

GATE XL General Aptitude

Easy Level (5 Questions)

1. **If $A = 3$ and $B = 5$, what is the value of $2A + B$?

- a) 11
- b) 10
- c) 9
- d) 8

****(Answer: b) 10****

2. **Find the missing number in the series: 2, 4, 8, 16, ?

- a) 24
- b) 32
- c) 36
- d) 48

****(Answer: b) 32****

3. **A train travels at a speed of 60 km/h. How much time will it take to cover a distance of 120 km?

- a) 1 hour
- b) 1.5 hours
- c) 2 hours
- d) 2.5 hours

****(Answer: c) 2 hours****

4. ****The synonym of "Abundant" is:****

- a) Scarce
- b) Plenty
- c) Insufficient
- d) Rare

****(Answer: b) Plenty****

5. ****The sum of the angles of a triangle is:****

- a) 90°
- b) 120°
- c) 180°
- d) 360°

****(Answer: c) 180° ****

**Moderate Level (5 Questions)**

6. ****If the sum of two numbers is 50 and their difference is 10, what is the larger number?****

- a) 30
- b) 20
- c) 40
- d) 25

****(Answer: a) 30****

7. ****Find the missing number in the series: 3, 6, 11, 18, ?****

a) 26

b) 27

c) 29

d) 30

****(Answer: c) 29****

(Pattern: +3, +5, +7, +9...)

8. ****A shopkeeper offers a 20% discount on a ₹500 product. What is the selling price?****

a) ₹300

b) ₹350

c) ₹400

d) ₹450

****(Answer: c) ₹400****

9. ****Choose the correct analogy: "Book" is to "Read" as "Pen" is to:****

a) Ink

b) Write

c) Paper

d) Pencil

****(Answer: b) Write****

10. ****A rectangle has a length of 10 cm and width of 5 cm. What is its area?****

a) 20 cm²

b) 25 cm²

c) 50 cm^2

d) 60 cm^2

****(Answer: c) 50 cm^2 ****

**Hard Level (5 Questions)**

11. ****The probability of drawing a red card from a standard deck of 52 playing cards is:****

a) $1/2$

b) $1/4$

c) $1/3$

d) $3/4$

****(Answer: a) $1/2$ ****

(Total red cards = 26, Probability = $26/52 = 1/2$)

12. ****If $\log_2 x = 3$, what is the value of x?****

a) 6

b) 8

c) 9

d) 12

****(Answer: b) 8****

(Since $2^3 = 8$)

13. ****A and B together can complete a work in 6 days. A alone can complete it in 9 days. How many days will B alone take?****

a) 12

b) 15

c) 18

d) 20

****(Answer: c) 18****

($1/A + 1/B = 1/6$, $1/9 + 1/B = 1/6$, solving gives $B = 18$ days)

14. **A clock gains 5 minutes every hour. If it is set to the correct time at 12:00 PM, what will be the time shown after 6 hours?**

a) 5:30 PM

b) 6:00 PM

c) 6:30 PM

d) 7:00 PM

****(Answer: c) 6:30 PM****

($6 \times 5 = 30$ extra minutes, so it shows 6:30 PM instead of 6:00 PM)

15. **A train 150 m long is moving at 60 km/h. How long will it take to cross a pole?**

a) 3 seconds

b) 5 seconds

c) 7 seconds

d) 9 seconds

****(Answer: b) 9 seconds****

(Convert speed: $60 \text{ km/h} = 16.67 \text{ m/s}$, time = $150/16.67 \approx 9$ seconds)

Chemistry

Easy Level (5 Questions)

1. **Which of the following is NOT an example of a Lewis acid?**

- a) AlCl_3
- b) BF_3
- c) NH_3
- d) Fe^{3+}

**(Answer: c) NH_3 *)

2. **Which quantum number determines the shape of an atomic orbital?**

- a) Principal quantum number (n)
- b) Azimuthal quantum number (l)
- c) Magnetic quantum number (m)
- d) Spin quantum number (s)

**(Answer: b) Azimuthal quantum number (l)*)

3. **The rate constant of a first-order reaction is 0.693 min^{-1} . What is the half-life of the reaction?**

- a) 1 min
- b) 0.5 min
- c) 10 min
- d) 100 min

**(Answer: a) 1 min*)

*(Formula: $t_{1/2} = 0.693/k$ *)

4. **Which of the following statements is TRUE about the Ideal Gas Law?

- a) It applies to all gases under all conditions
- b) It is given by $PV = nRT$
- c) It considers intermolecular forces
- d) It is derived from van der Waals equation

****(Answer: b) It is given by $PV = nRT$ ****

5. ****Which metal is extracted using the Bayer process?****

- a) Iron
- b) Aluminum
- c) Copper
- d) Zinc

****(Answer: b) Aluminum****

****Moderate Level (5 Questions)****

6. ****Which type of hybridization is observed in the central atom of SF_6 ?**

- a) sp^3
- b) sp^3d
- c) sp^3d^2
- d) sp^2

****(Answer: c) sp^3d^2 ****

7. ****A 0.1 M solution of acetic acid (CH_3COOH) is only 1.3% ionized. What is its dissociation constant (K_a)?**

a) 1.69×10^{-5}

b) 1.69×10^{-3}

c) 1.3×10^{-2}

d) 1.3×10^{-4}

****(Answer: a) 1.69×10^{-5} ****

($K_a = [H^+][A^-] / [HA]$, degree of ionization = 1.3%)

8. ****Which statement about SN1 and SN2 reactions is correct?****

a) SN1 reactions proceed via a carbocation intermediate

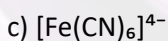
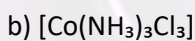
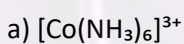
b) SN2 reactions are unimolecular

c) SN1 reactions are favored by strong nucleophiles

d) SN2 reactions show first-order kinetics

****(Answer: a) SN1 reactions proceed via a carbocation intermediate****

9. ****Which of the following molecules exhibits *facial-meridional* isomerism?****



****(Answer: b) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ ****

10. ****Calculate the standard cell potential (E°_{cell}) for the reaction: $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$, given:****

- $E^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$

- $E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$

a) 0.34 V

b) -0.42 V

c) 1.10 V

d) 0.42 V

****(Answer: c) 1.10 V****

($E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} = 0.34 - (-0.76)$)

**Hard Level (5 Questions)**

11. ****Which statement is TRUE regarding the kinetic isotope effect?***

a) It occurs due to differences in electronic configuration

b) It is observed when a heavier isotope replaces a lighter one in a molecule

c) It is independent of reaction mechanisms

d) It affects only unimolecular reactions

****(Answer: b) It is observed when a heavier isotope replaces a lighter one in a molecule****

12. ****For a reaction $A \rightarrow B$, the rate law is given as $\text{Rate} = k[A]^2$. If the initial concentration of A is doubled, how will the rate change?***

a) Remains the same

b) Doubles

c) Quadruples

d) Halves

****(Answer: c) Quadruples****

13. **The entropy change (ΔS) for the expansion of 1 mole of an ideal gas from volume V_1 to V_2 at constant temperature is given by:**

a) $\Delta S = nR \ln(V_2/V_1)$

b) $\Delta S = nC_v \ln(T_2/T_1)$

c) $\Delta S = nC_p \ln(P_2/P_1)$

d) $\Delta S = q_{rev}/T$

** (Answer: a) $\Delta S = nR \ln(V_2/V_1)$ **

14. **For a transition metal complex $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$, which ligand substitution follows an associative mechanism? **



** (Answer: c) CO **

15. **Consider the reaction: $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$, where $\Delta H < 0$. Which condition will shift the equilibrium toward N_2O_4 ? **

a) Increasing temperature

b) Decreasing pressure

c) Increasing pressure

d) Adding a catalyst

** (Answer: c) Increasing pressure **

(Higher pressure favors the side with fewer gas molecules, which is N_2O_4 in this case.)

GATE XL Biochemistry

---# **Easy Level (7 Questions)**

1. **Which of the following is NOT a component of an amino acid? **

- a) Amino group
- b) Carboxyl group
- c) Phosphate group
- d) R-group

****(Answer: c) Phosphate group****

2. ****Which vitamin is essential for blood clotting?****

- a) Vitamin A
- b) Vitamin K
- c) Vitamin C
- d) Vitamin B₁₂

****(Answer: b) Vitamin K****

3. ****What is the primary storage form of glucose in animals?****

- a) Starch
- b) Cellulose
- c) Glycogen
- d) Sucrose

****(Answer: c) Glycogen****

4. ****Which of the following enzymes catalyzes the first step of glycolysis?****

- a) Hexokinase
- b) Phosphofructokinase
- c) Pyruvate kinase
- d) Aldolase

****(Answer: a) Hexokinase****

5. ****Which of the following bonds is responsible for the stability of the DNA double helix?****

- a) Peptide bonds
- b) Hydrogen bonds
- c) Phosphodiester bonds
- d) Disulfide bonds

****(Answer: b) Hydrogen bonds****

6. ****The Michaelis-Menten equation describes the relationship between enzyme activity and:****

- a) pH
- b) Temperature
- c) Substrate concentration
- d) Cofactors

****(Answer: c) Substrate concentration****

7. ****Which of the following lipids is an essential precursor for steroid hormones?****

- a) Phospholipid
- b) Cholesterol
- c) Triglyceride
- d) Sphingomyelin

****(Answer: b) Cholesterol****

Moderate Level (7 Questions)

8. **Which of the following metabolic pathways occurs in the mitochondria?**

- a) Glycolysis
- b) Pentose phosphate pathway
- c) Fatty acid synthesis
- d) Citric acid cycle

(Answer: d) Citric acid cycle

9. **What is the function of ribonuclease?

- a) Synthesizes RNA
- b) Degrades RNA
- c) Synthesizes DNA
- d) Degrades proteins

(Answer: b) Degrades RNA

10. **Which of the following amino acids is both ketogenic and glucogenic?

- a) Leucine
- b) Lysine
- c) Alanine
- d) Tyrosine

(Answer: d) Tyrosine

11. **A protein has a molecular weight of 50 kDa. If 1 mg of this protein is dissolved in 1 mL of buffer, what is its molar concentration?

- a) 20 μ M

b) 10 μM

c) 5 μM

d) 1 μM

****(Answer: b) 10 μM ****

(Molarity = Mass / (Molecular weight $\times$ Volume))

12. ****What is the effect of a competitive inhibitor on enzyme kinetics?****

a) Increases V_{max} , decreases K_m

b) Decreases V_{max} , increases K_m

c) No change in V_{max} , increases K_m

d) No change in K_m , decreases V_{max}

****(Answer: c) No change in V_{max} , increases K_m ****

13. ****Which of the following coenzymes is involved in redox reactions?****

a) NAD^+

b) ATP

c) Coenzyme A

d) Biotin

****(Answer: a) NAD^+ ****

14. ****If the pK_a of acetic acid is 4.76, what will be the pH of a buffer containing 0.1 M acetic acid and 0.2 M sodium acetate?****

a) 4.16

b) 4.76

c) 5.06

d) 5.36

****(Answer: c) 5.06****

***(Henderson-Hasselbalch equation: $\text{pH} = \text{pK}_a + \log\left(\frac{[\text{A}^-]}{[\text{HA}]}\right))^*$**

**Hard Level (6 Questions)**

15. ****The standard free energy change (ΔG°) for ATP hydrolysis is approximately:****

- a) -7.3 kcal/mol
- b) -4.5 kcal/mol
- c) +7.3 kcal/mol
- d) +4.5 kcal/mol

****(Answer: a) -7.3 kcal/mol****

16. ****Which enzyme catalyzes the rate-limiting step in cholesterol biosynthesis?****

- a) HMG-CoA reductase
- b) Acetyl-CoA carboxylase
- c) Citrate synthase
- d) Pyruvate dehydrogenase

****(Answer: a) HMG-CoA reductase****

17. ****A patient has a metabolic disorder where they cannot metabolize branched-chain amino acids (leucine, isoleucine, valine). This condition is known as:****

- a) Phenylketonuria (PKU)
- b) Maple syrup urine disease
- c) Alkaptonuria

d) Homocystinuria

****(Answer: b) Maple syrup urine disease****

18. ****An enzyme follows Michaelis-Menten kinetics with a V_{max} of $100 \mu\text{mol/min}$ and a K_m of 5 mM . What is the reaction rate when the substrate concentration is 5 mM ?****

a) $25 \mu\text{mol/min}$

b) $50 \mu\text{mol/min}$

c) $75 \mu\text{mol/min}$

d) $100 \mu\text{mol/min}$

****(Answer: b) $50 \mu\text{mol/min}$ ****

(Use: $v = V_{max} [S] / (K_m + [S])$)

19. ****During oxidative phosphorylation, the proton gradient is generated across which mitochondrial membrane?***

a) Outer membrane

b) Inner membrane

c) Intermembrane space

d) Matrix

****(Answer: b) Inner membrane****

20. ****Which of the following RNA polymerases transcribes rRNA in eukaryotic cells?***

a) RNA polymerase I

b) RNA polymerase II

c) RNA polymerase III

d) Reverse transcriptase

****(Answer: a) RNA polymerase I****

GATE XL Microbiology

Easy Level (7 Questions)

1. **Which of the following structures is unique to Gram-negative bacteria?**

- a) Peptidoglycan layer
- b) Lipopolysaccharide (LPS)
- c) Teichoic acid
- d) Peptide bonds

(Answer: b) Lipopolysaccharide (LPS)

2. **Which of the following methods is used for sterilization of heat-sensitive materials?

- a) Autoclaving
- b) Pasteurization
- c) Filtration
- d) Incineration

(Answer: c) Filtration

3. **What is the function of the bacterial capsule?

- a) ATP synthesis
- b) Phagocytosis evasion
- c) DNA replication

d) Protein synthesis

****(Answer: b) Phagocytosis evasion****

4. ****Which of the following is an obligate intracellular parasite?****

a) *Escherichia coli*

b) *Mycobacterium tuberculosis*

c) *Chlamydia trachomatis*

d) *Staphylococcus aureus*

****(Answer: c) *Chlamydia trachomatis*****

5. ****Which of the following staining methods is used for *Mycobacterium tuberculosis*?****

a) Gram staining

b) Acid-fast staining

c) Endospore staining

d) Capsule staining

****(Answer: b) Acid-fast staining****

6. ****Which phase of bacterial growth is characterized by rapid cell division?****

a) Lag phase

b) Log phase

c) Stationary phase

d) Death phase

****(Answer: b) Log phase****

7. ****Which of the following microorganisms is commonly used in industrial ethanol production?****

- a) *Bacillus subtilis*
- b) *Escherichia coli*
- c) *Saccharomyces cerevisiae*
- d) *Pseudomonas aeruginosa*

****(Answer: c) *Saccharomyces cerevisiae*****

**Moderate Level (7 Questions)**

8. ****Which of the following is an example of a psychrophilic microorganism?****

- a) *Thermus aquaticus*
- b) *Bacillus subtilis*
- c) *Pseudomonas fluorescens*
- d) *Escherichia coli*

****(Answer: c) *Pseudomonas fluorescens*****

9. ****Which of the following enzymes is responsible for the conversion of hydrogen peroxide into water and oxygen?****

- a) Catalase
- b) Superoxide dismutase
- c) Peroxidase
- d) Dehydrogenase

****(Answer: a) Catalase****

10. **A bacterial culture has a generation time of 30 minutes. If the initial population is 100 cells, how many cells will be present after 3 hours?**

- a) 800
- b) 1600
- c) 3200
- d) 6400

(Answer: d) 6400

(Formula: $N = N_0 \times 2^{(t/g)}$, where $t = 180$ min, $g = 30$ min)

11. **Which of the following statements about bacterial plasmids is TRUE?**

- a) They are essential for bacterial survival
- b) They are double-stranded DNA molecules
- c) They are part of the bacterial chromosome
- d) They do not carry antibiotic resistance genes

(Answer: b) They are double-stranded DNA molecules

12. **Which bacterial genus is known for its ability to fix atmospheric nitrogen?**

- a) Bacillus
- b) Rhizobium
- c) Clostridium
- d) Escherichia

(Answer: b) Rhizobium

13. **Which of the following is a selective medium for Gram-negative bacteria?**

- a) Blood agar
- b) Mannitol salt agar

c) MacConkey agar

d) Nutrient agar

****(Answer: c) MacConkey agar****

14. ****Which microorganism is commonly used in recombinant DNA technology for gene cloning?****

a) Escherichia coli

b) Staphylococcus aureus

c) Bacillus anthracis

d) Pseudomonas aeruginosa

****(Answer: a) Escherichia coli****

**Hard Level (6 Questions)**

15. ****Which of the following bacterial toxins acts by inhibiting protein synthesis?****

a) Botulinum toxin

b) Cholera toxin

c) Diphtheria toxin

d) Tetanus toxin

****(Answer: c) Diphtheria toxin****

16. ****Which technique is commonly used to measure bacterial cell viability?****

a) Gram staining

b) Serial dilution and plating

c) Microscopy

d) Spectrophotometry

****(Answer: b) Serial dilution and plating****

17. ****A sample contains 2.5×10^6 CFU/mL of bacteria. If 1 mL is diluted in 9 mL of sterile water, what is the new concentration?****

a) 2.5×10^7 CFU/mL

b) 2.5×10^5 CFU/mL

c) 2.5×10^4 CFU/mL

d) 2.5×10^3 CFU/mL

****(Answer: b) 2.5×10^5 CFU/mL****

(Dilution factor = 10, so concentration = original / 10)

18. ****Which of the following genes is typically used as a molecular marker in microbial phylogenetics?****

a) 18S rRNA

b) 16S rRNA

c) RNA polymerase II

d) DNA polymerase III

****(Answer: b) 16S rRNA****

19. ****A researcher is performing a plaque assay to determine the viral titer of a sample. The countable range of plaques on a plate is:****

a) 0-10

b) 20-200

c) 200-500

d) 500-1000

**** (Answer: b) 20-200****

20. ****Which of the following organisms is involved in methane production in anaerobic environments?****

- a) Escherichia coli
- b) Methanobacterium
- c) Clostridium perfringens
- d) Pseudomonas putida

**** (Answer: b) Methanobacterium****

GATE XL Zoology

**Easy Level (7 Questions)**

1. ****Which of the following is a characteristic feature of chordates?****

- a) Open circulatory system
- b) Presence of notochord
- c) Exoskeleton
- d) Radial symmetry

**** (Answer: b) Presence of notochord****

2. ****Which blood cells are responsible for immunity?****

- a) Erythrocytes
- b) Thrombocytes
- c) Leukocytes
- d) Platelets

**** (Answer: c) Leukocytes ****

3. ****Which organ is responsible for producing bile?****

- a) Pancreas
- b) Stomach
- c) Liver
- d) Small intestine

**** (Answer: c) Liver ****

4. ****Which of the following is an example of a cartilaginous fish?****

- a) Goldfish
- b) Shark
- c) Tuna
- d) Salmon

**** (Answer: b) Shark ****

5. ****What is the primary nitrogenous waste excreted by amphibians?****

- a) Uric acid
- b) Ammonia
- c) Urea

d) Creatinine

****(Answer: c) Urea****

6. ****Which part of the brain controls balance and coordination?****

a) Cerebrum

b) Cerebellum

c) Medulla oblongata

d) Hypothalamus

****(Answer: b) Cerebellum****

7. ****Which of the following is a sexually transmitted disease (STD)?****

a) Tuberculosis

b) Influenza

c) Syphilis

d) Malaria

****(Answer: c) Syphilis****

**Moderate Level (7 Questions)**

8. ****Which of the following is a function of hemoglobin?****

a) Transports glucose

b) Transports oxygen

c) Produces antibodies

d) Transmits nerve impulses

****(Answer: b) Transports oxygen****

9. ****Which hormone is responsible for molting in insects?****

a) Insulin

b) Ecdysone

c) Estrogen

d) Oxytocin

****(Answer: b) Ecdysone****

10. ****Which of the following is the correct sequence of events in muscle contraction?****

a) ATP binding → Myosin binding to actin → Power stroke → ADP release

b) Power stroke → ATP binding → Myosin binding to actin → ADP release

c) Myosin binding to actin → ATP binding → Power stroke → ADP release

d) ATP binding → Power stroke → ADP release → Myosin binding to actin

****(Answer: a) ATP binding → Myosin binding to actin → Power stroke → ADP release****

11. ****If a population of 100 rabbits has a birth rate of 0.2 and a death rate of 0.1 per year, what will be the population after one year?****

a) 110

b) 120

c) 105

d) 115

****(Answer: a) 110****

(Population change = Initial population × (birth rate - death rate))

12. ****Which of the following is a viviparous animal?****

- a) Frog
- b) Snake
- c) Platypus
- d) Dolphin

****(Answer: d) Dolphin****

13. ****Which part of the nephron is primarily responsible for reabsorption of water?****

- a) Glomerulus
- b) Proximal convoluted tubule
- c) Loop of Henle
- d) Collecting duct

****(Answer: c) Loop of Henle****

14. ****Which of the following is a marsupial?****

- a) Tiger
- b) Kangaroo
- c) Elephant
- d) Horse

****(Answer: b) Kangaroo****

**Hard Level (6 Questions)**

15. **Which enzyme is responsible for DNA replication in eukaryotic cells?**

- a) DNA polymerase III
- b) DNA polymerase I
- c) DNA polymerase α
- d) RNA polymerase

(Answer: c) DNA polymerase α

16. **What is the respiratory quotient (RQ) for carbohydrate metabolism?

- a) 0.7
- b) 0.8
- c) 1.0
- d) 1.2

(Answer: c) 1.0

17. **In a dihybrid cross, what is the probability of obtaining an offspring with both dominant traits if both parents are heterozygous for both traits?

- a) 1/16
- b) 3/16
- c) 9/16
- d) 12/16

(Answer: c) 9/16

(Use Punnett square: $(3/4) \times (3/4) = 9/16$ for dominant traits)

18. **In an ecosystem, which trophic level has the highest energy content?

- a) Primary producers
- b) Primary consumers

c) Secondary consumers

d) Tertiary consumers

****(Answer: a) Primary producers****

19. ****If a genetic disorder follows an X-linked recessive pattern, what is the probability that a carrier mother and a healthy father will have an affected son?****

a) 0%

b) 25%

c) 50%

d) 100%

****(Answer: c) 50%****

20. ****Which of the following is an example of convergent evolution?****

a) Homologous structures

b) Analogous structures

c) Vestigial structures

d) Adaptive radiation

****(Answer: b) Analogous structures****

GATE XL Botany

**Easy Level (7 Questions)**

1. ****Which of the following is a primary photosynthetic pigment in plants?****

a) Chlorophyll a

b) Xanthophyll

c) Carotene

d) Anthocyanin

****(Answer: a) Chlorophyll a****

2. ****Which plant hormone is primarily responsible for seed dormancy?****

a) Auxin

b) Gibberellin

c) Absciscic acid

d) Cytokinin

****(Answer: c) Absciscic acid****

3. ****What is the main function of xylem in plants?****

a) Transport of food

b) Transport of water and minerals

c) Photosynthesis

d) Gas exchange

****(Answer: b) Transport of water and minerals****

4. ****Which of the following is an example of a C4 plant?****

a) Rice

b) Wheat

c) Maize

d) Barley

****(Answer: c) Maize****

5. ****Which type of root system is commonly found in monocots?****

- a) Taproot system
- b) Fibrous root system
- c) Adventitious root system
- d) Both a and b

****(Answer: b) Fibrous root system****

6. ****Which plant tissue is responsible for the transport of organic nutrients?****

- a) Xylem
- b) Phloem
- c) Parenchyma
- d) Collenchyma

****(Answer: b) Phloem****

7. ****Which of the following is an example of an insectivorous plant?****

- a) Sunflower
- b) Nepenthes
- c) Maize
- d) Rose

****(Answer: b) Nepenthes****

Moderate Level (7 Questions)

8. **Which enzyme is responsible for carbon fixation in the Calvin cycle?**

- a) Rubisco
- b) PEP carboxylase
- c) Nitrate reductase
- d) Catalase

****(Answer: a) Rubisco)****

9. **What is the ploidy level of the endosperm in angiosperms?

- a) Haploid
- b) Diploid
- c) Triploid
- d) Tetraploid

****(Answer: c) Triploid)****

10. **Which of the following plant tissues provides structural support?

- a) Parenchyma
- b) Collenchyma
- c) Phloem
- d) Xylem

****(Answer: b) Collenchyma)****

11. **A plant cell has a water potential (Ψ) of -0.5 MPa and is placed in a solution with a water potential of -0.8 MPa. What will happen to the cell?

- a) It will gain water

- b) It will lose water
- c) It will remain unchanged
- d) It will rupture

****(Answer: b) It will lose water****

12. ****Which of the following is a non-essential element for plant growth?****

- a) Nitrogen
- b) Phosphorus
- c) Cobalt
- d) Potassium

****(Answer: c) Cobalt****

13. ****Which of the following is a feature of CAM (Crassulacean Acid Metabolism) plants?****

- a) They perform Calvin cycle during the day
- b) They fix CO₂ at night
- c) They use Rubisco in primary carbon fixation
- d) They do not undergo photosynthesis

****(Answer: b) They fix CO₂ at night****

14. ****If a plant has 24 chromosomes in its sporophyte, how many chromosomes will be present in its gametophyte?****

- a) 12
- b) 24
- c) 48
- d) 36

****(Answer: a) 12****

Hard Level (6 Questions)

15. **Which of the following is the first stable product of C3 photosynthesis?**

- a) Oxaloacetate
- b) Phosphoenolpyruvate
- c) 3-Phosphoglycerate (3-PGA)
- d) Malate

(Answer: c) 3-Phosphoglycerate (3-PGA)

16. **Which of the following is an example of a secondary metabolite?**

- a) Glucose
- b) ATP
- c) Alkaloids
- d) NADH

(Answer: c) Alkaloids

17. **In a population of plants, if the dominant allele frequency (p) is 0.6, what is the expected frequency of heterozygous individuals ($2pq$) according to Hardy-Weinberg equilibrium?**

- a) 0.16
- b) 0.24
- c) 0.48
- d) 0.36

(Answer: c) 0.48

$*(2pq = 2 \times 0.6 \times 0.4 = 0.48)*$

18. ****Which enzyme is responsible for nitrogen fixation in legumes?****

- a) Nitrate reductase
- b) Nitrogenase
- c) Rubisco
- d) PEP carboxylase

**** (Answer: b) Nitrogenase ****

19. ****A plant population follows exponential growth with an intrinsic growth rate (r) of 0.02 per day. If the initial population is 1000, what will be the population size after 10 days?****

- a) 1220
- b) 1480
- c) 1649
- d) 1814

**** (Answer: c) 1649 ****

(Using the exponential growth formula: $N = N_0 e^{(rt)}$)

20. ****Which of the following fungi form mycorrhizal associations with plant roots?****

- a) Rhizobium
- b) Aspergillus
- c) Glomus
- d) Penicillium

**** (Answer: c) Glomus ****

Easy Level (7 Questions)

1. **Which of the following microorganisms is primarily responsible for the fermentation of yogurt?**

- a) *Saccharomyces cerevisiae*
- b) *Lactobacillus bulgaricus*
- c) *Pseudomonas aeruginosa*
- d) *Bacillus subtilis*

(Answer: b) *Lactobacillus bulgaricus*

2. **Which vitamin is most sensitive to heat during food processing?

- a) Vitamin A
- b) Vitamin B1 (Thiamine)
- c) Vitamin C
- d) Vitamin D

(Answer: c) Vitamin C

3. **Which of the following is an example of a non-enzymatic browning reaction?

- a) Maillard reaction
- b) Lipid oxidation
- c) Enzymatic browning
- d) Protein denaturation

(Answer: a) Maillard reaction

4. **Which of the following is a common food preservative?

- a) Sodium benzoate

b) Glucose

c) Casein

d) Pectin

****(Answer: a) Sodium benzoate****

5. ****Which food processing technique is used to kill pathogenic bacteria without significantly affecting food quality?****

a) Canning

b) Pasteurization

c) Freezing

d) Irradiation

****(Answer: b) Pasteurization****

6. ****Which of the following is NOT a function of food additives?****

a) Improve flavor

b) Enhance nutrition

c) Increase toxicity

d) Extend shelf life

****(Answer: c) Increase toxicity****

7. ****Which oil has the highest smoke point and is ideal for deep frying?****

a) Olive oil

b) Coconut oil

c) Sunflower oil

d) Ghee

****(Answer: c) Sunflower oil****

****Moderate Level (7 Questions)****

8. ****Which type of emulsion is mayonnaise?****

- a) Water-in-oil
- b) Oil-in-water
- c) Solid-in-liquid
- d) Gas-in-liquid

**** (Answer: b) Oil-in-water ****

9. ****Which of the following enzymes is responsible for breaking down pectin in fruit juices?****

- a) Amylase
- b) Lipase
- c) Pectinase
- d) Protease

**** (Answer: c) Pectinase ****

10. ****A milk sample has 4% fat content. How much fat is present in 500 mL of milk?****

- a) 10 g
- b) 15 g
- c) 20 g
- d) 25 g

**** (Answer: c) 20 g ****

$*(Fat = (4/100) \times 500 = 20\text{ g})*$

11. ****Which of the following packaging materials provides the best protection against moisture?****

- a) Paper
- b) Glass
- c) Polyethylene
- d) Aluminum foil

**** (Answer: d) Aluminum foil****

12. ****What is the main function of an anti-caking agent in food products?****

- a) Enhance flavor
- b) Improve texture
- c) Prevent clumping
- d) Preserve color

**** (Answer: c) Prevent clumping****

13. ****Which of the following is an example of an artificial sweetener?****

- a) Stevia
- b) Xylitol
- c) Saccharin
- d) Fructose

**** (Answer: c) Saccharin****

14. ****Which of the following organisms is commonly associated with foodborne botulism?****

- a) Salmonella enterica

- b) Clostridium botulinum
- c) Escherichia coli
- d) Listeria monocytogenes

****(Answer: b) Clostridium botulinum)****

**Hard Level (6 Questions)**

15. ****Which of the following thermal processes is used to achieve commercial sterility in canned foods?****

- a) Pasteurization
- b) Ultra-high temperature (UHT) processing
- c) Retort sterilization
- d) Refrigeration

****(Answer: c) Retort sterilization)****

16. ****A food product has a moisture content of 40% on a wet basis. What is its moisture content on a dry basis?****

- a) 50%
- b) 66.67%
- c) 75%
- d) 80%

****(Answer: b) 66.67%****

(Moisture on dry basis = (Wet basis moisture) / (1 - Wet basis moisture))

17. **Which fatty acid is considered essential because it cannot be synthesized by the human body?**

- a) Oleic acid
- b) Linoleic acid
- c) Palmitic acid
- d) Stearic acid

(Answer: b) Linoleic acid

18. **Which of the following methods is best for determining the protein content of food?**

- a) Soxhlet extraction
- b) Kjeldahl method
- c) Brix refractometer
- d) Calorimetry

(Answer: b) Kjeldahl method

19. **A food product contains 10% protein and 5% fat. If 100 g of the food provides 120 kcal, what percentage of the total energy comes from protein?**

- a) 16.67%
- b) 33.33%
- c) 50%
- d) 66.67%

(Answer: b) 33.33%

(Protein: $10 \text{ g} \times 4 \text{ kcal/g} = 40 \text{ kcal}$, Fat: $5 \text{ g} \times 9 \text{ kcal/g} = 45 \text{ kcal}$, Total = 120 kcal, % from protein = $(40/120) \times 100 = 33.33\%$)

20. **Which of the following mycotoxins is produced by *Aspergillus flavus* and is a significant concern in food safety?

- a) Aflatoxin

b) Ochratoxin

c) Patulin

d) Fumonisin

****(Answer: a) Aflatoxin****

