

## SECTION : CHEMISTRY

1. The compound which is formed when sodium benzoate is fused with sodium hydroxide is:

a) Benzoic acid	
b) Phenol	✓
c) Benzene	
d) None of the above	

2. The compound which is highly useful in organic synthesis and has magnesium-carbon bond is known as:

a) Grignard reagent	✓
b) Organometallic reagent	
c) Ylide	
d) None of the above	

3. An organic compound may be aromatic if it has:

a) Molecule must be planar	
b) Molecule must be cyclic	
c) Molecule must have $(4n+2)$ pi electrons delocalised in the ring.	
d) All <i>a</i> , <i>b</i> and <i>c</i>	✓

4. Which of the following is the attacking species in electrophilic aromatic substitution reaction of benzene:

a) Cation	✓
b) Anion	
c) Free radical	
d) All of the above	

5. The only aldehyde which undergo iodoform reaction is

a) Methanol	
b) Ethanal	✓
c) Propanal	
d) Butanal	

6. Which of the following is true about ethanone:

a) It is an aldehyde.	
b) It is an alcohol.	
c) It is an ether.	
d) It does not exist.	✓

7. Despite the fact that butan-1-ol and ethoxyethane have the same relative molecular mass, they have very different boiling points. The boiling points of butan-1-ol and ethoxyethane are  $117^{\circ}\text{C}$  and  $35^{\circ}\text{C}$  respectively. The reason for this difference is that

a) Intramolecular hydrogen bonding exists in butan-1-ol.	
b) Weak van der Waals' forces of attraction exist in butan-1-ol.	
c) Intermolecular hydrogen bonding exists in butan-1-ol.	✓
d) Butan-1-ol is a non-polar molecule.	

8. Halogenation of alkanes is a

a) Free radical substitution reaction	✓
b) Nucleophilic substitution reaction	
c) Electrophilic substitution reaction	
d) Addition reaction	

9. Aluminium chloride is a

a) Lewis acid	✓
b) Lewis base	
c) Bronsted Lowry acid	
d) Bronsted Lowry base	

10. Which of the following metals are used in catalysis:

a) Alkali metals	
b) Alkaline Earth Metals	
c) Transition Metals	✓
d) None of the above	

11. In methane, the C-H bond is:

a) Polar	
b) Non-polar	✓
c) Ionic	
d) Coordinate	

12. At room temperature, bromine ( $\text{Br}_2$ ) exists as:

a) Solid	
b) Liquid	✓
c) Gas	
d) Powder	

13. Sulphur, Selenium and Tellurium are known as:

a) Chalcogens	✓
b) Transition elements	
c) Rare earth elements	
d) None of the above	

14. While moving down a group, metallic character of elements.....

a) Decreases	
b) Increases	✓
c) Does not change.	
d) Undergo random variation.	

15. Bleaching powder is

a) Sodium hypochlorite	
b) Hypochlorous acid	
c) Sodium bicarbonate	
d) $\text{Ca}(\text{ClO})_2$	✓

16. Inorganic benzene is

a) Borazine	✓
b) Phosphazene	
c) Polyphosphazene	
d) None of the above	

17. How many oxides are formed by nitrogen?

a) One	
b) Two	
c) Three	
d) Five	✓

18. In Freundlich Adsorption isotherm, the value of  $1/n$  is:

a) between 0 and 1 in all cases	✓
b) between 2 and 4 in all cases	
c) 1 in case of physical adsorption	
d) 1 in case of chemisorptions	

19. Equimolar solutions of the following substances were prepared separately. Which one of these will record the highest pH value ?

e) $\text{BaCl}_2$	✓
f) $\text{AlCl}_3$	
g) $\text{LiCl}$	
h) $\text{BeCl}_2$	

20. Which statement is FALSE?

a) Bond length of benzene is higher than that of double bonds of 1,3-butadiene.	
b) Bond length of benzene is smaller than that of single bonds of 1,3-butadiene.	
c) All the bonds of benzene are equal in length.	
d) Three C-C bonds are large and three are small	✓

in benzene.

21. A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 408 pm. The diameter of the metal atom is:

i) 408 pm	
j) 144 pm	
k) 204 pm	
l) 288 pm	✓

22. Sulphur is

a) Metal	
b) Non-metal	✓
c) Metalloid	
d) None of the above	

23. The most electronegative element is:

m) Chlorine	
n) Bromine	
o) Fluorine	✓
p) Nitrogen	

24. Which of the following carbocation is most stable:

q) Benzylic carbocation	✓
r) Allylic carbocation	
s) Tertiary carbocation	
t) Secondary carbocation	

25. Aldol condensation reaction is given by :

u) Carbonyl compounds	✓
v) Alcohols	
w) Phenols	
x) Carboxylic acids	

## Computer Science

1. Which of the following functions  $f: \mathbb{R} \rightarrow \mathbb{R}$  is not a surjection?

- A)  $f(x) = x^2$   
 B)  $f(x) = x^3$   
 C)  $f(x) = \pm\sqrt{x}$   
 D) None of the above

2. Let  $[.]$  and  $\lceil . \rceil$  denote floor and ceil functions respectively. What is the value of  $\lceil x \rceil - [x]$ ?

- A) 0  
 B) 1  
 C) 0 if  $x$  is an integer, and 1 otherwise  
 D) Any real value between 0 and 1
3. How many subsets with an odd number of elements does a set with 10 elements have?  
 A) 10  
 B) 512  
 C) 1024  
 D) 2048
4. The probability that a random permutation of MNOPQRST contains the string MOP is  
 A)  $1/8$   
 B)  $3/8$   
 C)  $3/56$   
 D)  $1/56$
5. Mean, median and variance of the data 5, 4, 3, 2, 1 are  
 A) 3, 3, 1  
 B) 3, 3, 2  
 C) 1, 2, 1  
 D) 3, 1, 2
6. If  $A$  is a  $3 \times 3$  matrix and  $|A| = 3$ , then  $|\text{adj } A| =$   
 A) 1  
 B) 3  
 C) 9  
 D) None of these
7. Equation of the line that makes intercepts 2 and  $-3$  on the  $y$  and  $x$  axes respectively is  
 A)  $2x - 3y - 6 = 0$   
 B)  $2x + 3y - 6 = 0$   
 C)  $2x - 3y + 6 = 0$   
 D)  $2x + 3y + 6 = 0$
8. What is the probability of the event: "The first success occurs on the  $10^{\text{th}}$  trial, where each trial results in a failure with probability  $f$ ".  
 A)  $1 - f$   
 B)  $f^{10}$   
 C)  $(1 - f)^9 f$   
 D)  $f^9(1 - f)$
9.  $\lim_{x \rightarrow 1} \frac{x^{15} - 1}{x^{10} - 1}$  is  
 A)  $3/2$   
 B)  $2/3$   
 C)  $+\infty$   
 D) undefined
10. Given the vectors  $\vec{a}$  and  $\vec{b}$  such that  $|\vec{a}| = 3$  and  $|\vec{b}| = \frac{\sqrt{2}}{3}$ , then  $\vec{a} \times \vec{b}$  is a unit vector if the angle between  $\vec{a}$  and  $\vec{b}$  is  
 A)  $\frac{\pi}{2}$   
 B)  $\frac{\pi}{3}$   
 C)  $\frac{\pi}{4}$   
 D)  $\frac{\pi}{6}$
11. Which of the following computer language is written in binary codes only?  
 A) Pascal  
 B) Machine Language  
 C) C  
 D) C#
12. Which of the following devices provides the communication between a computer and the outer world?  
 A) Compact  
 B) I/O  
 C) Storage  
 D) Drivers
13. Which of the following service allows a user to log in to another computer somewhere on the Internet?  
 A) e-mail  
 B) UseNet  
 C) Telnet  
 D) FTP
14. What does GUI stand for?  
 A) Graphical User Instruction  
 B) General User Instruction  
 C) General User Interface  
 D) Graphical User Interface
15. \_\_\_\_\_ is designed to solve a specific problem or to do a specific task.  
 A) Application Software  
 B) System Software  
 C) Utility Software  
 D) User
16. ANSI stands for  
 A) Alan Numeric Symbols Information  
 B) American Numeric Symbols Institute  
 C) American National Symbols Institute  
 D) American National Standards Institute
17. Convert:  $(11010)_2 = ( \quad )_{16}$ .

- A) A1
- B) 1A
- C) C0
- D) 62

18. The decimal equivalent of  $(1011.1011)_2$  is

- A) 11.6875
- B) 11.3125
- C) 10.6875
- D) 10.3125

19. The 9's complement of 6578 is \_\_\_\_\_.

- A) 3420
- B) 3421
- C) 1234
- D) 3124

20. A system wherein items are added from one end and removed from the other end is called

- A) Stack
- B) Queue
- C) Linked List
- D) Array

21. If in a certain code language COMPUTER is written as RFUVQNPC, MEDICINE will be coded as

- A) MFEDJJOE
- B) EOJDEJFM
- C) MFEJDJOE
- D) EOJDJEFM

22. Starting from her house a woman walks 15 km towards South. She turns right and walks 35 km. Again she turns right and walks 15 km. Then she turns left and walks 5 km. How far is her house now?

- A) 35
- B) 40
- C) 15
- D) 50

23. Statement of the form "If X, then Y" is false when

- A) X is true and Y is true
- B) X is true and Y is false
- C) X is false and Y is true
- D) X is false and Y is false

24. The next number in the sequence 0, 1, -1, 3, -5, 11, is

- A) -9
- B) -11
- C) -21
- D) 43

25. Two cups of ice-tea and three cups of ice-cream cost Rs. 177. Three cups of ice-tea and two cups of ice-cream cost Rs. 173. What can you buy, if you have Rs. 35.?

- A) A cup of ice-tea
- B) A cup of ice-cream
- C) Both A and B
- D) None

## Mathematics

1. The area bounded by the curve  $y = x^3$  the x-axis and the ordinates at  $x = -2$  and  $x = 2$

a) 16	
b) 0	
c) -8	
d) 8	

2. If  $|f(x)|$  is continuous at  $x = a$  then  $f(x)$  is

a) continuous at $x = a$	
b) discontinuous at $x = a$	
c) continuous at $x = \sqrt{a}$	
d) not continuous at $x = -a$	

3. Rolle's theorem is not applicable for the function  $f(x) = |x|$  in the interval  $[-1,1]$  because

a) $f(1)$ does not exist	
b) $f(-1)$ does not exist	
c) $f(x)$ is discontinuous at $x = 0$	
d) $f(0)$ does not exist	

4. The order and the degree of the differential equation  $d^2y/dx^2 + \sqrt{(x + [dy/dx]^3)} = 0$  is

a) (2, 2)	
b) (3, 2)	
c) (2, 3)	
d) (1, 3)	

5. The cube roots of unity

a) are collinear	
b) lie on a circle of radius 1	
c) form an equilateral triangle	
d) None of these	

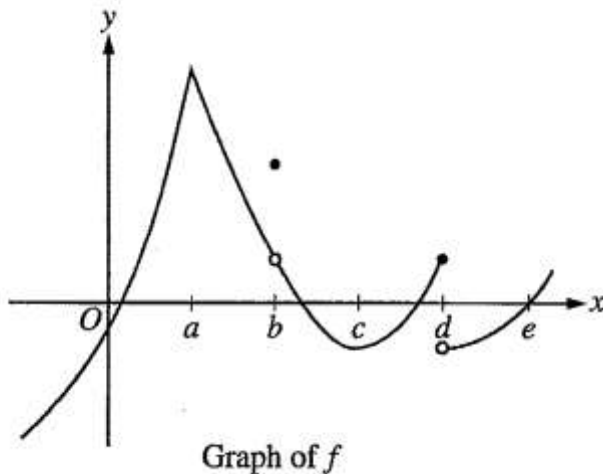
6. In order that a relation R defined in a non-empty set A is an equivalence relation, it is sufficient to show that R is

a) reflexive	
b) reflexive, ant symmetric and transitive	
c) reflexive, symmetric and transitive	
d) None of these	

7. For a function  $f$  continuous on a closed interval  $[a, b]$  and  $x \in [a, b]$  we have that

a) $f(x+) = f(x)$	
b) $f(x+) = f(x-)$	
c) $f(x+) = f(x) = f(x-)$	
d) None of these	

8.  $\int 35x^4 \cos(x^5) dx =$   
 a)  $\frac{1}{5} \sin(x^5) + C$   
 b)  $7 \sin(x^5) + C$   
 c)  $7 \cos(x^5) + C$   
 d) None of these



9. The graph of the function  $f$  is shown above. At which point  $x$  the function  $f$  is continuous but not differentiable?

- a)  $a$    b)  $b$    c)  $c$    (d) None of these

10.  $\frac{d}{dx} \left( \frac{e^x}{1+x} \right) =$

- a)  $\frac{xe^x}{1+x}$   
 b)  $\frac{e^x+x}{1+x}$   
 c)  $\frac{xe^x}{(1+x)^2}$   
 d) None of these

11. Which of the following is the empty set?

- (a)  $\{x : x \text{ is a real number and } x^2 - 1 = 0\}$ .  
 (b)  $\{x : x \text{ is a real number and } x^2 + 1 = 0\}$ .  
 (c)  $\{x : x \text{ is a real number and } x^2 - 9 = 0\}$ .  
 (d)  $\{x : x \text{ is a real number and } x^2 = x + 2\}$ .

12. Let  $R$  be a relation such that  $(x, y)$  is an element of  $R$  if  $x - y$  is divisible by  $m$ , where  $x, y, m$  are integers with  $m > 1$ . Then  $R$  is

- (a) Reflexive, Symmetric but not Transitive.  
 (b) Reflexive, Transitive but not Symmetric.  
 (c) Symmetric, Transitive but not Reflexive.  
 (d) Reflexive, Symmetric and Transitive.

13. Consider the function  $f(x) = x^2$  from  $R$  onto  $R$ .

Then,  $f$  is

- a) Onto  
 b) one one  
 c) neither one one nor onto  
 d) None of these

14. In a survey of 60 people, 25 read Jagran, 26 read Amar Ujala, 26 Read Navbharat Times. 9 read both Jagran and Navbharat Times, 11 read both Jagran and Amar Ujala, 8 read both Amar Ujala and Navbharat Times, 3 read all three newspapers. Then the number of people reading at least one of the three newspapers is

- a) 26  
 b) 52  
 c) 9

d) None of these

15. If  $g(x) = \frac{2x-3}{5x-7}$  then  $g^{-1}(x) =$

- a)  $\frac{7x-3}{5x-2}$   
 b)  $\frac{2x-3}{5x-7}$   
 c)  $\frac{7x-3}{5x-7}$

d) None of these

16. Out of the four statements

- (i) Delhi is in Nepal or  $2 + 2 = 5$   
 (ii) Delhi is in India or  $2 + 2 = 5$   
 (iii) Delhi is in India or  $2 + 2 = 4$   
 (iv) Delhi is in Nepal or  $2 + 2 = 4$

The False statement is

- a) (i)  
 b) (ii)  
 c) (iii)  
 d) (iv)

17. The value of the integral  $\int_0^3 |1 - x^2| dx =$

- a) 0  
 b) 1  
 c)  $11/3$   
 d)  $22/3$

18.  $\int_{-2}^1 \frac{3}{x^2+4x+13} dx =$

- a)  $\frac{\pi}{13}$   
 b)  $\frac{1}{4}$   
 c) 0  
 d)  $\frac{\pi}{4}$

19. The function  $f(x) = \frac{1}{\sqrt{x^2+3x-10}}$  has domain

- a)  $(2, \infty)$   
 b)  $(-\infty, -5) \cup (2, \infty)$   
 c)  $(-\infty, \infty)$   
 d) None of these

$$20. \lim_{x \rightarrow 0} \frac{(\sin x)^{100}}{x^{99} \sin(2x)} =$$

- a) 0  
b) 2  
c) 1/2  
d) None of these

- (c) 3/2  
(d) 2/3

21. What will be the value of  $a$ , for which the equation  $5x^2 + ax + 5 = 0$  and  $x^2 - 12x + a = 0$  will have real roots?

- a)  $a = 37$   
b)  $10 < a < 36$   
c)  $36 < a < 10$   
d)  $a = 9$

22. If the roots of  $ax^2 + bx + c = 0$  are in the ratio  $m : n$ , then

- a)  $mna^2 = (m + n) c^2$   
b)  $mnb^2 = (m + n) ac$   
c)  $mn b^2 = (m + n)^2 ac$   
d)  $mnb^2 = (m - n)^2 ac$

23. If  $\omega$  is an imaginary cube root of unity, then  $(1 + \omega - \omega^2)^7$  equals

- a)  $128\omega$   
b)  $-128\omega$   
c)  $128\omega^2$   
d)  $-128\omega^2$

24. The complex numbers  $\sin x + i \cos 2x$  and  $\cos x - i \sin 2x$  are conjugate to each other for

- a)  $x = n\pi$   
b)  $x = 0$   
c)  $x = \left(n + \frac{1}{2}\right)\pi$   
d) No value of  $x$

25. For any natural number  $n$ ,  $7^n - 2^n$  is divisible by

- a) 3  
b) 4  
c) 5  
d) 7

### Physics

Q1. An object is placed at 10 cm in front of a concave mirror having radius of curvature 15 cm. What is the magnification (m) of the image?

- (a) 3

- (b) -3

Q2. If  $n_{21}$  is the refractive index of medium 2 with respect to medium 1 and  $n_{12}$  is refractive index of medium 1 with respect to medium 2, then which one is correct?

- (a)  $n_{12} = n_{21}$   
(b)  $n_{12} = -n_{21}$   
(c)  $n_{12} = \frac{1}{n_{21}}$   
(d)  $n_{12} = -\frac{1}{n_{21}}$

Q3. If  $f$  is the focal length of a lens,  $u$  is the object distance and  $v$  is the image distance then considering the sign convention, the thin lens formula is:

- (a)  $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$   
(b)  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$   
(c)  $\frac{1}{v} + \frac{1}{u} = -\frac{1}{f}$   
(d)  $v + u = f$

Q4. The dimension of a light year is:

- (a)  $M^0L^0T^1$   
(b)  $M^0L^1T^0$   
(c)  $M^1L^0T^0$   
(d)  $M^0L^1T^{-1}$

Q5 The Current flowing through wire depends on time as  $I=3t^2+2t+5$ . The charge flowing through the cross-section of the wire in time  $t=0$  to  $t=2$  second is

- (a) 22 C  
(b) 20 C  
(c) 18 C  
(d) 5 C

Q6. The Charge  $Q$  flowing through a resistance  $R$  varies with time  $t$  as  $Q=at-bt^2$ . The total heat produced in  $R$  is

- (a)  $a^3R/6b$   
(b)  $a^3R/3b$   
(c)  $a^3R/2b$   
(d)  $a^3R/b$

Q7. A wire of resistance  $R$  is cut into  $n$  equal parts. These parts are then connected in parallel. The equivalent resistance of the combination will be

- (a)  $nR$

- (b)  $R/n$

(c)  $n/R$

(d)  $R/n^2$

Q8. At what frequency will a 0.5H inductor have a resistance of 1000 ohm

(a) 218 Hz

(b) 318.5 Hz

(c) 543 Hz

(d) 423.6 Hz

Q9. A body starts from rest and has an acceleration 20 cm/sec<sup>2</sup>. What is the distance covered by the body in first 8 sec

(a) 160 cm

(b) 640 cm

(c) 1280 cm

(d) 1640 cm

Q10. Speeds of two identical cars are  $u$  and  $4u$  at a specific instant. The ratio of the respective distances in which the two cars are stopped in the same time

(a) 1:1

(b) 1:4

(c) 1:8

(d) 1:16

Q11. When a body is thrown with a velocity  $u$  making an angle  $\theta$  with the horizontal plane, the maximum distance covered by it in horizontal direction is

(a)  $\frac{u^2 \sin \theta}{g}$

(b)  $\frac{u^2 \sin 2\theta}{2g}$

(c)  $\frac{u^2 \sin 2\theta}{g}$

(d)  $\frac{u^2 \cos 2\theta}{g}$

Q12. The velocity of a bullet is reduced from 200m/s to 100m/s while travelling through a wooden block of thickness of 10 cm. The retardation assuming to be uniform, will be

(a)  $15 \times 10^4 \text{ m/s}^2$

(b)  $13.5 \times 10^4 \text{ m/s}^2$

(c)  $12 \times 10^4 \text{ m/s}^2$

(d)  $17 \times 10^4 \text{ m/s}^2$

Q13. A transistor has three impurity regions. All the three regions have different doping level. In order of increasing doping level, the regions are

(a) emitter, base and collector

(b) collector, base and emitter

(c) base, emitter and collector

(d) base, collector and emitter

Q14. A semiconductor has \_\_\_\_\_ temperature coefficient of resistance.

(a) positive

(b) zero

(c) negative

(d) none of the above

Q15. In a transistor if  $\beta = 100$  and collector current is 10 mA, then emitter current is \_\_\_\_\_

(a) 100mA

(b) 100.1mA

(c) 110 mA

(d) none of the above

Q16. The conductivity of silicon (Si) with rise in temperature

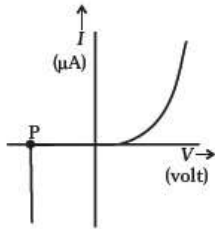
(a) decreases

(b) increases

(c) remains same

(d) is negative

Q17. Name the type of diode whose characteristics is shown in figure below:



- (a) Zener diode  
 (b) Ideal diode  
 (c) p-n junction diode

(d) None of the above

Q18. An electron, a proton and an alpha particle having the same kinetic energy are moving in circular orbit of radii  $r_e$ ,  $r_p$ ,  $r_\alpha$  respectively in a uniform magnetic field  $B$ . The relation between  $r_e$ ,  $r_p$ ,  $r_\alpha$  is:

- (a)  $r_e > r_p = r_\alpha$   
 (b)  $r_e < r_p = r_\alpha$   
 (c)  $r_e < r_p < r_\alpha$   
 (d)  $r_e < r_\alpha < r_p$

A19. The dipole moment of a circular loop carrying a current  $I$ , is  $m$  and the magnetic field at the centre of the loop is  $B_1$ . When the dipole moment is doubled by keeping the current constant, the magnetic field at the centre of the loop is  $B_2$ . The ratio  $B_2:B_1$  is

- (a)  $3^{1/2}$   
 (b)  $2^{1/2}$   
 (c) 2  
 (d) 3

Q20. A sinusoidal voltage  $V(t) = 100 \sin(500t)$  is applied across a pure inductance of  $L = 0.02H$ . The current through the coil is:

- (a)  $10 \cos(500t)$   
 (b)  $-10 \cos(500t)$   
 (c)  $10 \sin(500t)$   
 (d)  $-10 \sin(500t)$

Q21. The orientation of atomic-orbitals depend on their

- (a) Spin quantum number  
 (b) Magnetic quantum number  
 (c) Azimuthal quantum number  
 (d) Principal quantum number

Q22. The electronic configuration of atomic number 20 of an atom is which of the following?

- (a) 2, 6, 6, 2  
 (b) 2, 8, 8, 2  
 (c) 2, 4, 6, 2  
 (d) 2, 4, 6, 2

Q23. The isotopes of a neutral atom of an element differ in which of these?

- (a) Physical properties  
 (b) Chemical properties  
 (c) Atomic number  
 (d) Mass number

Q24. The maximum mass of an atom is concentrated in which of these?

- (a) Nucleus  
 (b) Neutrons  
 (c) Protons  
 (d) Electrons

Q25. An atom differs from an ion with respect to which of the following?

- (a) Number of protons  
 (b) Nuclear charge  
 (c) Number of electrons  
 (d) Mass number