

### Mechanics

1. A particle moves along a straight line such that its displacement is given by  $s = t^3 - 6t^2 + 3t + 4$  meters, where  $t$  is in seconds. The velocity of the particle when its acceleration is zero is:
  - (a) -9 m/s
  - (b) -12 m/s
  - (c) 3 m/s
  - (d) 42 m/s
2. A block of mass  $m$  is placed on a rough inclined plane of inclination  $\theta$ . If the coefficient of static friction between the block and the plane is  $\mu_s$ , the maximum force parallel to the plane required to move the block up the plane is:
  - (a)  $mg(\sin\theta + \mu_s \cos\theta)$
  - (b)  $mg(\cos\theta + \mu_s \sin\theta)$
  - (c)  $mg(\sin\theta - \mu_s \cos\theta)$
  - (d)  $mg(\cos\theta - \mu_s \sin\theta)$
3. A body of mass 2 kg is rotating with an angular velocity of 2 rad/s. If the radius of the circular path is 1 m, the centripetal force acting on the body is:
  - (a) 4 N
  - (b) 8 N
  - (c) 16 N
  - (d) 2 N

### Heat and Thermodynamics

4. One mole of an ideal gas undergoes an isothermal expansion from volume  $V_1$  to  $V_2$  at temperature  $T$ . The work done by the gas is:
  - (a)  $RT \ln(V_2/V_1)$
  - (b)  $RT(V_2 - V_1)$
  - (c)  $RT \ln(V_1/V_2)$
  - (d)  $P(V_2 - V_1)$
5. The efficiency of a Carnot engine operating between temperatures  $T_1$  (source) and  $T_2$  (sink) is:
  - (a)  $1 - T_1/T_2$
  - (b)  $1 - T_2/T_1$
  - (c)  $T_1/T_2$
  - (d)  $T_2/T_1$

### Waves and Optics

6. In a Young's double-slit experiment, the distance between the slits is 0.2 mm and the distance of the screen from the slits is 1 m. If the wavelength of light used is 500 nm, the fringe width is:
  - (a) 2.5 mm
  - (b) 2.5 cm
  - (c) 5 mm
  - (d) 5 cm
7. The speed of light in a medium is  $2 \times 10^8$  m/s. The refractive index of the medium is:
  - (a) 1.5


- (b) 1.33
  - (c) 1
  - (d) 2
8. The equation of a progressive wave is given by  $y=5\sin(100\pi t-2\pi x)$ , where  $x$  and  $y$  are in meters and  $t$  is in seconds. The wavelength of the wave is:
- (a) 2 m
  - (b) 1 m
  - (c) 0.5 m
  - (d) 0.2 m


#### Electricity and Magnetism

9. The equivalent capacitance between points A and B in the given circuit, where each capacitor has a capacitance of  $C$ , is:
- (a)  $C/3$
  - (b)  $3C$
  - (c)  $C$
  - (d)  $2C/3$  (Describe a circuit with 3 capacitors in series)
10. A proton is moving with a velocity of 105 m/s perpendicular to a magnetic field of 1 T. The force acting on the proton is:
- (a)  $1.6 \times 10^{-14}$  N
  - (b)  $1.6 \times 10^{-19}$  N
  - (c)  $1.6 \times 10^{-24}$  N
  - (d)  $1.6 \times 10^{-10}$  N
11. The self-inductance of a solenoid of length  $l$  and area of cross-section  $A$  with  $N$  turns is:
- (a)  $\mu_0 N^2 A / l$
  - (b)  $\mu_0 N A / l$
  - (c)  $\mu_0 N^2 l / A$
  - (d)  $\mu_0 N l / A$

#### Modern Physics

12. The de Broglie wavelength of an electron accelerated through a potential difference of  $V$  volts is proportional to:

○ (a)  $V$  

○ (b)  $1/V$  

○ (c)  $V$

○ (d)  $1/V$

13. The half-life of a radioactive substance is 10 days. The time taken for the activity to reduce to  $1/8$  of its initial value is:
- (a) 30 days
  - (b) 40 days

- (c) 20 days
  - (d) 80 days
14. In a photoelectric effect experiment, if the frequency of incident light is doubled, the kinetic energy of the emitted photoelectrons:
- (a) doubles
  - (b) remains the same
  - (c) increases by more than a factor of two
  - (d) decreases.

Solutions (without detailed steps):

1. (a)
2. (a)
3. (b)
4. (a)
5. (b)
6. (a)
7. (a)
8. (b)
9. (a)
10. (a)
11. (a)
12. (b)
13. (a)
14. (c)

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Physical Chemistry

1. The rate constant of a first-order reaction is  $6.93 \times 10^{-3} \text{ s}^{-1}$ . The time required for 50% completion of the reaction is:
  - (a) 100 s
  - (b) 693 s
  - (c) 1000 s
  - (d) 69.3 s
2. The van't Hoff factor (i) for a dilute solution of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  is:
  - (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
3. The pH of a  $10^{-3} \text{ M}$  solution of an acid is 5. The dissociation constant of the acid is:
  - (a)  $10^{-5}$
  - (b)  $10^{-7}$
  - (c)  $10^{-9}$
  - (d)  $10^{-11}$
4. For a reaction,  $\text{A} + \text{B} \rightarrow \text{Products}$ , the rate law is:  $\text{Rate} = k[\text{A}][\text{B}]^2$ . If the concentration of B is doubled, the rate of the reaction will increase by:
  - (a) 2 times

- (b) 4 times
- (c) 8 times
- (d) 6 times

#### Inorganic Chemistry

5. Which of the following elements shows the maximum number of oxidation states?
  - (a) Cr
  - (b) Mn
  - (c) Fe
  - (d) V
6. Which of the following has the strongest reducing power?
  - (a)  $F^{-}$
  - (b)  $Cl^{-}$
  - (c)  $Br^{-}$
  - (d)  $I^{-}$
7. The shape of the  $XeF_4$  molecule is:
  - (a) Tetrahedral
  - (b) Square planar
  - (c) Pyramidal
  - (d) Distorted tetrahedral
8. Which of the following is an example of a coordination polymer?
  - (a) Teflon
  - (b) Bakelite
  - (c) Zeigler-Natta Catalyst
  - (d) Silicones

#### Organic Chemistry

9. Which of the following compounds will give a positive iodoform test?
  - (a) Methanol
  - (b) Ethanol
  - (c) Benzaldehyde
  - (d) Phenol
10. The product formed when acetaldehyde reacts with Tollen's reagent is:
  - (a)  $CH_3COOH$
  - (b)  $CH_3CH_2OH$
  - (c) Ag
  - (d)  $CH_3CHO$
11. Which of the following is used as a tranquilizer?
  - (a) Paracetamol
  - (b) Chloramphenicol
  - (c) Equanil
  - (d) Aspirin
12. The monomer of neoprene is:
  - (a) Isoprene
  - (b) Chloroprene
  - (c) Butadiene

- (d) Ethylene
- 13. Which of the following is a condensation polymer?
  - (a) Polythene
  - (b) PVC
  - (c) Nylon 6,6
  - (d) Teflon
- 14. Which reagent is used for the conversion of an alkyl halide to an alkane?
  - (a) Alcoholic KOH
  - (b) Aqueous KOH
  - (c) Zn/HCl
  - (d) Br<sub>2</sub>/H<sub>2</sub>O

Solutions (without detailed steps):

1. (a)
2. (d)
3. (c)
4. (b)
5. (b)
6. (d)
7. (b)
8. (d)
9. (b)
10. (c)
11. (c)
12. (b)
13. (c)
14. (c)

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Algebra

1. If  $A = [1324]$ , then  $|A^2 - 5A|$  is:
  - (a) 0
  - (b) 1
  - (c) -2
  - (d) 2
2. The number of solutions of the equation  $\sin x + \sin 2x + \sin 3x = \cos x + \cos 2x + \cos 3x$  in the interval  $[0, \pi]$  is:
  - (a) 4
  - (b) 3
  - (c) 2
  - (d) 5
3. If  $nCr - 1 = 36$ ,  $nCr = 84$ , and  $nCr + 1 = 126$ , then  $r$  is:
  - (a) 1

- (b) 2
- (c) 3
- (d) 4

4. The sum of the infinite geometric series  $1+3+9+27+...$  is:

- (a) 23
- (b) 21
- (c) 32
- (d) 34

#### Calculus

5. The derivative of  $\tan^{-1}(1-x^2/2x)$  with respect to  $\sin^{-1}(1+x^2/2x)$  is:

- (a) 1
- (b) -1
- (c) 2
- (d) 0

6. The area enclosed by the curves  $y^2=4x$  and  $x^2=4y$  is:

- (a) 316 sq. units
- (b) 332 sq. units
- (c) 38 sq. units
- (d) 16 sq. units

7. The solution of the differential equation  $xdy=xx+y$  is:

- (a)  $y=x\ln x+cx$
- (b)  $y=x\ln x+c$
- (c)  $y=\ln x+cx$
- (d)  $y=x+c$

8. The value of  $\int_0^{\pi/2} \sin x \boxed{!} + \cos x \boxed{!} \sin x \boxed{!} dx$  is:

- (a)  $\pi/4$
- (b)  $\pi/2$
- (c)  $\pi$
- (d) 0

#### Coordinate Geometry

9. The equation of the tangent to the parabola  $y^2=4x$  at the point (1, 2) is:

- (a)  $x-y+1=0$
- (b)  $x+y-3=0$
- (c)  $x+y+1=0$
- (d)  $x-y-1=0$

10. The distance between the foci of the ellipse  $25x^2 + 9y^2 = 1$  is:

- (a) 8
- (b) 6
- (c) 10
- (d) 4

11. The equation of the plane passing through the point  $(1, 2, 3)$  and perpendicular to the vector  $\hat{i} + 2\hat{j} - \hat{k}$  is:

- (a)  $x + 2y - z = 4$
- (b)  $x + 2y - z = 0$
- (c)  $x - 2y + z = 0$
- (d)  $x - 2y - z = 4$

#### Probability and Statistics

12. Two dice are thrown. The probability of getting a total score of 7 is:

- (a)  $\frac{1}{6}$
- (b)  $\frac{1}{365}$
- (c)  $\frac{1}{367}$
- (d)  $\frac{1}{91}$

13. If  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{1}{3}$ , and  $P(A \cap B) = \frac{1}{4}$ , then  $P(A|B)$  is:

- (a)  $\frac{1}{2}$
- (b)  $\frac{2}{3}$
- (c)  $\frac{1}{4}$
- (d)  $\frac{3}{2}$

14. The mean and variance of a binomial distribution are 4 and 2, respectively. The probability of getting exactly 2 successes is:

- (a)  $\frac{28}{256}$
- (b)  $\frac{219}{256}$
- (c)  $\frac{128}{256}$
- (d)  $\frac{37}{256}$

#### Solutions (without detailed steps):

1. (c)
2. (a)
3. (c)
4. (a)
5. (a)
6. (a)
7. (a)
8. (a)
9. (b)
10. (a)

- 11. (a)
- 12. (a)
- 13. (b)
- 14. (a)

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#### Genetics and Biotechnology

1. Which technique is used for amplifying a specific DNA sequence?
  - (a) ELISA
  - (b) PCR
  - (c) Western blotting
  - (d) Southern blotting
2. A plant with the genotype AaBb is self-pollinated. What is the probability of producing a plant with the genotype aabb?
  - (a) 1/2
  - (b) 1/4
  - (c) 1/8
  - (d) 1/16
3. The enzyme that joins the fragments of DNA is:
  - (a) DNA polymerase
  - (b) DNA ligase
  - (c) Helicase
  - (d) Topoisomerase
4. Which of the following is a vector used in genetic engineering?
  - (a) Agarose
  - (b) Plasmid
  - (c) Enzyme
  - (d) Protein

#### Human Physiology

5. The primary function of the sinoatrial (SA) node is to:
  - (a) Initiate heart contractions
  - (b) Filter blood
  - (c) Exchange gases
  - (d) Secrete hormones
6. Which part of the human brain controls voluntary actions?
  - (a) Cerebellum
  - (b) Medulla oblongata
  - (c) Cerebrum
  - (d) Thalamus



7. The functional unit of the kidney is the:

- (a) Ureter
- (b) Nephron
- (c) Glomerulus
- (d) Bowman's capsule

8. Which hormone is responsible for the "fight or flight" response?

- (a) Insulin
- (b) Thyroxine
- (c) Adrenaline
- (d) Estrogen

Plant Physiology and Ecology

9. The process of guttation in plants is due to:

- (a) Transpiration
- (b) Root pressure
- (c) Photosynthesis
- (d) Osmosis

10. Which of the following is a greenhouse gas?

- (a) Oxygen
- (b) Nitrogen
- (c) Carbon dioxide
- (d) Hydrogen

11. The primary producers in an ecosystem are:

- (a) Herbivores
- (b) Carnivores
- (c) Plants
- (d) Decomposers

12. The term "biodiversity hotspot" refers to regions with:

- (a) High temperature
- (b) High rainfall
- (c) High species richness
- (d) High pollution

Cell Biology and Diversity of Life

13. The site of ATP synthesis in a cell is the:

- (a) Golgi apparatus
- (b) Endoplasmic reticulum
- (c) Mitochondria
- (d) Nucleus

14. Which of the following is a viral disease?

- (a) Tuberculosis
- (b) Malaria
- (c) AIDS
- (d) Tetanus

15. The cell wall of fungi is composed of:

- (a) Cellulose
- (b) Pectin
- (c) Chitin
- (d) Lignin

16. Which of the following is a characteristic feature of mammals?

- (a) Scales
- (b) Feathers
- (c) Mammary glands
- (d) Gills

Evolution and Reproduction

17. The theory of natural selection was proposed by:

- (a) Lamarck
- (b) Darwin
- (c) Mendel
- (d) De Vries

18. Double fertilization is a characteristic feature of:

- (a) Algae
- (b) Fungi
- (c) Gymnosperms
- (d) Angiosperms

19. The process of the formation of gametes is called:

- (a) Sporulation
- (b) Gametogenesis
- (c) Regeneration
- (d) Budding.

20. Which of the following is a sexually transmitted disease?

- (a) Common cold
  - (b) Typhoid
  - (c) Syphilis
  - (d) Pneumonia.
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## Logical Reasoning

1. If all pens are books, and some books are erasers, which of the following must be true?
  - (a) All pens are erasers.
  - (b) Some pens are erasers.
  - (c) Some books are pens.
  - (d) No pens are erasers.
2. Complete the series: 2, 5, 10, 17, ?
  - (a) 24
  - (b) 26
  - (c) 28
  - (d) 30
3. If 'TABLE' is coded as 'UBAMD', how is 'CHAIR' coded?
  - (a) DIBSJS
  - (b) BIDJS
  - (c) SBIDJ
  - (d) DJIBSS
4. A is the brother of B. C is the father of A. D is the mother of C. What is the relationship between D and B?
  - (a) Grandmother
  - (b) Aunt
  - (c) Mother
  - (d) Sister
5. Find the odd one out: Apple, Banana, Orange, Potato.
  - (a) Apple
  - (b) Banana
  - (c) Orange
  - (d) Potato

## Verbal Ability

6. Choose the synonym of 'Abundant':
  - (a) Scarce
  - (b) Plentiful
  - (c) Deficient
  - (d) Meager
7. Choose the antonym of 'Courage':
  - (a) Bravery
  - (b) Fear
  - (c) Valor
  - (d) Boldness



8. Complete the analogy: Book : Author :: Symphony : ?

- ☐ (a) Painter
- ☐ (b) Composer
- ☐ (c) Sculptor
- ☐ (d) Director

9. Fill in the blank: The committee was \_\_\_\_\_ in their decision.

- ☐ (a) Unanimous
- ☐ (b) Different
- ☐ (c) Varied
- ☐ (d) Divided

10. Choose the correct spelling:

- ☐ (a) Accomodate
- ☐ (b) Accommodate
- ☐ (c) Acommodate
- ☐ (d) Acomodate

#### Quantitative Aptitude

11. A train travels 120 km in 2 hours. What is its speed in m/s?

- ☐ (a) 16.67 m/s
- ☐ (b) 60 m/s
- ☐ (c) 100 m/s
- ☐ (d) 120 m/s

12. If a rectangle has a length of 10 cm and a width of 5 cm, what is its area?

- ☐ (a) 15 sq. cm
- ☐ (b) 25 sq. cm
- ☐ (c) 50 sq. cm
- ☐ (d) 100 sq. cm

13. A shopkeeper sells an item for ₹100, making a profit of 25%. What was the cost?

- ☐ (a) ₹75
- ☐ (b) ₹80
- ☐ (c) ₹125
- ☐ (d) ₹120

14. What is 20% of 150?

- ☐ (a) 15
- ☐ (b) 20
- ☐ (c) 30
- ☐ (d) 45

15. If the average of 5 numbers is 20, what is their sum?

- ☐ (a) 25
- ☐ (b) 100
- ☐ (c) 80
- ☐ (d) 15

Mixed Aptitude

16. If a clock gains 5 minutes every hour, how many minutes will it gain in 24 hours?

- ☐ (a) 60 minutes
- ☐ (b) 120 minutes
- ☐ (c) 180 minutes
- ☐ (d) 240 minutes

17. If 'A' means '+', 'B' means '-', 'C' means 'x', and 'D' means '/', then  $10\ C\ 5\ A\ 20\ B\ 10\ D\ 2\ =?$

- ☐ (a) 55
- ☐ (b) 60
- ☐ (c) 65
- ☐ (d) 70

18. In a row of children, Ravi is 10th from the left and Mohan is 15th from the right. When they exchange positions, Ravi becomes 15th from the left. How many children are there in the row?

- ☐ (a) 28
- ☐ (b) 29
- ☐ (c) 30
- ☐ (d) 31

19. A person can complete a piece of work in 10 days, and another person can complete the same work in 15 days. How many days will they take to complete the work together?

- ☐ (a) 5 days
- ☐ (b) 6 days
- ☐ (c) 8 days
- ☐ (d) 12.5 days

20. A cube has a side of 5 cm. What is its volume?

- ☐ (a) 25 cu. cm
- ☐ (b) 100 cu. cm
- ☐ (c) 125 cu. cm
- ☐ (d) 150 cu. cm

Answers:

1. (c)
2. (b)

3. (b)
4. (a)
5. (d)
6. (b)
7. (b)
8. (b)
9. (a)
10. (b)
11. (a)
12. (c)
13. (b)
14. (c)
15. (b)
16. (b)
17. (a)
18. (b)
19. (b)
20. (c)



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#### Grammar and Sentence Correction

1. Choose the correct sentence:

- ☐ (a) Neither he or I are going.
- ☐ (b) Neither him nor I am going.
- ☐ (c) Neither he nor I am going.
- ☐ (d) Neither he nor I is going.

2. Identify the error in the sentence: "The teacher, along with his students, are going to the museum."

- ☐ (a) The teacher
- ☐ (b) along with his students
- ☐ (c) are going
- ☐ (d) to the museum

3. Fill in the blank with the correct preposition: "She is proficient \_\_\_\_\_ playing the piano."

- ☐ (a) at
- ☐ (b) in
- ☐ (c) on
- ☐ (d) with

4. Choose the correct form of the verb: "If I \_\_\_\_\_ known, I would have helped."

- ☐ (a) had
- ☐ (b) have
- ☐ (c) would have

- (d) will have
5. Select the most appropriate article: "He is \_\_\_\_\_ honest man."

- (a) a
- (b) an
- (c) the
- (d) no article

#### Vocabulary

6. Choose the synonym of "Ubiquitous":

- (a) Rare
- (b) Common
- (c) Unique
- (d) Hidden

7. Choose the antonym of "Ephemeral":

- (a) Transient
- (b) Fleeting
- (c) Permanent
- (d) Brief

8. What does the idiom "to kick the bucket" mean?

- (a) To succeed
- (b) To fail
- (c) To die
- (d) To celebrate

9. Complete the analogy: "Writer : Book :: Architect : \_\_\_\_\_."

- (a) Novel
- (b) Building
- (c) Pen
- (d) Design

10. Choose the word that best fits the sentence: "The politician made a \_\_\_\_\_ speech to the crowd."

- (a) tedious
- (b) rousing
- (c) monotonous
- (d) dull

#### Reading Comprehension

(Passage) "The digital age has transformed the way we communicate and access information. While it offers unprecedented opportunities for connectivity and knowledge sharing, it also presents challenges such as information overload and the spread of misinformation. Critical

thinking skills are essential for navigating this complex landscape and discerning reliable sources from unreliable ones."

11. What is the main idea of the passage?

- (a) The benefits of the digital age.
- (b) The challenges of the digital age.
- (c) The importance of critical thinking in the digital age.
- (d) The evolution of communication.

12. According to the passage, what is a challenge of the digital age?

- (a) Lack of connectivity
- (b) Limited access to information
- (c) Spread of misinformation
- (d) Decline in communication

13. The word "discerning" in the passage means:

- (a) Ignoring
- (b) Understanding
- (c) Distinguishing
- (d) Sharing

Sentence Rearrangement

14. Arrange the following sentences in a logical order:

- P: It is a beautiful city.
- Q: I visited Paris last summer.
- R: The Eiffel Tower was breathtaking.
- S: We also went to the Louvre Museum.
- (a) QPRS
- (b) QRSP
- (c) PQRS
- (d) RSPQ

Error Spotting

15. Find the error: "Despite of the rain, we went for a walk."

- (a) Despite of
- (b) the rain
- (c) we went
- (d) for a walk

One Word Substitution

16. A person who is skilled in foreign languages:

- (a) Linguist
- (b) Polyglot
- (c) Translator
- (d) Interpreter

Active and Passive Voice

17. Change the sentence to passive voice: "Someone stole my wallet."



- (a) My wallet stole someone.
- (b) My wallet was stolen.
- (c) Someone was stolen by my wallet.
- (d) Stole my wallet.

#### Direct and Indirect Speech

18. Change the sentence to indirect speech: "He said, 'I am going to the library.'"

- (a) He said that I am going to the library.
- (b) He said that he is going to the library.
- (c) He said that he was going to the library.
- (d) He said that I was going to the library.

#### Tenses

19. Choose the correct tense: "She \_\_\_\_\_ a book when I entered the room."

- (a) reads
- (b) was reading
- (c) read
- (d) will read

#### Conditional Sentences

20. Complete the sentence: "If it rains, we \_\_\_\_\_ stay at home."

- (a) will
- (b) would
- (c) had
- (d) have

#### Answers:

1. (c)
2. (c)
3. (a)
4. (a)
5. (b)
6. (b)
7. (c)
8. (c)
9. (b)
10. (b)
11. (c)
12. (c)
13. (c)
14. (a)
15. (a)
16. (b)
17. (b)
18. (c)
19. (b)
20. (a)



