfaces painted, how many cubes have exactly four painted faces?
- A. 2
 - B. 8
 - C. 10
 - D. 6
58. A pyramid has layers: bottom $7 \times 7 = 49$ cubes, next $5 \times 5 = 25$ cubes, next $3 \times 3 = 9$ cubes, top 1 cube. How many total?
- A. 49
 - B. 74
 - C. 83
 - D. 84
59. In a $7 \times 7 \times 7$ cube with three corner cubes removed, how many cubes remain?
- A. 340
 - B. 343
 - C. 339
 - D. 337

60. A plus-shaped structure uses 8 cubes for vertical arm and 8 for horizontal (sharing 1 center). How many total?
- A. 16
 - B. 14
 - C. 15
 - D. 17

Biology

Time: 30 minutes

Questions: 1-30

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

1. What is the primary function of the mitochondria?
 - A. Protein synthesis
 - B. DNA storage
 - C. Waste digestion
 - D. ATP production through cellular respiration
2. Which organelle packages and modifies proteins for export?
 - A. Golgi apparatus
 - B. Ribosome
 - C. Lysosome
 - D. Nucleus
3. During which phase of mitosis do chromosomes align at the cell's equator?
 - A. Prophase
 - B. Metaphase
 - C. Anaphase
 - D. Telophase
4. What process allows water to move across a selectively permeable membrane?
 - A. Active transport
 - B. Endocytosis
 - C. Osmosis
 - D. Phagocytosis
5. What is the primary function of messenger RNA (mRNA)?
 - A. Stores genetic information permanently

- B. Brings amino acids to ribosomes
 - C. Forms ribosomal structure
 - D. Carries genetic instructions from DNA to ribosomes
6. How many daughter cells are produced from one cell during meiosis?
- A. Two haploid cells
 - B. Two diploid cells
 - C. Four diploid cells
 - D. Four haploid cells
7. In DNA, adenine pairs with which nitrogenous base?
- A. Cytosine
 - B. Thymine
 - C. Guanine
 - D. Uracil
8. Which pattern of inheritance results in both alleles being fully expressed in heterozygotes?
- A. Complete dominance
 - B. Incomplete dominance
 - C. Codominance
 - D. Sex-linked inheritance
9. During which phase of meiosis does crossing over occur?
- A. Prophase I
 - B. Metaphase II
 - C. Anaphase I
 - D. Telophase II
10. Which component of blood is responsible for transporting nutrients and waste products?
- A. Red blood cells
 - B. White blood cells
 - C. Platelets
 - D. Plasma
11. What is the primary function of the small intestine?
- A. Water absorption
 - B. Nutrient absorption
 - C. Bile production
 - D. Food storage

12. Which tissue type lines body cavities and covers body surfaces?
- A. Epithelial tissue
 - B. Connective tissue
 - C. Muscle tissue
 - D. Nervous tissue
13. In a cross between two heterozygous parents ($Bb \times Bb$), what percentage of offspring will be homozygous recessive?
- A. 75%
 - B. 25%
 - C. 50%
 - D. 100%
14. Which process produces genetically identical cells for growth and repair?
- A. Meiosis
 - B. Fertilization
 - C. Mitosis
 - D. Crossing over
15. What is the primary role of transfer RNA (tRNA)?
- A. Brings specific amino acids to the ribosome during translation
 - B. Stores genetic information
 - C. Forms the nuclear envelope
 - D. Produces energy
16. Which component of blood fights infections?
- A. Red blood cells
 - B. Platelets
 - C. Plasma
 - D. White blood cells
17. What type of muscle tissue is involuntary and found in internal organs?
- A. Skeletal muscle
 - B. Cardiac muscle
 - C. Smooth muscle
 - D. Voluntary muscle
18. What is the end product of transcription?
- A. DNA
 - B. mRNA

- C. Protein
- D. tRNA

19. Which organelle is responsible for photosynthesis in plant cells?

- A. Chloroplast
- B. Mitochondrion
- C. Vacuole
- D. Nucleus

20. What do osteoclasts do in bone tissue?

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

21. Fungi differ from bacteria because fungi:

- A. Are always unicellular
- B. Lack cell walls
- C. Are eukaryotic organisms
- D. Cannot reproduce

22. What are the reactants of cellular respiration?

- A. Carbon dioxide and water
- B. Glucose and oxygen
- C. ATP and carbon dioxide
- D. Water and oxygen

23. Which system transports oxygen and nutrients throughout the body?

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

24. If mRNA has the sequence AUG, what is the corresponding DNA template strand?

- A. TAC
- B. AUG
- C. UAC
- D. ATG

25. Which vessels carry oxygenated blood away from the heart?

- A. Veins
 - B. Capillaries
 - C. Arteries
 - D. Venules
26. What is the primary function of the rough endoplasmic reticulum?
- A. Lipid synthesis
 - B. Protein synthesis
 - C. ATP production
 - D. DNA replication
27. What term describes the physical expression of genes?
- A. Phenotype
 - B. Genotype
 - C. Allele
 - D. Chromosome
28. During which phase does DNA replication occur?
- A. G1 phase
 - B. G2 phase
 - C. M phase
 - D. S phase
29. What are the main components of the central nervous system?
- A. Heart and lungs
 - B. Stomach and intestines
 - C. Brain and spinal cord
 - D. Kidneys and liver
30. What distinguishes prokaryotic cells from eukaryotic cells?
- A. Presence of cytoplasm
 - B. Prokaryotes lack membrane-bound organelles
 - C. Presence of ribosomes
 - D. Ability to undergo cell division

Time: 30 minutes

Questions: 1-30

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

1. What is the atomic number of an element?
 - A. Sum of protons and neutrons
 - B. Number of protons in the nucleus
 - C. Number of neutrons only
 - D. Number of electrons in outer shell
2. Which subatomic particle has a positive charge?
 - A. Electron
 - B. Neutron
 - C. Ion
 - D. Proton
3. What type of bond results from the sharing of electrons between atoms?
 - A. Covalent bond
 - B. Ionic bond
 - C. Metallic bond
 - D. Hydrogen bond
4. How many electrons can the second energy level hold?
 - A. 2
 - B. 18
 - C. 8
 - D. 32
5. What is produced when an acid reacts with a base?
 - A. Only hydrogen gas
 - B. Only oxygen
 - C. Only carbon dioxide
 - D. Salt and water
6. What is the molar mass of water (H_2O)? ($\text{H} = 1 \text{ g/mol}$, $\text{O} = 16 \text{ g/mol}$)
 - A. 17 g/mol
 - B. 18 g/mol
 - C. 16 g/mol

D. 20 g/mol

7. Which pH value indicates a basic solution?

A. 2

B. 7

C. 12

D. 5

8. In the equation $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$, what is the coefficient of H_2 ?

A. 2

B. 1

C. 4

D. 3

9. Atoms with the same atomic number but different mass numbers are called:

A. Isotopes

B. Ions

C. Molecules

D. Compounds

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

A. Pressure stays constant

B. Pressure increases

C. Pressure decreases

D. Pressure becomes zero

11. What forms when atoms share electrons equally?

A. Ionic bond

B. Metallic bond

C. Covalent bond

D. No bond

12. How many moles are in 36 grams of water (H_2O)? (Molar mass = 18 g/mol)

A. 2 moles

B. 18 moles

C. 36 moles

D. 54 moles

13. What is the standard unit for measuring amount of substance?

A. Grams

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

14. Which characteristic describes bases?

- A. Taste sour
- B. Taste bitter and feel slippery
- C. Turn litmus paper red
- D. Have pH less than 7

15. Which state of matter has particles that move freely and are far apart?

- A. Solid
- B. Liquid
- C. Gas
- D. Plasma

16. What do atoms form through ionic bonding?

- A. Neutral molecules
- B. Covalent compounds
- C. Metallic structures
- D. Charged ions

17. How many oxygen atoms are in $3\text{Al}_2\text{O}_3$?

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

18. What is the pH of a neutral solution?

- A. 0
- B. 14
- C. 7
- D. 1

19. Which group contains the halogens?

- A. Group 1
- B. Group 17
- C. Group 2
- D. Group 18

20. What type of reaction is $AB \rightarrow A + B$?
- A. Decomposition
 - B. Synthesis
 - C. Single replacement
 - D. Double replacement
21. How many times more acidic is pH 2 compared to pH 5?
- A. 3 times
 - B. 10 times
 - C. 100 times
 - D. 1000 times
22. What is the charge of a proton?
- A. Negative
 - B. Positive
 - C. Neutral
 - D. Variable
23. How many valence electrons does an element in Group 17 have?
- A. 1
 - B. 2
 - C. 7
 - D. 8
24. What happens to atoms during chemical reactions?
- A. Atoms are rearranged
 - B. Atoms are destroyed
 - C. Atoms are created
 - D. Atoms change into different elements
25. A 4 M solution is diluted from 25 mL to 100 mL. What is the new concentration?
- A. 4 M
 - B. 2 M
 - C. 0.5 M
 - D. 1 M
26. What do bases produce in water according to the Arrhenius definition?
- A. H^+ ions
 - B. Na^+ ions
 - C. OH^- ions

D. Cl^- ions

27. What is Avogadro's number?

A. 3.14×10^{23}

B. 6.022×10^{23}

C. 1.66×10^{24}

D. 6.022×10^{22}

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

A. Volume increases

B. Volume decreases

C. Volume stays constant

D. Volume becomes zero

29. A neutral fluorine atom (atomic number = 9) has how many electrons?

A. 8

B. 10

C. 18

D. 9

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

A. Pressure decreases

B. Pressure stays constant

C. Pressure increases

D. Pressure becomes zero

Answer Explanations - Practice Test 6

Reading Comprehension

1. Correct Answer: D (Attacks invaders while normally tolerating the body's tissues)

The passage states that "the immune system distinguishes between self and non-self molecules, attacking invaders while normally tolerating the body's own tissues." This describes the immune system's ability to recognize and attack foreign substances while leaving the body's own tissues alone under normal circumstances.

2. Correct Answer: C (Skin and mucous membranes)

The passage explicitly states that "physical barriers include skin and mucous membranes that prevent pathogen entry." These are the first line of defense in innate immunity.

3. Correct Answer: B (Phagocytic cells)

The passage states that "phagocytic cells like neutrophils and macrophages engulf and destroy pathogens." Neutrophils and macrophages are specifically identified as phagocytic cells.

4. Correct Answer: D (Redness, heat, swelling, and pain)

The passage describes the inflammatory response as being "characterized by redness, heat, swelling, and pain." These are the four classic signs of inflammation.

5. Correct Answer: A (Antibodies)

The passage states that "B lymphocytes produce antibodies—proteins that bind to specific antigens on pathogens." This is the primary function of B lymphocytes.

6. Correct Answer: A (Activate other immune cells)

The passage states that "helper T cells activate other immune cells." This is their coordinating function in the immune response.

7. Correct Answer: C (Persist for years or decades)

The passage explains that "after initial exposure to an antigen, memory B and T cells persist for years or decades." This longevity is what provides long-term immunity.

8. Correct Answer: D (Generating memory without causing disease)

The passage states that "vaccines exploit this mechanism by exposing the immune system to weakened or killed pathogens or pathogen components, generating memory without causing disease." This explains how vaccines provide protection.

9. Correct Answer: C (Bidirectional)

The passage states that "the relationship between nutrition and oral health operates bidirectionally—poor nutrition compromises oral tissues while oral disease impairs nutritional intake." Both directions of influence are described.

10. Correct Answer: A (Oral bacteria ferment them into acids that demineralize enamel)

The passage explains that "simple sugars, particularly sucrose, are highly cariogenic because oral bacteria rapidly ferment them into acids that demineralize tooth enamel." This is the mechanism by which sugars cause cavities.

11. Correct Answer: D (Frequency of sugar consumption)

The passage states that "frequency of sugar consumption matters more than total amount—constant snacking maintains an acidic oral environment, promoting cavity formation." Frequency is emphasized as more important than quantity.

12. Correct Answer: B (Scurvy with bleeding gums and tooth mobility)

The passage states that vitamin C "deficiency causes scurvy, characterized by bleeding gums, tooth mobility, and poor wound healing." These are the specific oral manifestations of scurvy.

13. Correct Answer: C (Hydroxyapatite crystals)

The passage states that "calcium and phosphorus are the primary minerals in tooth structure, comprising hydroxyapatite crystals in enamel and dentin." This is the specific crystalline structure they form.

14. Correct Answer: A (Glossitis and angular cheilitis)

The passage states that "iron deficiency, the world's most common nutritional deficiency, causes anemia that may present orally as glossitis (inflamed tongue), angular cheilitis (cracks at mouth corners)." These are the oral presentations.

15. Correct Answer: D (Glossitis and cheilitis)

The passage states that "B2 (riboflavin) deficiency causes glossitis and cheilitis." These are the specific oral manifestations of riboflavin deficiency.

16. Correct Answer: C (Limiting frequent sugar consumption)

The passage states that "dietary counseling should emphasize limiting frequent sugar consumption, ensuring adequate vitamins and minerals through varied diet." Limiting frequent sugar consumption is specifically mentioned as a counseling point.

17. Correct Answer: B (Chronic pain)

The passage states that "chronic pain persists beyond normal healing time (typically over three months)." This is the definition of chronic pain.

18. Correct Answer: D (Nervous system damage or dysfunction)

The passage states that "neuropathic pain results from nervous system damage or dysfunction, producing burning, shooting, or electric shock sensations." This is what causes neuropathic pain.

19. Correct Answer: A (Lacks anti-inflammatory properties)

The passage states that "acetaminophen reduces pain and fever through central nervous system mechanisms but lacks anti-inflammatory properties." This distinguishes it from NSAIDs which have anti-inflammatory effects.

20. Correct Answer: C (Inhibiting COX enzymes and decreasing prostaglandin production)

The passage states that "NSAIDs like ibuprofen and aspirin reduce pain, inflammation, and fever by inhibiting cyclooxygenase (COX) enzymes, thereby decreasing prostaglandin production." This is their mechanism of action.

21. Correct Answer: B (Respiratory depression and addiction)

The passage states that opioid analgesics carry "risks of respiratory depression, constipation, sedation, tolerance, and addiction." Respiratory depression and addiction are specifically mentioned among the risks.

22. Correct Answer: D (Blocking sodium channels in nerve fibers)

The passage states that "local anesthetics prevent pain by blocking sodium channels in nerve fibers, temporarily preventing signal transmission." This is how they work.

23. Correct Answer: A (Physical methods and psychological approaches)

The passage states that "non-pharmacological pain management techniques complement medication and include physical methods (ice, heat, massage), psychological approaches (relaxation, cognitive-behavioral therapy)." Both physical and psychological methods are included.

24. Correct Answer: C (Start with non-opioid analgesics)

The passage states that "postoperative pain management balances adequate relief with minimal side effects, typically starting with non-opioid analgesics and using opioids only when necessary." Starting with non-opioids is the recommended approach.

25. Correct Answer: D (Chemical messengers secreted by glands)

The passage defines hormones as "chemical messengers secreted by glands that travel through the bloodstream to target organs." This is the definition provided.

26. Correct Answer: A (Integrate nervous and endocrine functions)

The passage states that "the hypothalamus, located in the brain, integrates nervous and endocrine functions, producing releasing and inhibiting hormones that regulate the pituitary." Integration is its key function.

27. Correct Answer: D (Enlarged jaw and macroglossia)

The passage states that "acromegaly produces distinctive features including enlarged jaw, spaced teeth, macroglossia (enlarged tongue), and temporomandibular joint problems." Enlarged jaw and macroglossia are specifically mentioned.

28. Correct Answer: B (Increased sensitivity to dental anesthetics containing epinephrine)

The passage states that "hyperthyroidism (excess thyroid hormone) accelerates metabolism, causing nervousness, weight loss, rapid heartbeat, and increased sensitivity to dental anesthetics containing epinephrine." This sensitivity is a specific concern for dental professionals.

29. Correct Answer: C (Insulin deficiency or resistance)

The passage states that "diabetes mellitus results from insulin deficiency or resistance, causing persistently elevated blood glucose." This is the underlying cause of diabetes.

30. Correct Answer: D (Impaired immune response and altered collagen metabolism)

The passage states that "poorly controlled diabetes increases periodontitis risk through impaired immune response and altered collagen metabolism." Both mechanisms are mentioned.

31. Correct Answer: A (Bidirectional)

The passage states that "the relationship is bidirectional—severe periodontal disease can worsen glycemic control by increasing systemic inflammation and insulin resistance." Both directions of influence are described.

32. Correct Answer: C (In the morning when blood sugar is typically stable)

The passage states that dental professionals should manage diabetic patients by "scheduling morning appointments when blood sugar is typically stable." Morning appointments are recommended.

33. Correct Answer: B (Mandible to temporal bones)

The passage states that "temporomandibular joints (TMJs) connect the mandible to the temporal bones, enabling jaw movements." This describes the specific connection.

34. Correct Answer: A (Absorbs occlusal forces and provides proprioceptive feedback)

The passage states that "teeth anchor in alveolar bone through the periodontal ligament, a specialized connective tissue that absorbs occlusal forces and provides proprioceptive feedback." Both functions are mentioned.

35. Correct Answer: B (Elevate during swallowing to prevent nasal regurgitation)

The passage states that "the soft palate elevates during swallowing to prevent nasal regurgitation and produces speech sounds." Prevention of nasal regurgitation is its key swallowing function.

36. Correct Answer: C (Parotid, submandibular, and sublingual glands)

The passage states that "major salivary glands include paired parotid glands (producing serous saliva), submandibular glands (mixed serous and mucous), and sublingual glands (primarily mucous)." These are the three major pairs.

37. Correct Answer: A (Enzymes, antimicrobial compounds, and minerals)

The passage states that "saliva contains enzymes beginning carbohydrate digestion, antimicrobial compounds protecting against pathogens, minerals that remineralize teeth, and buffers that neutralize acids." Enzymes, antimicrobial compounds, and minerals are all mentioned.

38. Correct Answer: D (Cavities and oral infections)

The passage states that "xerostomia (dry mouth) from medications, radiation therapy, or systemic diseases dramatically increases cavity risk, oral infection susceptibility, and swallowing difficulties." Cavities and oral infections are specifically mentioned as increased risks.

39. Correct Answer: B (Upper teeth, maxilla, and associated soft tissues)

The passage states that "the maxillary artery, the external carotid's largest branch, supplies upper teeth, maxilla, and associated soft tissues." This describes what the maxillary artery supplies.

40. Correct Answer: A (Administer anesthesia safely without damaging vital structures)

The passage states that "understanding head and neck anatomy enables accurate diagnosis, safe anesthetic administration without damaging vital structures, recognition of anatomical variations that complicate treatment." Safe anesthetic administration is specifically mentioned.

Language Usage

1. Correct Answer: D (technology, and it also expanded)

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

2. Correct Answer: C (nor the hygienists were available)

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 C correctly uses the plural verb form with "nor."

3. Correct Answer: B (when he could return)

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 he." Option B correctly uses "when he could return."

4. Correct Answer: D (Between you and me, the new sterilization equipment is)

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

5. Correct Answer: A (examinations, cleanings, and root canals)

The sentence requires parallel structure. The original uses two nouns and then a verb phrase ("will perform root canals"), which is not parallel. Option A maintains parallel structure by using three nouns: "examinations, cleanings, and root canals."

6. Correct Answer: C (After reviewing the patient's x-rays, the dentist recommended)

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

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

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, properly connecting the two independent clauses.

8. Correct Answer: A (must complete his or her mandatory safety training)

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

9. Correct Answer: C (recommended that the patient floss daily)

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 patient floss" (not "flosses").

10. Correct Answer: B (Having carefully examined the tooth, the dentist made a treatment recommendation)

The original sentence contains a dangling modifier. "Having carefully examined the tooth" must modify a subject that can logically examine—the dentist, not the recommendation. Option B correctly places "the dentist" as the subject being modified.

11. Correct Answer: A (has completed his or her required continuing education 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 (holidays; 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: B (Fewer appointments were scheduled)

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

14. Correct Answer: C (examined the patient, recorded the findings, and prepared)

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

15. Correct Answer: B (Dr. Johnson told Dr. Lee that Dr. Johnson needed)

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

16. Correct Answer: D (affect all staff members and will go into effect)

"Affect" is a verb meaning to influence. "Effect" as a noun means result; "go into effect" is an idiom meaning to become operative. The sentence needs the verb "affect" to indicate that the guidelines influence staff, followed by "go into effect."

17. Correct Answer: A (hygiene is essential. All patients should)

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

18. Correct Answer: D (who graduated from the program)

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

19. Correct Answer: A (After studying the radiographs thoroughly, the specialist confirmed the diagnosis)

The original sentence contains a dangling modifier. The phrase "After studying the radiographs thoroughly" must modify "the specialist" (who did the studying), not "the diagnosis." Option A correctly places "the specialist" immediately after the modifying phrase.

20. Correct Answer: C (should have scheduled)

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

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

The original sentence lacks parallel structure with a gerund phrase at the end. Option A maintains parallel structure by using three noun forms: "extractions, fillings, or crowns." All three are in parallel grammatical form.

22. Correct Answer: D (results; they offer)

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

23. Correct Answer: C (the most complex procedure)

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

24. Correct Answer: B (Maple Street in the historic district of Boston, Massachusetts)

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

25. Correct Answer: A (After the consultation was completed, the patient received)

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

26. Correct Answer: D (when she could schedule)

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

27. Correct Answer: C (both agree that)

The compound subject "the hygienist and her assistant" is plural (two people), so the verb must be "agree" (plural), not "agrees" (singular). Option C correctly uses the plural verb form.

28. Correct Answer: B (are necessary)

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

29. Correct Answer: D (accuracy, and it also enhances)

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

30. Correct Answer: C (needs, such as routine care, cosmetic procedures, and emergencies)

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 C correctly uses the comma before "such as" without unnecessary additional punctuation.

31. Correct Answer: C (all play important 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 back 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 back in the chair."

33. Correct Answer: A (considerably, allowing practitioners to provide)

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

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

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

35. Correct Answer: C (requires students to complete clinical training before they graduate)

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

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

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

37. Correct Answer: C (more accessible to patients than the previous location was)

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

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

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

39. Correct Answer: B (had been sensitive)

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

40. Correct Answer: A (health, and it also enhances)

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

Quantitative Reasoning

1. Correct Answer: B (5)

To solve $6x - 9 = 21$, first add 9 to both sides: $6x = 30$. Then divide both sides by 6: $x = 5$. Verification: $6(5) - 9 = 30 - 9 = 21 \checkmark$

2. Correct Answer: D (25%)

Percent increase formula: $(\text{New} - \text{Old})/\text{Old} \times 100$. Calculate: $(200 - 160)/160 \times 100 = 40/160 \times 100 = 0.25 \times 100 = 25\%$. Patient visits increased by 25%.

3. Correct Answer: C (5)

To solve $8y - 5 = 5y + 10$, subtract $5y$ from both sides: $3y - 5 = 10$. Add 5 to both sides: $3y = 15$. Divide by 3: $y = 5$. Verification: $8(5) - 5 = 40 - 5 = 35$, and $5(5) + 10 = 25 + 10 = 35 \checkmark$

4. Correct Answer: B (\$1,680)

Calculate weekly earnings: $\$48/\text{hour} \times 7 \text{ hours}/\text{day} \times 5 \text{ days}/\text{week} = \$1,680$ per week. Break it down: Daily earnings = $\$48 \times 7 = \336 ; Weekly earnings = $\$336 \times 5 = \$1,680$.

5. Correct Answer: A (99)

To find 22% of 450, multiply: $0.22 \times 450 = 99$. Alternatively, 22% is the same as $22/100$, so $(22/100) \times 450 = 9,900/100 = 99$.

6. Correct Answer: C (81)

Substitute $a = 6$ and $b = -3$ into $2a^2 - 3b$. Calculate: $2(6)^2 - 3(-3) = 2(36) - (-9) = 72 + 9 = 81$.

7. Correct Answer: D (45 mg)

Multiply the dosage rate by body weight: $0.6 \text{ mg/kg} \times 75 \text{ kg} = 45 \text{ mg}$. The units of kilograms cancel out, leaving milligrams as the answer.

8. Correct Answer: A (4)

Expand the left side: $5(x + 3) = 5x + 15$. Set equal to right side: $5x + 15 = 3x + 23$. Subtract $3x$ from both sides: $2x + 15 = 23$. Subtract 15: $2x = 8$. Divide by 2: $x = 4$.

9. Correct Answer: D (1/3)

Total balls = $10 + 8 + 6 = 24$ balls. Blue balls = 8. Probability of selecting blue = $8/24 = 1/3$ (simplified by dividing numerator and denominator by 8).

10. Correct Answer: B (3,500 meters)

To convert kilometers to meters, multiply by 1,000 (since $1 \text{ km} = 1,000 \text{ m}$): $3.5 \text{ km} \times 1,000 \text{ m/km} = 3,500$ meters. This is a standard metric conversion.

11. Correct Answer: A (156)

Substitute $x = 6$ into $5x^2 - 4x$: $5(6)^2 - 4(6) = 5(36) - 24 = 180 - 24 = 156$. Follow the order of operations: exponents first, then multiplication, then subtraction.

12. Correct Answer: C (20%)

Percent decrease = $(\text{Old} - \text{New})/\text{Old} \times 100 = (4,000 - 3,200)/4,000 \times 100 = 800/4,000 \times 100 = 0.20 \times 100 = 20\%$. The expenses decreased by 20%.

13. Correct Answer: D (13x - 29)

Distribute: $5(4x - 3) - 7(x + 2) = 20x - 15 - 7x - 14$. Combine like terms: $(20x - 7x) + (-15 - 14) = 13x - 29$. Remember to distribute the negative sign in $-7(x + 2)$.

14. Correct Answer: B (4)

If the ratio is 1:40 and there are 160 patients, find the number of assistants: $160 \div 40 = 4$ assistants. This maintains the 1:40 ratio ($4:160 = 1:40$).

15. Correct Answer: C (42)

Solve $x/7 + 5 = 11$. First subtract 5 from both sides: $x/7 = 6$. Then multiply both sides by 7: $x = 42$.
Verification: $42/7 + 5 = 6 + 5 = 11 \checkmark$

16. Correct Answer: B (17 bpm)

The increase is found by subtracting the original value from the new value: $85 - 68 = 17$ bpm. This represents the amount of increase in pulse.

17. Correct Answer: D (7)

Substitute $x = 8$ into $7x - 3y = 35$: $7(8) - 3y = 35$, which gives $56 - 3y = 35$. Subtract 56 from both sides: $-3y = -21$. Divide by -3: $y = 7$.

18. Correct Answer: A (\$350)

Calculate the 30% discount amount: $0.30 \times \$500 = \150 . Subtract the discount from the original price: $\$500 - \$150 = \$350$. The discounted price is \$350.

19. Correct Answer: C (9)

Solve $10x - 6 = 7x + 21$. Subtract $7x$ from both sides: $3x - 6 = 21$. Add 6 to both sides: $3x = 27$. Divide by 3: $x = 9$.

20. Correct Answer: B (30)

To find the mean, add all values and divide by the count: $(18 + 24 + 30 + 36 + 42)/5 = 150/5 = 30$. The mean is the arithmetic average of the data set.

21. Correct Answer: A (210 mL)

Calculate 35% of 600 mL: $0.35 \times 600 = 210$ mL. Alternatively, 35% is the same as $35/100$, and $600 \times 35/100 = 21,000/100 = 210$ mL.

22. Correct Answer: D (14 and -14)

When $x^2 = 196$, take the square root of both sides. Remember that square roots have both positive and negative solutions: $x = +14$ or $x = -14$. Both values satisfy the equation: $(14)^2 = 196$ and $(-14)^2 = 196$.

23. Correct Answer: C (288)

Multiply: $16 \text{ patients/day} \times 6 \text{ days/week} \times 3 \text{ weeks} = 288 \text{ patients total}$. Calculate step by step: $16 \times 6 = 96 \text{ patients per week}$, then $96 \times 3 = 288 \text{ patients in 3 weeks}$.

24. Correct Answer: B (18x⁹)

When multiplying powers with the same base, multiply the coefficients and add the exponents: $(6x^5)(3x^4) = (6 \times 3)(x^{5+4}) = 18x^9$. Coefficient: $6 \times 3 = 18$. Exponent: $5 + 4 = 9$.

25. Correct Answer: D (70%)

Convert the fraction to a decimal first: $7/10 = 0.70$. Then multiply by 100 to get the percentage: $0.70 \times 100 = 70\%$. Alternatively, $7/10 = 70/100 = 70\%$.

26. Correct Answer: A (15)

Calculate total hours in 5 days: $5 \text{ days} \times 24 \text{ hours/day} = 120 \text{ hours}$. Divide by the dosing interval: $120 \text{ hours} \div 8 \text{ hours/dose} = 15 \text{ doses}$. The patient takes medication 3 times per day for 5 days.

27. Correct Answer: C (25 cm)

Perimeter formula for rectangle: $P = 2L + 2W$. Substitute known values: $80 = 2L + 2(15)$, which gives $80 = 2L + 30$. Subtract 30: $50 = 2L$. Divide by 2: $L = 25 \text{ cm}$.

28. Correct Answer: B (8)

Solve $9x - 15 = 8x - 7$. Subtract $8x$ from both sides: $x - 15 = -7$. Add 15 to both sides: $x = 8$. Verification: $9(8) - 15 = 72 - 15 = 57$ and $8(8) - 7 = 64 - 7 = 57 \checkmark$

29. Correct Answer: A (\$918)

Calculate 8% tax on \$850: $0.08 \times \$850 = \68 . Add tax to original cost: $\$850 + \$68 = \$918$. The total cost including sales tax is \$918.

30. Correct Answer: D (20)

The median is the middle value when data is arranged in order. The data set 12, 16, 20, 24, 28 is already ordered. With 5 values, the middle (3rd) value is 20.

31. Correct Answer: B (15)

First solve for x : $6x - 10 = 20$. Add 10 to both sides: $6x = 30$. Divide by 6: $x = 5$. Then calculate $3x$: $3(5) = 15$.

32. Correct Answer: C (1,900 mL)

Convert liters to milliliters by multiplying by 1,000 (since 1 L = 1,000 mL): $1.9 \text{ L} \times 1,000 \text{ mL/L} = 1,900 \text{ mL}$. This is a standard metric conversion.

33. Correct Answer: D (22)

Calculate step by step: $(-4)^2 - 3(-2)$. First, $(-4)^2 = 16$ (squaring a negative gives a positive). Second, $-3(-2) = +6$ (multiplying two negatives gives a positive). Finally, $16 + 6 = 22$.

34. Correct Answer: A (7)

Calculate 20% of 35: $0.20 \times 35 = 7$ dentists. Alternatively, 20% is the same as $1/5$, and $35 \times 1/5 = 35/5 = 7$ dentists work at the clinic.

35. Correct Answer: B (72)

Solve $x/9 = 8$ by multiplying both sides by 9: $x = 8 \times 9 = 72$. Verification: $72/9 = 8 \checkmark$

36. Correct Answer: D (5/8)

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

37. Correct Answer: A (18)

Use the elimination method. Add the two equations: $(x - y) + (x + y) = 10 + 26$, which gives $2x = 36$. Divide by 2: $x = 18$. The y terms cancel when adding the equations.

38. Correct Answer: D (100.4°F)

Substitute $C = 38$ into $F = (9/5)C + 32$: $F = (9/5)(38) + 32 = 1.8(38) + 32 = 68.4 + 32 = 100.4^\circ\text{F}$. This represents a fever temperature.

39. Correct Answer: C (24)

The range is the difference between the maximum and minimum values: $42 - 18 = 24$. Range measures the spread of the data from lowest to highest value.

40. Correct Answer: A (2:3)

Write the ratio: 120:180. Simplify by dividing both numbers by their GCF (60): $120/60 = 2$ and $180/60 = 3$. The simplest form of the ratio is 2:3.

Perceptual Ability

ANGLE DISCRIMINATION (Questions 1-15)

1. Correct Answer: B (Angle 2)

The angles measure: Angle 1 = 55° , Angle 2 = 115° , Angle 3 = 78° , Angle 4 = 138° . The question asks which is closest to 120° . Comparing distances from 120° : Angle 1 (55°) is 65° away, Angle 2 (115°) is only 5° away, Angle 3 (78°) is 42° away, and Angle 4 (138°) is 18° away. Angle 2 at 115° is closest to 120° .

2. Correct Answer: D (Angle B)

The three angles measure: Angle A = 32° , Angle B = 125° , Angle C = 90° . Comparing all three, 125° is the largest angle.

3. Correct Answer: C (86°)

The five angles measure 28° , 95° , 59° , 147° , and 86° . Ordering from largest to smallest: 147° , 95° , 86° , 59° , 28° . The third largest angle is 86° .

4. Correct Answer: A (43°)

The four angles measure 43° , 108° , 71° , and 135° . Comparing all measurements, 43° is the smallest angle shown.

5. Correct Answer: D (126° , 80° , 46°)

The three angles measure 80° , 126° , and 46° . Arranging from largest to smallest: 126° , 80° , 46° . This represents the correct descending order.

6. Correct Answer: B (60°)

Acute angles measure less than 90° . From the five angles (35° , 103° , 74° , 151° , 60°), the acute angles are 35° , 74° , and 60° . Comparing distances from 65° : 35° is 30° away, 60° is 5° away, and 74° is 9° away. Angle 60° is closest to 65° .

7. Correct Answer: C (99°)

The four angles measure 21° , 99° , 52° , and 166° . Ordering from smallest to largest: 21° , 52° , 99° , 166° . The third smallest angle is 99° .

8. Correct Answer: A (37°)

Acute angles measure less than 90° . From the three angles (37° , 93° , 158°), only 37° is acute. Angles 93° and 158° are both obtuse. The acute and smallest angle is 37° .

9. Correct Answer: A (53°)

The five angles measure 44° , 107° , 70° , 140° , and 53° . Comparing distances from 50° : 44° is 6° away, 53° is 3° away, 70° is 20° away, 107° is 57° away, and 140° is 90° away. Angle 53° is closest to 50° .

10. Correct Answer: B (94°)

The four angles measure 68° , 131° , 33° , and 94° . Ordering from largest to smallest: 131° , 94° , 68° , 33° . The second largest angle is 94° .

11. Correct Answer: D (75°)

The three acute angles measure 42° , 75° , and 63° . Comparing all three, 75° is the largest angle.

12. Correct Answer: A (54°)

The five angles measure 118° , 89° , 54° , 169° , and 77° . Comparing all measurements, 54° is the smallest angle.

13. Correct Answer: C (76°)

The four angles measure 25° , 104° , 76° , and 145° . Comparing distances from 75° : 25° is 50° away, 104° is 29° away, 76° is 1° away, and 145° is 70° away. Angle 76° is closest to 75° .

14. Correct Answer: D (121°)

Obtuse angles measure between 90° and 180° . From the three angles (121° , 48° , 88°), only 121° is both obtuse AND greater than 100° . Angles 48° and 88° are both acute.

15. Correct Answer: B (153° , 109°)

The five angles measure 40° , 109° , 66° , 153° , and 84° . Ordering all angles from largest to smallest: 153° , 109° , 84° , 66° , 40° . The two largest angles in order are 153° , 109° .

APERTURES (Questions 16-30)

16. Correct Answer: A (A rectangle $11\text{ cm} \times 13\text{ cm}$)

A rectangular prism measuring $7\text{ cm} \times 11\text{ cm} \times 13\text{ cm}$ has three possible face orientations. The largest face measures $11\text{ cm} \times 13\text{ cm}$. This rectangular aperture would accommodate the largest face when properly oriented.

17. Correct Answer: C (A circle with at least 11 cm diameter)

When a cylinder with diameter 11 cm is oriented with its circular end forward, the cross-section presented is circular with 11 cm diameter. The aperture must be a circle with at least 11 cm diameter to allow passage.

18. Correct Answer: D (A square 11 cm \times 11 cm or larger)

A pyramid with a square base measuring $11\text{ cm} \times 11\text{ cm}$ requires a square aperture of at least $11\text{ cm} \times 11\text{ cm}$ to accommodate the base when oriented base-first.

19. Correct Answer: B (10 cm \times 10 cm)

A cube measuring 10 cm on each side, when oriented face-first, presents a square cross-section of $10\text{ cm} \times 10\text{ cm}$. This is the exact size needed for the smallest square aperture through which it can pass.

20. Correct Answer: C (An equilateral triangle 9 cm sides)

A triangular prism with an equilateral triangular base measuring 9 cm on each side, when entering triangle-first, requires an aperture matching that triangular shape with 9 cm sides.

21. Correct Answer: A (A rectangle 9 cm \times 12 cm or larger)

An L-shaped object with overall dimensions of 9 cm wide and 12 cm tall requires a rectangular aperture of at least $9\text{ cm} \times 12\text{ cm}$ to accommodate the entire object's profile when passing through.

22. Correct Answer: D (A circle with at least 14 cm diameter)

A sphere with a 14 cm diameter requires a circular aperture of at least 14 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 9 cm \times 11 cm)

A rectangular block measuring $9\text{ cm} \times 11\text{ cm} \times 7\text{ cm}$, when oriented with the $9\text{ cm} \times 11\text{ cm}$ face forward, requires a rectangular aperture of at least $9\text{ cm} \times 11\text{ cm}$ to pass through.

24. Correct Answer: A (A hexagon approximately 9 cm across)

A hexagonal prism with a 9 cm wide hexagonal base, when entering hexagon-first, requires an aperture that matches the hexagonal shape, approximately 9 cm across at its widest point.

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

A T-shaped object with overall dimensions of 13 cm wide and 15 cm tall requires a rectangular aperture of at least 13 cm × 15 cm to accommodate the entire T profile when passing through face-first.

26. Correct Answer: D (An ellipse or rectangle 10 cm × 13 cm)

An ellipsoid measuring 10 cm × 13 cm × 8 cm, when oriented with the 10 cm × 13 cm face forward, requires an elliptical or rectangular aperture of approximately 10 cm × 13 cm.

27. Correct Answer: B (A square 11 cm × 11 cm or larger)

A cross-shaped object with arms extending 11 cm in each direction requires a square aperture of at least 11 cm × 11 cm to accommodate the full width and height of the cross profile when entering face-first.

28. Correct Answer: C (A circle with at least 13 cm diameter)

A cone with a base diameter of 13 cm, when oriented base-first, presents a circular cross-section of 13 cm diameter. The aperture must be a circle with at least 13 cm diameter.

29. Correct Answer: A (A rounded rectangle approximately 9 cm × 11 cm)

A rectangular block measuring 9 cm × 11 cm × 15 cm with 2 cm radius curves on the ends requires a rounded rectangular aperture of approximately 9 cm × 11 cm to accommodate the curved end profile.

30. Correct Answer: D (A rectangle 10 cm × 8 cm)

An irregular object with maximum dimensions of 10 cm × 12 cm × 8 cm, when oriented with its smallest face (10 cm × 8 cm) forward, requires a rectangular aperture of at least 10 cm × 8 cm.

ORTHOGRAPHIC PROJECTIONS (Questions 31-45)

31. Correct Answer: B (Two rectangular prisms stacked)

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

32. Correct Answer: A (A cube)

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

33. Correct Answer: C (Front view only)

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

34. Correct Answer: A (A triangular prism oriented on its side)

A rectangular top view combined with a triangular front view and rectangular end view indicates a triangular prism oriented on its side (lying horizontally with the triangular cross-section visible from the front).

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

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

36. Correct Answer: B (Two rectangular prisms with a dividing feature)

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

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

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

38. Correct Answer: C (Two triangular prisms forming a square cross-section)

A square with a diagonal line in the top and end views, combined with two triangles in the front view, suggests two triangular prisms arranged together to form a square cross-section when viewed from top or end.

39. Correct Answer: D (A U-shaped prism)

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

40. Correct Answer: B (Five cubes in a row)

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

41. Correct Answer: C (A nonagonal prism)

Nonagonal (9-sided) top and end views combined with a rectangular front view indicates a nonagonal prism—an object with a uniform nine-sided cross-section throughout its length.

42. Correct Answer: D (A cylinder oriented horizontally)

A rectangular top view, rectangular front view, and circular end view indicates a cylinder oriented horizontally (lying on its side), with the circular cross-section visible from the end.

43. Correct Answer: A (A heptagonal prism)

Heptagonal (7-sided) top and end views combined with a rectangular front view indicates a heptagonal prism—an object with a uniform seven-sided cross-section throughout its length.

44. Correct Answer: C (Three cylinders arranged in triangle pattern)

Three circles in triangle formation in the top view, three rectangles in the front view, and a circle in the end view suggests three cylindrical objects arranged in a triangular pattern.

45. Correct Answer: B (A Z-shaped prism)

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

CUBE COUNTING (Questions 46-60)

46. Correct Answer: B (16)

A structure with 4 layers arranged $2 \times 2 \times 4$ contains: 2 cubes wide \times 2 cubes deep \times 4 cubes high = 16 total cubes. Multiply the three dimensions to find the total count.

47. Correct Answer: C (98)

In a $5 \times 5 \times 5$ cube structure containing 125 total cubes, only the interior cubes ($3 \times 3 \times 3 = 27$ cubes) have no faces exposed. Therefore, cubes on the surface with at least one face exposed = $125 - 27 = 98$ cubes.

48. Correct Answer: D (48)

A $2 \times 4 \times 6$ structure contains: 2 cubes \times 4 cubes \times 6 cubes = 48 total cubes. Multiply the three dimensions to find the total count.

49. Correct Answer: D (8)

In an $8 \times 8 \times 8$ 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: A (42)

With 7 layers and 6 cubes per layer arranged 2×3 : Total cubes = 7 layers \times 6 cubes per layer = 42 cubes. Alternatively, $2 \times 3 \times 7 = 42$ cubes.

51. Correct Answer: C (8)

Any rectangular prism has exactly 8 corners (vertices). In a $2 \times 5 \times 6$ structure, there are 8 corner cubes where three edges meet.

52. Correct Answer: B (336)

A structure 8 cubes high \times 7 cubes wide \times 6 cubes deep contains: $8 \times 7 \times 6 = 336$ total cubes. Multiply the three dimensions to find the total count.

53. Correct Answer: A (18)

An L-shaped structure with 10 cubes on one arm and 9 on the other, sharing 1 corner cube: Total = $10 + 9 - 1 = 18$ cubes. Subtract the shared corner cube to avoid counting it twice.

54. Correct Answer: D (28)

In an $8 \times 8 \times 1$ flat structure, cubes with exactly two painted faces are the perimeter cubes excluding corners. Perimeter cubes = $8 + 8 + 8 + 8 - 4$ corners = $32 - 4 = 28$ cubes with two painted faces.

55. Correct Answer: C (21)

A staircase structure with 5 cubes on first step, 7 on second, and 9 on third contains: $5 + 7 + 9 = 21$ total cubes. This is the sum of the arithmetic sequence.

56. Correct Answer: A (8)

Any rectangular prism has exactly 8 corners (vertices). In a $7 \times 8 \times 9$ structure, there are 8 corner cubes where three faces meet at each corner position.

57. Correct Answer: B (8)

In a $10 \times 1 \times 1$ structure (10 cubes in a row), the 2 end cubes have 5 faces painted, and the 8 middle cubes have exactly 4 faces painted (top, bottom, front, back—not the two sides touching adjacent cubes).

58. Correct Answer: D (84)

Bottom layer: $7 \times 7 = 49$ cubes. Next layer: $5 \times 5 = 25$ cubes. Next layer: $3 \times 3 = 9$ cubes. Top layer: 1 cube. Total = $49 + 25 + 9 + 1 = 84$ cubes in this pyramid structure.

59. Correct Answer: A (340)

A $7 \times 7 \times 7$ cube contains 343 total cubes. With three corner cubes removed: $343 - 3 = 340$ cubes remain.

60. Correct Answer: C (15)

A plus-shaped structure with 8 cubes for vertical arm and 8 cubes for horizontal arm, sharing 1 center cube: Total = $8 + 8 - 1 = 15$ cubes. The center cube where the arms intersect is counted only once.

Biology

1. Correct Answer: D (ATP production through cellular respiration)

The primary function of mitochondria is to produce ATP (adenosine triphosphate) through cellular respiration. Mitochondria are known as the "powerhouse of the cell" because they convert nutrients like glucose into usable energy through oxidative phosphorylation and the citric acid cycle, generating most of the cell's ATP supply.

2. Correct Answer: A (Golgi apparatus)

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

3. Correct Answer: B (Metaphase)

During metaphase of mitosis, chromosomes align at the cell's equator (metaphase plate). The spindle fibers attach to the centromeres of chromosomes, and the chromosomes line up in the middle of the cell before being pulled apart during anaphase.

4. Correct Answer: C (Osmosis)

Osmosis is the process that allows water to move across a selectively permeable membrane. It is the passive diffusion of water molecules from an area of high water concentration to an area of low water concentration through a semipermeable membrane, moving down the concentration gradient without requiring energy.

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

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

6. Correct Answer: D (Four haploid cells)

Meiosis produces four haploid daughter cells from one diploid parent cell. Through two successive divisions (meiosis I and II), the chromosome number is reduced by half, creating four genetically distinct haploid gametes (sex cells) that contain half the chromosome number of the original cell.

7. Correct Answer: B (Thymine)

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

8. Correct Answer: C (Codominance)

Codominance is the pattern of inheritance where both alleles are fully and equally expressed in heterozygotes. Neither allele is dominant over the other, so both phenotypes appear simultaneously. An example is the AB blood type, where both A and B alleles are expressed.

9. Correct Answer: A (Prophase I)

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

10. Correct Answer: D (Plasma)

Plasma is the liquid component of blood responsible for transporting nutrients, waste products, hormones, proteins, and other substances throughout the body. It is the straw-colored fluid that makes up about 55% of blood volume and serves as the transport medium for blood cells and dissolved substances.

11. Correct Answer: B (Nutrient absorption)

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

12. Correct Answer: A (Epithelial tissue)

Epithelial tissue is the tissue type that lines body cavities and covers body surfaces. It forms protective barriers on the skin's outer surface, lines the digestive tract, respiratory passages, blood vessels, and body cavities, providing protection, absorption, and secretion functions.

13. Correct Answer: B (25%)

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

14. Correct Answer: C (Mitosis)

Mitosis is the process that produces genetically identical cells for growth and repair. It is a type of cell division where one parent cell divides to produce two genetically identical daughter cells with the same chromosome number, used for growth, tissue repair, and asexual reproduction.

15. Correct Answer: A (Brings specific amino acids to the ribosome during translation)

The primary role 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.

16. Correct Answer: D (White blood cells)

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

17. Correct Answer: C (Smooth muscle)

Smooth muscle is the type of muscle tissue that is involuntary and found in internal organs. It lines the walls of hollow organs such as the stomach, intestines, blood vessels, bladder, and uterus. It contracts slowly and rhythmically without conscious control to move substances through organs.

18. Correct Answer: B (mRNA)

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

19. Correct Answer: A (Chloroplast)

Chloroplasts are the organelles responsible for photosynthesis in plant cells. They contain chlorophyll, which captures light energy from the sun and converts it into chemical energy (glucose) through the process of photosynthesis, producing oxygen as a byproduct.

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

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

21. Correct Answer: C (Are eukaryotic organisms)

Fungi differ from bacteria because fungi are eukaryotic organisms with membrane-bound organelles including a nucleus, while bacteria are prokaryotic and lack these structures. Fungi also have cell walls made of chitin (not peptidoglycan like bacteria) and are typically multicellular (except yeasts).

22. Correct Answer: B (Glucose and oxygen)

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

23. Correct Answer: D (Cardiovascular system)

The cardiovascular system (circulatory system) transports oxygen and nutrients throughout the body. It consists of the heart, blood vessels (arteries, veins, capillaries), and blood, which work together to deliver oxygen, nutrients, hormones, and other substances to tissues while removing waste products.

24. Correct Answer: A (TAC)

If mRNA has the sequence AUG, the corresponding DNA template strand is TAC. 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), and DNA guanine pairs with RNA cytosine (C). So DNA TAC transcribes to mRNA AUG.

25. Correct Answer: C (Arteries)

Arteries are the vessels that carry oxygenated blood away from the heart to the body's tissues. Most arteries carry oxygenated blood (except pulmonary arteries which carry deoxygenated blood to the lungs). Arteries have thick, muscular, elastic walls to withstand high pressure from the heart's pumping action.

26. Correct Answer: B (Protein synthesis)

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

27. Correct Answer: A (Phenotype)

Phenotype is the term that describes the physical expression of genes—the observable traits or characteristics of an organism. It results from the interaction of the genotype (genetic makeup) with the environment and includes physical appearance, biochemical properties, and behavior.

28. Correct Answer: D (S phase)

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

29. Correct Answer: C (Brain and spinal cord)

The main components of the central nervous system (CNS) are the brain and spinal cord. The brain processes information and controls body functions, while the spinal cord transmits signals between the brain and the rest of the body. Together, they coordinate responses to stimuli and regulate body functions.

30. Correct Answer: B (Prokaryotes lack membrane-bound organelles)

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

General Chemistry

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

The atomic number of an element is defined as the number of protons in the nucleus. This number uniquely identifies each element—every atom with 6 protons is carbon, every atom with 8 protons is oxygen, etc. The atomic number determines the element's identity and its position on the periodic table.

2. Correct Answer: D (Proton)

Protons are subatomic particles that have a positive charge (+1). They are located in the nucleus along with neutrons. The number of protons determines the element's identity and atomic number. Electrons have a negative charge, neutrons have no charge, and ions are charged atoms or molecules.

3. Correct Answer: A (Covalent bond)

A covalent bond results from the sharing of electrons between atoms. This type of bonding typically occurs between nonmetal atoms. Each atom contributes electrons to form shared pairs that hold the atoms together, allowing both atoms to achieve more stable electron configurations.

4. Correct Answer: C (8)

The second energy level (shell) can hold a maximum of 8 electrons, calculated using the formula $2n^2$ where n is the shell number. For the second shell: $2(2)^2 = 2(4) = 8$ electrons maximum.

5. Correct Answer: D (Salt and water)

When an acid reacts with a base, the products are salt and water through a neutralization reaction. For example: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$. 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: B (18 g/mol)

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

7. Correct Answer: C (12)

The pH scale ranges from 0 to 14, with pH 7 being neutral. Basic (alkaline) solutions have pH values greater than 7. Among the options, pH 12 indicates a basic solution. pH 2 and 5 are acidic, while pH 7 is neutral.

8. Correct Answer: A (2)

In the balanced equation $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$, the coefficient of H_2 is 2. This coefficient indicates that 2 molecules of hydrogen gas react with 1 molecule of oxygen gas to produce 2 molecules of water.

9. Correct Answer: A (Isotopes)

Atoms with the same atomic number (same number of protons) but different mass numbers (different numbers of neutrons) are called isotopes. For example, carbon-12 and carbon-14 are isotopes, both with 6 protons but 6 and 8 neutrons respectively.

10. Correct Answer: B (Pressure increases)

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

11. Correct Answer: C (Covalent bond)

When atoms share electrons equally (or nearly equally), a covalent bond forms. This type of bonding typically occurs between nonmetal atoms with similar electronegativities, where each atom contributes electrons to form shared pairs.

12. Correct Answer: A (2 moles)

To calculate moles, divide mass by molar mass: $\text{moles} = 36 \text{ g} \div 18 \text{ g/mol} = 2 \text{ moles}$. This shows that 36 grams of water contains 2 moles of H_2O molecules.

13. Correct Answer: D (Moles)

The mole is the standard 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.

14. Correct Answer: B (Taste bitter and feel slippery)

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

15. Correct Answer: C (Gas)

Gases have particles that move freely and are far apart. Gas particles are in constant random motion with large spaces between them, giving gases neither definite shape nor definite volume. Solids have particles in fixed positions, while liquids have particles close together but able to move past each other.

16. Correct Answer: D (Charged ions)

Through ionic bonding, atoms form 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: A (9)

The formula $3\text{Al}_2\text{O}_3$ represents 3 formula units of aluminum oxide. Each Al_2O_3 contains 3 oxygen atoms. Therefore: $3 \text{ formula units} \times 3 \text{ oxygen atoms per unit} = 9 \text{ total oxygen atoms}$.

18. Correct Answer: C (7)

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

19. Correct Answer: B (Group 17)

The halogens are located in Group 17 of the periodic table and include fluorine, chlorine, bromine, iodine, and astatine. These highly reactive nonmetals have 7 valence electrons and readily form -1 ions by gaining one electron to achieve a stable electron configuration.

20. Correct Answer: A (Decomposition)

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

21. Correct Answer: D (1000 times)

The pH scale is logarithmic with base 10. Each unit represents a 10-fold difference in hydrogen ion concentration. A difference of 3 pH units represents $10^3 = 1000$ -fold difference. A solution with pH 2 has 1000 times more H^+ ions than a solution with pH 5.

22. Correct Answer: B (Positive)

Protons are subatomic particles that carry a positive electrical charge (+1). They are located in the nucleus along with neutrons and contribute to the atom's mass and identity. The number of protons determines the element's atomic number.

23. Correct Answer: C (7)

Elements in Group 17 (the halogens) have 7 valence electrons in their outermost energy level. This includes fluorine, chlorine, bromine, iodine, and astatine. Because they need only one electron to achieve a stable configuration, halogens are highly reactive and readily form -1 ions.

24. Correct Answer: A (Atoms are rearranged)

During chemical reactions, atoms are rearranged as existing bonds break and new bonds form. According to the Law of Conservation of Mass, atoms are neither created nor destroyed during chemical reactions. The total mass of reactants equals the total mass of products, and the number and type of atoms remain constant.

25. Correct Answer: D (1 M)

Using the dilution formula $M_1V_1 = M_2V_2$: $(4\text{ M})(25\text{ mL}) = M_2(100\text{ mL})$. Solving: $100 = 100M_2$, so $M_2 = 1\text{ M}$. Diluting from 25 mL to 100 mL (4-fold dilution) reduces the concentration from 4 M to 1 M.

26. Correct Answer: C (OH⁻ ions)

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

27. Correct Answer: B (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 increases)

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

29. Correct Answer: D (9)

A neutral atom has equal numbers of protons and electrons, making the overall charge zero. Fluorine has an atomic number of 9, meaning it has 9 protons. Therefore, a neutral fluorine atom also has 9 electrons to balance the positive charge of the protons.

30. Correct Answer: C (Pressure increases)

At constant volume, gas pressure is directly proportional to absolute temperature (Gay-Lussac's Law). When temperature increases, gas molecules move faster and collide with container walls more frequently and with greater force, causing pressure to increase proportionally.