

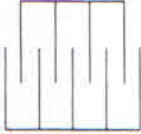
AIIMS

Medical Entrance Exam

Solved Paper 2011

Physics

1. In Young's double slit experiment carried out with wavelength $\lambda = 5000 \text{ \AA}$, the distance between the slits is 0.2 mm and the screen is 2 m away from the slits. The central maxima is at $n = 0$. The third maxima will be at a distance x (from central maxima) is equal to
- (a) 5.0 cm (b) 0.5 cm
 (c) 4.67 cm (d) 1.5 cm

2. A gang capacitor is formed by interlocking a number of plates as shown in figure. The distance between the consecutive plates is 0.885 cm and the overlapping area of the plates is 5 cm^2 . The capacity of the unit is
- 
- (a) 1.06 pF (b) 4 pF
 (c) 6.36 pF (d) 12.72 pF

3. The freezer in a refrigerator is located at the top section so that
- (a) the entire chamber of the refrigerator is cooled quickly due to convection
 (b) the motor is not heated
 (c) the heat gained from the environment is high
 (d) the heat gained from the environment is low

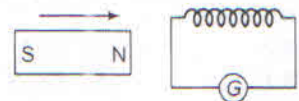
4. A choke is preferred to a resistance for limiting current in AC circuit because
- (a) choke is cheap
 (b) there is no wastage of power
 (c) choke is compact in size
 (d) choke is a good absorber of heat

5. A thin prism P_1 of angle 4° and refractive index 1.54° is combined with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation. The angle of P_2 is
- (a) 4° (b) 5.33°
 (c) 2.6° (d) 3°

6. What will be the number of photons emitted per second by a 10 W sodium vapour lamp assuming that 90% of the consumed energy is converted into light [Wavelength of sodium light is 590 nm , and $h = 6.63 \times 10^{-34} \text{ J-s}$]
- (a) 0.267×10^{18} (b) 0.267×10^{19}
 (c) 0.267×10^{20} (d) 0.267×10^{17}

7. 200 MeV of energy may be obtained per fission of U^{235} . A reactor is generating 100 kW of power. The rate of nuclear fission in the reaction is
- (a) 1000 (b) 2×10^8
 (c) 3.125×10^{16} (d) 931

8. As shown in the figure a magnet is moved with a fast speed towards a coil at rest. Due to this induced emf, induced current and induced charge in the coil is E, I and Q respectively. If the speed of the magnet is doubled, the incorrect statement is



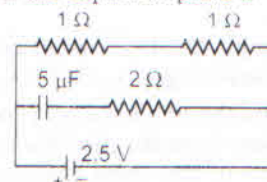
- (a) E increases (b) I increases
 (c) Q remains same (d) Q decreases

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9. Which one of the following is not made of soft iron?
 (a) Electromagnet
 (b) Core of transformer
 (c) Core of dynamo
 (d) Magnet of loudspeaker
10. Two tangent galvanometer having coils of the same radius are connected in series. A current flowing in them produces deflection of 60° and 45° respectively. The ratio of the number of turns in the coils is
 (a) $4/3$
 (b) $(\sqrt{3} + 1)/1$
 (c) $\sqrt{3}/1$
 (d) $(\sqrt{3} + 1)/(\sqrt{3} - 1)$
11. A bar magnet of magnetic moment 10^4 J/T is free to rotate in a horizontal plane. The work done in rotating the magnet slowly from a direction parallel to a horizontal magnetic field of 4×10^{-5} T to a direction of 60° from the field will be
 (a) 0.2 J
 (b) 2 J
 (c) 4.18 J
 (d) 2×10^2 J
12. An ideal coil of 10 H is joined in series with a resistance of 5Ω and battery of 5 V, 2 s after joining the current flowing (in ampere) in the circuit will be
 (a) e^{-1}
 (b) $(1 - e^{-1})$
 (c) $(1 - e)$
 (d) e
13. A rocket is fired upward from the earth surface such that it creates an acceleration of 19.6 m/s^2 . If after 5 s, its engine is switched off, the maximum height of the rocket from earth's surface would be
 (a) 245 m
 (b) 490 m
 (c) 980 m
 (d) 735 m
14. A 60 kg weight is dragged on a horizontal surface by a rope through a distance of 2m. If coefficient of friction is $\mu = 0.5$, the angle of rope with surface is 60° and $g = 9.8 \text{ m/s}^2$, then work done is
 (a) 294 J
 (b) 15 J
 (c) 588 J
 (d) 197 J
15. A small uncharged metallic sphere is positioned exactly at a point midway between two equal and opposite point

charges. If the sphere is slightly displaced towards the positive charge and released then

- (a) it will oscillate about its original position
 (b) it will move further towards the positive charge
 (c) its electric potential energy will decrease and kinetic energy will increase
 (d) its total energy remains constant but is non-zero
16. A capacitor of capacitance $5 \mu\text{F}$ is connected as shown in the figure. The internal resistance of the cell is 0.5Ω . The amount of charge on the capacitor plate is



- (a) zero
 (b) $5 \mu\text{C}$
 (c) $10 \mu\text{C}$
 (d) $25 \mu\text{C}$
17. The resistance of a circular coil of 50 turns and 10 cm diameter is 5Ω . What must be the potential difference across the ends of the coil so as to nullify the earth's magnetic field ($H = 0.314$ gauss) at the centre of the coil? How should the coil be placed to achieve this result?
 (a) 0.5 V with plane of coil normal to the magnetic meridian
 (b) 0.5 V with plane of coil in the magnetic meridian
 (c) 0.25 V with plane of coil normal to the magnetic meridian
 (d) 0.25 V with plane of coil in the magnetic meridian
18. If C and L denote the capacitance and inductance respectively, the units of LC are
 (a) $[\text{M}^0\text{L}^0\text{T}^{-2}]$
 (b) $[\text{M}^0\text{L}^2\text{T}^{-2}]$
 (c) $[\text{MLT}^{-2}]$
 (d) $[\text{M}^0\text{L}^0\text{T}^0]$
19. The K_α line from molybdenum (atomic number = 42) has a wavelength of 0.7078 \AA . The wavelength of K_α line of zinc (atomic number = 30) will be
 (a) 1 \AA
 (b) 1.3872 \AA
 (c) 0.3541 \AA
 (d) 0.5 \AA

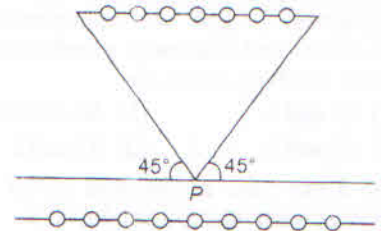
20. A body of mass 0.5 kg is projected under gravity with a speed of 98 m/s at an angle of 60° with the horizontal. The change in momentum (in magnitude) of the body is
 (a) 24.5 N-s
 (b) 49.0 N-s
 (c) 98.0 N-s
 (d) 50.0 N-s
21. The diameter of the objective of a telescope is 0.1 m and the wavelength of the light is 6000 \AA . Its resolving power would be approximately
 (a) 6×10^{-5} rad
 (b) 6×10^4 rad
 (c) 6×10^{-3} rad
 (d) 6×10^{-6} rad
22. The dispersive powers of glasses of lenses used in an achromatic pair are in the ratio 5 : 3. If the focal length of the concave lens is 15 cm, then the nature and focal length of the other lens would be
 (a) convex, 9 cm
 (b) concave, 9 cm
 (c) convex, 25 cm
 (d) concave, 25 cm
23. A charge Q is divided into two parts of q and $Q - q$. If the coulomb repulsion between them when they are separated is to be maximum, the ratio of $\frac{Q}{q}$ should be
 (a) 2
 (b) 1/2
 (c) 4
 (d) 1/4
24. A rectangular vessel when full of water, takes 10 min to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water?
 (a) 9 min
 (b) 7 min
 (c) 5 min
 (d) 3 min
25. If there were no gravity, which of the following will not be there for a fluid?
 (a) Viscosity
 (b) Surface tension
 (c) Pressure
 (d) Archimedes' upward thrust

26. $\mathbf{A} = 4\mathbf{i} + 4\mathbf{j} - 4\mathbf{k}$ and $\mathbf{B} = 3\mathbf{i} + \mathbf{j} + 4\mathbf{k}$, then angle between vectors \mathbf{A} and \mathbf{B} is
 (a) 180°
 (b) 90°
 (c) 45°
 (d) 0°

27. Consider the following statements
 (i) For a permanent magnet the area of a hysteresis loop is allowed to be large.
 (ii) Coercivity of the material in permanent magnets should be small.

Which of the following statements is/are true?

- (a) (i) but not (ii)
 (b) (ii) but not (i)
 (c) Both (i) and (ii)
 (d) Neither (i) nor (ii)
28. Two capacitors of $10 \mu\text{F}$ and $20 \mu\text{F}$ are connected in series with a 30 V battery. The charge on the capacitors will be respectively
 (a) $100 \mu\text{C}$, $100 \mu\text{C}$
 (b) $200 \mu\text{C}$, $100 \mu\text{C}$
 (c) $200 \mu\text{C}$, $200 \mu\text{C}$
 (d) $100 \mu\text{C}$, $200 \mu\text{C}$
29. The magnetic field at P on the axis of a solenoid having 100 turn/m and carrying a current of 5 A is



- (a) $250 \mu_0$
 (b) $500\sqrt{2} \mu_0$
 (c) $500 \mu_0$
 (d) $250\sqrt{2} \mu_0$
30. In an isobaric process of an ideal gas. The ratio of heat supplied and work done by the system $\left[\text{ie, } \left(\frac{Q}{W} \right) \right]$ is
 (a) $\frac{\gamma - 1}{\gamma}$
 (b) γ
 (c) $\frac{\gamma}{\gamma - 1}$
 (d) 1

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31. The velocity of sound in air at NTP is 330 m/s. What will be its value when temperature is doubled and pressure is halved?
 (a) 330 m/s (b) 165 m/s
 (c) $330\sqrt{2}$ m/s (d) $330/\sqrt{2}$ m/s
32. Doppler's effect in sound in addition of relative velocity between source and observer, also depends while source and observer or both are moving. Doppler effect in light depend only on the relative velocity of source and observer. The reason of this is
 (a) Einstein mass-energy relation
 (b) Einstein theory of relativity
 (c) photoelectric effect
 (d) None of the above
33. If emf $E = 4 \cos 1000t$ volt is applied to an L - R circuit of inductance 3 mH and resistance 4Ω , the amplitude of current in the circuit is
 (a) $\frac{4}{\sqrt{7}}$ A (b) 1.0 A
 (c) $\frac{4}{7}$ A (d) 0.8 A
34. Two coherent monochromatic light beams of intensities I and $4I$ superimpose. The maximum and minimum possible intensities in the resulting beam are
 (a) $5I$ and I (b) $5I$ and $3I$
 (c) $3I$ and I (d) $9I$ and I
35. The X-ray tube is operated at 50 kV. The minimum wavelength produced is
 (a) 0.5 \AA (b) 0.75 \AA
 (c) 0.25 \AA (d) 1.0 \AA
36. The energy gap between conduction band and valence band is of the order of 0.07 eV. It is a/an
 (a) insulator
 (b) conductor
 (c) semiconductor
 (d) alloy
37. The earth circles around the sun once a year. The work which would have to be done on the earth to bring it to rest relative to the sun is, (Ignore the rotation of earth about its own axis) given that the mass of the earth

$= 6 \times 10^{24}$ kg and distance between sun and earth is 1.5×10^8 km)

- (a) 2.7×10^{30} J (b) 2.7×10^{31} J
 (c) -2×10^{33} J (d) $+2.7 \times 10^{33}$ J
38. A longitudinal wave is represented by

$$x = x_0 \sin 2\pi \left(nt - \frac{x}{\lambda} \right)$$

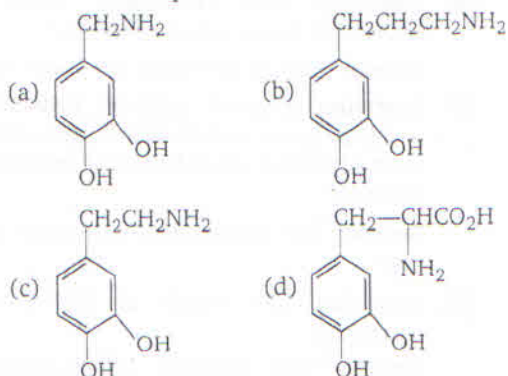
The maximum particle velocity will be four times the wave velocity, if

- (a) $\lambda = \frac{\pi x_0}{4}$ (b) $\lambda = 2\pi x_0$
 (c) $\lambda = \frac{\pi x_0}{2}$ (d) $\lambda = 4\pi x_0$
39. The rate of dissipation of heat by a black body at temperature T is Q . What will be the rate of dissipation of heat by another body at temperature $2T$ and emissivity 0.25?
 (a) $16Q$ (b) $4Q$
 (c) $8Q$ (d) $4.5Q$
40. The radius of gyration of a body about an axis at a distance of 6 cm from its centre of mass is 10 cm. Then, its radius of gyration about a parallel axis through its centre of mass will be
 (a) 800 cm (b) 8 cm
 (c) 0.8 cm (d) 80 m
- Direction (41-60)** In each of the following questions a statement of **Assertion** is given followed by a corresponding statement of **Reason** just below it. Of the statements mark the correct answer as
 (a) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion**.
 (b) If both **Assertion** and **Reason** are true but the **Reason** is not the correct explanation of the **Assertion**.
 (c) If **Assertion** is true but **Reason** is false.
 (d) If both **Assertion** and **Reason** are false.
41. **Assertion** The projectile has only vertical component of velocity at the highest point of its trajectory.
Reason At the highest point only one component of velocity present.

42. **Assertion** Thrust on a rocket depends not only on the rate of decrease of mass.
Reason Thrust also depends upon exhaust speed of the gases.
43. **Assertion** When a ball collides elastically with a floor, it rebounds with the same velocity as with it strikes.
Reason Momentum of earth + ball system remains constant.
44. **Assertion** When a body accelerates down an incline rolling purely. Static friction force acts on the body.
Reason Point of contact of the body with incline remains at rest.
45. **Assertion** A small drop of mercury is spherical but bigger drops are oval in shape.
Reason surface tension of liquid decreases with increase in temperature.
46. **Assertion** C_p can be less than C_v .
Reason $C_p C_v = R$ is valid only for ideal gases.
47. **Assertion** Bulk modulus of elasticity B represents incompressibility of the material.
Reason $B = -\frac{\Delta p}{\Delta V/V}$, where symbols have their usual meaning.
48. **Assertion** To float, a body must displace liquid whose weight is greater than actual weight of the body.
Reason During floating the body will experience no net downward force in that case.
49. **Assertion** It is hotter over the top of a fire than at the same distance of the side.
Reason Air surrounding the fire conducts, more heat upward.
50. **Assertion** The molecules of a monatomic gas has three degree of freedom.
Reason The molecules of a diatomic gas has five degree of freedom.
51. **Assertion** In a stationary wave, there is no transfer of energy.
Reason There is no outward motion of the disturbance from one particle to adjoining particle in a stationary wave.
52. **Assertion** Though large number of free electrons are present in the metal. Yet there is no current in the absence of electric field.
Reason In the absence of electric field electrons move randomly in all directions.
53. **Assertion** The value of temperature coefficient of resistance is positive for metals.
Reason The temperature coefficient of resistance for insulator is also positive.
54. **Assertion** Magnetic field due to an infinite straight conductor varies inversely as the distance from it.
Reason The magnetic field at the centre of the circular coil in the following figure is zero.
55. **Assertion** The resistance of an ideal voltmeter should be infinite.
Reason The lower resistance of voltmeters gives a reading lower than the actual potential difference across the terminals.
56. **Assertion** The centripetal forces and centrifugal forces never cancel out.
Reason They do not act at the same time.
57. **Assertion** A quick collision between two bodies is more violent than a slow collision, even when the initial and final velocities are identical.
Reason The momentum is greater in first case.
58. **Assertion** The length of day is slowly increasing.
Reason The tidal effect causing a slowdown in the rotation of the earth is the gravitational pull of other planets in the solar system.
59. **Assertion** On a decay daughter nucleus shifts two places to the left from the parent nucleus.
Reason An alpha particle carries four units of mass.
60. **Assertion** When base region has larger width, the collector current increases.
Reason Electron hole combination in base result in increase of base current.

Chemistry

- Which of the following pair of transition metal ions have the same calculated values of magnetic moment?
 - Ti^{2+} and V^{2+}
 - Fe^{2+} and Cu^{2+}
 - Cr^{2+} and Fe^{2+}
 - Co^{2+} and Ti^{2+}
- A radioactive substance ${}_{88}X^{228}$ (IIA) emits 3α and 3β -particles to form 'Y'. To which group of long form of the Periodic Table does 'Y' belong?
 - IVA
 - VA
 - VIA
 - VIIA
- Which of the following is not a conjugate acid-base pair?
 - HPO_3^{2-} , PO_3^{3-}
 - $H_2PO_4^-$, HPO_4^{2-}
 - $H_2PO_4^-$, H_3PO_4
 - $H_2PO_4^-$, PO_3^{3-}
- Parkinson's disease is linked to abnormalities in the levels of dopamine in the body. The structure of dopamine is

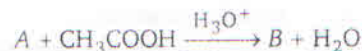


- The wavelength of a spectral line emitted by hydrogen atom in the Lyman series is $\frac{16}{15R}$ cm. What is the value of n_2 ?

(R = Rydberg constant)

 - 2
 - 3
 - 4
 - 1
- 138 g of ethyl alcohol is mixed with 72 g of water. The ratio of mole fraction of alcohol to water is
 - 3 : 4
 - 1 : 2
 - 1 : 4
 - 1 : 1

- Which of the following is a biodegradable polymer?
 - Polythene
 - Bakelite
 - PHBV
 - PVC



In the above reactions 'A' and 'B' respectively are

- $\text{CH}_3\text{COOC}_2\text{H}_5$, $\text{C}_2\text{H}_5\text{OH}$
 - CH_3CHO , $\text{C}_2\text{H}_5\text{OH}$
 - $\text{C}_2\text{H}_5\text{OH}$, CH_3CHO
 - $\text{C}_2\text{H}_5\text{OH}$, $\text{CH}_3\text{COOC}_2\text{H}_5$
- Which one of the following noble gases is used in miner's cap lamps?
 - Helium
 - Neon
 - Argon
 - Krypton
 - The following are some statements related to VA group hydrides,
 - Reducing property increases from NH_3 to BiH_3
 - Tendency to donate lone pair decreases from NH_3 to BiH_3
 - Thermal stability of hydrides decreases from NH_3 to BiH_3
 - Bond angle of hydrides decreases from NH_3 to BiH_3
 The correct statements are
 - I, II, III and IV
 - I, III and IV
 - I, II and IV
 - I and IV
 - Which of the following is not tetrahedral?
 - BF_4^-
 - NH_4^+
 - CO_3^{2-}
 - SO_4^{2-}
 - An organic compound 'X' on treatment with pyridinium chloro chromate in dichloromethane gives compound 'Y'. Compound 'Y' reacts with I_2 and alkali to form triiodomethane. The compound 'X' is
 - $\text{C}_2\text{H}_5\text{OH}$
 - CH_3CHO
 - CH_3COCH_3
 - CH_3COOH

13. Which of the following is not a peroxy acid?
 (a) Perphosphoric acid
 (b) Pernitric acid
 (c) Perdisulphuric acid
 (d) Perchloric acid

14. Which of the following is not correct?
 (a) Milk is a naturally occurring emulsion.
 (b) Gold sol is a lyophilic sol.
 (c) Physical adsorption decreases with rise in temperature.
 (d) Chemical adsorption is unilayered.

15. Which one of the following species is diamagnetic in nature?

- (a) H_2^- (b) H_2^+
 (c) H_2 (d) He_2^+

16. Aluminium oxide may be electrolysed at $1000^\circ C$ to furnish aluminium metal (Atomic mass = 27 u; $1F = 96500 C$). The cathode reaction is



To prepare 5.12 kg of aluminium metal by this method would require

- (a) $5.49 \times 10^1 C$ of electricity
 (b) $5.49 \times 10^4 C$ of electricity
 (c) $1.83 \times 10^7 C$ of electricity
 (d) $5.49 \times 10^7 C$ of electricity

17. The solubility product of a salt having general formula MX_2 , in water is 4×10^{-12} . The concentration of M^{2+} ions in the aqueous solution of the salt is

- (a) $4.0 \times 10^{-10} M$ (b) $1.6 \times 10^{-4} M$
 (c) $1.0 \times 10^{-4} M$ (d) $2.0 \times 10^{-6} M$

18. A reaction involving two different reactants can never be

- (a) bimolecular reaction
 (b) second order reaction
 (c) first order reaction
 (d) unimolecular reaction

19. During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are

- (a) Fe and Ni (b) Ag and Au
 (c) Pb and Zn (d) Se and Ag

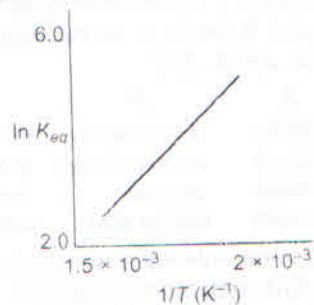
20. Based on lattice energy and other considerations, which one of the following alkali metal chlorides is expected to have the highest melting point?

- (a) RbCl (b) KCl
 (c) NaCl (d) LiCl

21. Heating mixture of Cu_2O and Cu_2S will give

- (a) Cu_2SO_3
 (b) $CuO + CuS$
 (c) $Cu + SO_3$
 (d) $Cu + SO_2$

22. A schematic plot of $\ln K_{eq}$ versus inverse of temperature for a reaction is shown below



The reaction must be

- (a) highly spontaneous at ordinary temperature
 (b) one with negligible enthalpy change
 (c) endothermic
 (d) exothermic

23. Calomel (Hg_2Cl_2) on reaction with ammonium hydroxide gives

- (a) HgO
 (b) Hg_2O
 (c) $NH_2-Hg-Hg-Cl$
 (d) $HgNH_2Cl$

24. The IUPAC name of the coordination compound $K_3[Fe(CN)_6]$ is

- (a) tripotassium hexacyanoiron (II)
 (b) potassium hexacyanoiron (II)
 (c) potassium hexacyanoferrate (III)
 (d) potassium hexacyanoferrate (II)

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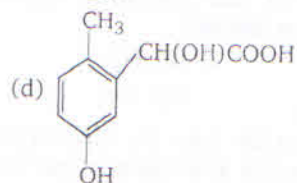
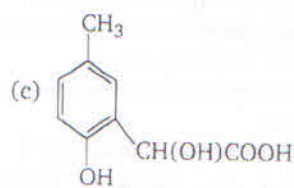
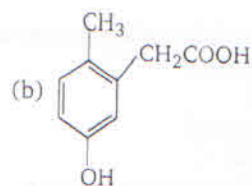
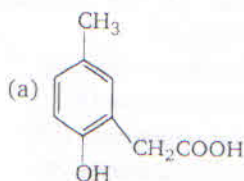
25. Which of the following compounds shows optical isomerism?

- (a) $[\text{Co}(\text{CN})_6]^{3-}$
 (b) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$
 (c) $[\text{ZnCl}_4]^{2-}$
 (d) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
26. The best reagent to convert pent-3-en-2-ol into pent-3-en-2-one is
- (a) pyridinium chloro-chromate
 (b) chromic anhydride in glacial acetic acid
 (c) acidic dichromate
 (d) acidic permanganate
27. A codon has a sequence of A and specifies a particular B that is to be incorporated into a C. What are? A, B, C

	<u>A</u>	<u>B</u>	<u>C</u>
(a)	3 bases	amino acid	carbohydrate
(b)	3 acids	carbohydrate	protein
(c)	3 bases	protein	amino acid
(d)	3 bases	amino acid	protein

28. Which of the following statement in relation to the hydrogen atom is correct?

- (a) 3s, 3p and 3d-orbitals all have the same energy
 (b) 3s and 3p-orbitals are of lower energy than 3d-orbital
 (c) 3p-orbital is lower in energy than 3d orbital
 (d) 3s-orbital is lower in energy than 3p orbital
29. *p*-cresol reacts with chlorofom in alkaline medium to give a compound A which adds hydrogen cyanide to form another compound B. This latter on acidic hydrolysis gives chiral carboxylic acid. The structure of the carboxylic acid is



30. If the bond dissociation energies of XY , X_2 and Y_2 (all diatomic molecules) are in the ratio of 1 : 1 : 0.5 and ΔH_f for the formation of XY is -200 kJ mol^{-1} . The bond dissociation energy of X_2 will be

- (a) 400 kJ mol^{-1} (b) 300 kJ mol^{-1}
 (c) 200 kJ mol^{-1} (d) 800 kJ mol^{-1}
31. $t_{1/4}$ can be taken as the time taken for the concentration of a reactant to drop to $\frac{3}{4}$ of its initial value. If the rate constant for a first order reaction is k , the $t_{1/4}$ can be written as
- (a) $0.75/k$ (b) $0.69/k$
 (c) $0.29/k$ (d) $0.10/k$
32. The number of sodium atoms in 2 moles of sodium ferrocyanide is
- (a) 12×10^{23} (b) 26×10^{23}
 (c) 34×10^{23} (d) 48×10^{23}
33. In the reaction,



H_2O_2 acts as

- (a) reducing agent (b) oxidising agent
 (c) bleaching agent (d) None of these
34. Which of the following is used widely in the manufacture of lead storage battery?
- (a) Arsenic (b) Lithium
 (c) Bismuth (d) Antimony

35. Two solutions of a substance (non electrolyte) are mixed in the following manner :

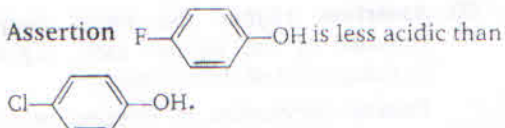
480 mL of 1.5 M first solution + 520 mL of 1.2 M second solution.

What is the molarity of the final mixture?

- (a) 2.70 M (b) 1.344 M
(c) 1.50 M (d) 1.20 M
36. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is
- (a) +3 (b) +2
(c) +6 (d) +4
37. The weight of iron which will be converted into its oxide (Fe_2O_3) by the action of 18 g of steam on it will be (At. wt. of Fe = 56)
- (a) 168 g (b) 84 g
(c) 42 g (d) 21 g
38. Work done during isothermal expansion of one mole of an ideal gas from 10 atm to 1 atm at 300 K is
- (a) 4938.8 J (b) 4138.8 J
(c) 5744.1 J (d) 6257.2 J
39. When alkyl halide is heated with dry Ag_2O , it produces
- (a) ester (b) ether
(c) ketone (d) alcohol
40. How many atoms of calcium will be deposited from a solution of CaCl_2 by a current of 5 mA flowing for 60 s?
- (a) 4.68×10^{18} (b) 4.68×10^{15}
(c) 4.68×10^{12} (d) 4.68×10^9

Direction (41-60) In each of the following questions a statement of **Assertion** is given followed by a corresponding statement of **Reason** just below it. Of the statements mark the correct answer as

- (a) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion**.
(b) If both **Assertion** and **Reason** are true but the **Reason** is not the correct explanation of the **Assertion**.
(c) If **Assertion** is true but **Reason** is false.
(d) If both **Assertion** and **Reason** are false.

41. **Assertion**  is less acidic than

Reason —F exerts better + mesomeric effect than —Cl.

42. **Assertion** Phenoxide ion on treatment with active alkyl halide (e.g., $\text{CH}_2=\text{CH}-\text{CH}_2\text{Cl}$) gives two products viz. O-substituted and C-substituted.
- Reason** Phenoxide ion is an ambident nucleophile.
43. **Assertion** K, Rb and Cs form superoxides.
- Reason** The stability of the superoxides increases from 'K' to 'Cs' due to decrease in lattice energy.
44. **Assertion** A catalyst increases the rate of a reaction.
- Reason** In presence of a catalyst, the activation energy of the reaction decreases.
45. **Assertion** NaCl is less soluble in heavy water than in ordinary water.
- Reason** Dielectric constant of ordinary water is more than that of heavy water.
46. **Assertion** Equal moles of different substances contain same number of constituent particles.
- Reason** Equal weights of different substances contain the same number of constituent particles.
47. **Assertion** The catalytic converter in the car's exhaust system converts polluting exhaust gases into non-toxic gases.
- Reason** Catalytic converter contains a mixture of transition metals and their oxides embedded in the inner support.
48. **Assertion** As a lead storage battery gets discharged, density of electrolyte, present in it, decreases.
- Reason** Lead and lead dioxide both react with sulphuric acid to form lead sulphate.
49. **Assertion** Atomic size of silver is almost equal to that of gold.
- Reason** d-subshell has low penetration power and produce poor shielding.

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50. **Assertion** Higher the molal depression constant of the solvent used, higher the freezing point of the solution.
Reason Depression in freezing point does not depend on the nature of the solvent.
51. **Assertion** The dissolution of ammonia in water does not follow Henry's law.
Reason Ammonia undergoes ionisation in water as
- $$\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$$
52. **Assertion** H_2 molecule is more stable than HeH molecule.
Reason The anti-bonding electron in the molecule destabilise it.
53. **Assertion** pH of neutral solution is always 7.
Reason pH of a solution does not depend upon temperature.
54. **Assertion** In chemisorption, adsorption keeps on increasing with temperature.
Reason Heat keeps on providing more and more activation energy.
55. **Assertion** The first ionisation enthalpy of Be is greater than that of B.
Reason $2p$ -orbital is lower in energy than $2s$ -orbital.
56. **Assertion** Nitriding is a process of heating steel in an atmosphere of nitrogen.
Reason Steel becomes brittle after nitriding.
57. **Assertion** Both Grignard reagent and dialkyl cadmium react with acid chlorides to form *tert*-alcohols.
Reason Grignard reagents are as reactive as dialkyl cadmium.
58. **Assertion** Methyl cyanide has higher boiling point than methyl isocyanide.
Reason Dipole moment of methyl cyanide is higher than that of methyl isocyanide.
59. **Assertion** Aspirin can cause ulcer in the stomach.
Reason The ester group in aspirin gets hydrolysed to acid group in the stomach where the pH is 2.
60. **Assertion** *p*-dichlorobenzene is less soluble in organic solvents than the corresponding *o*-isomer.
Reason *o*-dichlorobenzene is polar while *p*-dichlorobenzene is not.

Biology

- Basis of life are
 - nucleic acids
 - proteins
 - nucleoproteins
 - amino acids
- Life span of parrot is
 - 140 years
 - 60 years
 - 80 years
 - 40 years
- Theory of 'saltations' was given by
 - G Mendel
 - Hugo de Vries
 - J B S Haldane
 - H J Miller
- The animal group which does not exist in Galapagos island is
 - Insects
 - Protozoa
 - Crustacea
 - Amphibia
- Protists obtain their food as
 - photosynthesizers only
 - chemosynthesizers
 - heterotrophs only
 - Both (a) and (c)
- Photosynthetic bacteria have
 - pigment system I
 - pigment system II
 - Both (a) and (b)
 - some other kind of pigments, B_{890}
- Diatoms do not decay easily because
 - they have siliceous walls
 - their body is impervious to water
 - they are chitinous
 - they are abundant in saline soil

8. One of these protozoans is threat to apiculture and sericulture
 (a) *Eimeria*
 (b) *Ceratium*
 (c) *Nosema*
 (d) *Monocystis*
9. Ergotamine tartarate extracted from *Claviceps*, is used for cure of
 (a) bodyache
 (b) headache
 (c) fever
 (d) severe stomach pain
10. What type of sorus is present in *Nephrolepis*?
 (a) Coenosorus
 (b) Simple
 (c) Mixed
 (d) None of these
11. Pappus helps in dispersal of pollen in
 (a) Asteraceae
 (b) Brassicaceae
 (c) Malvaceae
 (d) Solanaceae
12. In which of the following groups are seeds present?
 (a) Psilophyta
 (b) Ginkgopsida
 (c) Lycopodiophyta
 (d) Bryophyta
13. Match the columns.

Column I (Vitamins)	Column II (Deficiency disease)
A. B ₁	1. Infertility
B. D	2. Scurvy
C. E	3. Beri-beri
D. C	4. Bone formity

Codes

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	3	4
(c)	4	3	1	2
(d)	2	4	1	3

14. One of the following is a connecting link between protozoans and poriferans
 (a) *Cliona*
 (b) *Leucosolenia*
 (c) *Oscarella*
 (d) *Proterospongia*

15. The chordate features shared by the non-chordates are
 (a) bilateral symmetry
 (b) triploblastic condition and bilateral symmetry
 (c) metamerism
 (d) All of the above
16. Which of the following ions are necessary for assembly of microtubules?
 (a) Na⁺ and K⁺
 (b) Ca²⁺ and Cl⁻
 (c) Ca⁺ and Mg²⁺
 (d) Na⁺ and Ca²⁺
17. If T = 40%, C = 10% then G = ? in a pollen cell
 (a) 40%
 (b) 10%
 (c) 91%
 (d) 20%
18. Nickel contributes to the formation of one of the following
 (a) urease
 (b) dehydrogenase
 (c) rubisco protein
 (d) nitrate reductase
19. If a stock has 2n = 48 and scion microspore mother cell has 2n = 24; then root cell and the microspores will have..... chromosomes respectively.
 (a) 12, 48
 (b) 48, 12
 (c) 24, 12
 (d) 24, 96
20. The percentage of cell surface that is impenetrable for ions is
 (a) 1%
 (b) 99.9%
 (c) 90%
 (d) 73%
21. A fertilized egg of a plant has 40 chromosomes. The number of chromosomes present in the microspore mother cell is
 (a) 20
 (b) 40
 (c) 60
 (d) 80
22. Match the columns.

Column I (Scientists)	Column II (Discoveries)
A. Stephan Hales	1. Importance of light and chlorophyll
B. Ingen Housz	2. Presence of chlorophyll in plants
C. Von Mohl	3. Product of photosynthesis is starch
D. Sach	4. Air and light control plant growth

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Code

	A	B	C	D
(a)	4	1	2	3
(b)	3	2	1	4
(c)	2	3	4	1
(d)	4	3	2	1

23. Genotypic and phenotypic ratio 1 : 2 : 1 in the offsprings explain the principle of
 (a) dominance
 (b) blending inheritance
 (c) recessiveness
 (d) All of the above
24. Satellite of chromosome is
 (a) rich in RNA and deficient in DNA
 (b) rich in DNA and deficient in RNA
 (c) rich in protein
 (d) lacks DNA
25. Sickle cell anaemia is example of
 (a) sex-linked inheritance
 (b) deficiency disease
 (c) autosomal heritable disease
 (d) infectious disease
26. Translocase is an enzyme required for
 (a) DNA replication
 (b) RNA synthesis
 (c) initiation of protein synthesis
 (d) protein synthesis chain elongation
27. Feathery stigma belongs to
 (a) wheat
 (b) pea
 (c) *Datura*
 (d) *Caesalpinia*
28. Inflorescence of Liliaceae is
 (a) actinomorphic
 (b) trimerous
 (c) pentamerous
 (d) imperfect
29. Bone marrow is absent in
 (a) reptilia (b) amphibia
 (c) fishes (d) birds
30. The property of semipermeability belongs to
 (a) cell wall
 (b) plasma membrane
 (c) mitochondria only
 (d) None of the above
31. Translocation of photosynthetic end products in sieve tubes is
 (a) 3-5 mm/h
 (b) 3-5 cm/h
 (c) 1-15 cm/h
 (d) 60-100 cm/h
32. Epidermis is specialized for
 (a) respiration (b) absorption
 (c) protection (d) All of these
33. The pH of stomach is 1.6, then which enzyme will digest protein?
 (a) Trypsin (b) Pepsin
 (c) Amylase (d) Erypsin
34. The normal type of embryo sac is 8-nucleated and
 (a) 8-celled (b) 7-celled
 (c) 6-celled (d) 5-celled
35. Embryo sac is
 (a) megaspore
 (b) microgametophyte
 (c) female gametophyte
 (d) megasporangium
36. The type of immunoglobulin present in the foetus are
 (a) IgD (b) IgE
 (c) IgG (d) IgM
37. For better survival of human Indian population, which is the most important step?
 (a) Afforestation
 (b) Reduction in population density
 (c) conservation of wild life including tribals
 (d) Both (a) and (c)
38. Leukaemia is caused by
 (a) Ca 40 (b) Sr 90
 (c) caesium (d) iodine
39. Rice wine is
 (a) beer
 (b) wine
 (c) cider
 (d) sake
40. An autoimmune disease is
 (a) B-lymphocytes induced
 (b) haemophilia
 (c) myasthenia gravis
 (d) None of the above

- Direction (41-60)** In each of the following questions a statement of **Assertion** is given followed by a corresponding statement of **Reason** just below it. Of the statements mark the correct answer as
- If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion**.
 - If both **Assertion** and **Reason** are true but the **Reason** is not the correct explanation of the **Assertion**.
 - If **Assertion** is true but **Reason** is false.
 - If both **Assertion** and **Reason** are false.
- Assertion** In alcoholic drink, the alcohol is converted into glucose in liver.
Reason Liver cells are able to produce glucose from alcohol by back fermentations.
 - Assertion** Wrapping food with newspaper can be dangerous.
Reason It is rich in cadmium which is toxic to health.
 - Assertion** Tertiary consumers are green plants.
Reason Microconsumers break down the dead protoplasm into simpler ones. They are last in the sequence of a food chain.
 - Assertion** In a Graafian follicle, the primary oocyte and the follicle cells may be considered sibling cells.
Reason Both are derived from oogonia.
 - Assertion** Old ladies are prone to osteoporosis.
Reason Oestrogen also maintain calcium balance in the bones and blood.
 - Assertion** Phylloclades are adaptation for xerophytic habitats.
Reason *Ruscus*, *Casuarina* have reduced or modified leaves to avoid transpiration.
 - Assertion** In the hydrophytes, the xylem is not differentiated into different types of cells.
Reason Xylem provides support and helps in the conduction of water which are not very important in hydrophytes.
 - Assertion** Gene expression is a molecular mechanism by which a gene expresses a phenotype.
Reason Structural genes are controlled by control genes.
 - Assertion** Neurohypophysis is situated in the cells of stomach.
Reason Neurohypophysis releases vasopressin and oxytocin.
 - Assertion** Cataract is the condition on which lens become completely opaque.
Reason In this condition, a person can see only near objects.
 - Assertion** Sinus venosus is a thin-walled sac with little muscular tissue in primitive heart.
Reason It receives venous blood through the hepatic veins.
 - Assertion** B-cells (Beta cells) account for about 80% of the total number of islet cells.
Reason They secrete a hormone called thyroxine.
 - Assertion** *Monotropa* grows in pine forests with the roots of pines.
Reason Saprophytes obtain their nutrition from dead organic matter.
 - Assertion** Outermost layer of the bone is a fibrous connective tissue.
Reason Matrix of bone is composed of protein ossein.
 - Assertion** Perennials live for many years.
Reason Their life cycle do not end with seed production.
 - Assertion** 'Reindeer moss' is used by reindeer, caribou and other animals as fodder.
Reason Reindeer moss is found in rainforests.
 - Assertion** TMV is a rod-shaped virus.
Reason It is made up of protein coat and RNA.
 - Assertion** Japanese prepare a popular vegetable 'Kombu' prepared from *Laminaria*.
Reason *Laminaria* is a fungus.

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59. Assertion Mesophytes show well developed root system.

Reason Mesophytes depend on moderate supply of water which they draw from their root.

60. Assertion Lichens are the plants growing perched on other plants.

Reason Lichens unitedly make association with algae and fungi and show mutualism.

General Knowledge

- Which premier event in India has the official motto 'vasudhaiva kutumbakam'?
 - International Film Festival of India
 - India International Trade Fair
 - Pravasi Bhartiya Divas
 - Jnanpith Awards
- How many languages feature on the language panel of contemporary Reserve Bank of India currency notes?
 - 12
 - 15
 - 13
 - 11
- The portrait of which of these Indian kings finds a place in the NASA headquarters?
 - Akbar
 - Babar
 - Shivaji
 - Tipu Sultan
- Which among the following industry has even traditionally called a 'Child of Protection'.
 - Textile Industry
 - Cement Industry
 - Sugar Industry
 - Petroleum Industry
- Which of the following states is called the 'Tiger State' of India?
 - Gujarat
 - Madhya Pradesh
 - West Bengal
 - Asom
- SEZ stands for
 - Special Economic Zone
 - Special Eastern Zone
 - Southern Economic Zone
 - South European Zone
- The Upper House of Parliament is known as
 - Lok Sabha
 - Rashtrapati Bhawan
 - Parliament House
 - Rajya Sabha
- 'Lilavati' an ancient work on Mathematics, was written by
 - Aryabhata
 - Bhaskaracharya
 - Banabhata
 - Varahmihira
- How many members of the Anglo-Indian Community can be nominated by the President to the Lok Sabha?
 - 4
 - 6
 - 12
 - 2
- Which is the first state in India to launch an e-payment system for commercial tax payers?
 - Gujarat
 - Karnataka
 - Goa
 - Maharashtra
- The Government has formally conferred 'Maharatna' status to four of its flagship PSUs. Which of these is not one of the four?
 - SAIL
 - IOC
 - NMDC
 - ONGC
- Which of the following has not been awarded a Nobel Prize and a Bharat Ratna?
 - Dalai Lama
 - C.V. Raman
 - Nelson Mandela
 - Mother Teresa
- The word 'M' in MRF tyres corresponds to which of the following?
 - Maharashtra
 - Major
 - Metropolitan
 - Madras
- Shivaraj V. Patil Committee is associated with
 - CWG Scam
 - 2G Spectrum Scam
 - Vedanta Mining Project
 - POSCO Project in Odisha

15. 2018 FIFA World Cup would be held in
 (a) Russia
 (b) Qatar
 (c) France
 (d) Netherlands
16. Who discovered South Pole?
 (a) Tasman
 (b) Amundsen
 (c) Robert Peary
 (d) John Cabot
17. The position of Indian Railways Network in the world is
 (a) fifth
 (b) second
 (c) fourth
 (d) third
18. Who among the following is the first Indian winner of the Hoover Prize?
 (a) D. Amartya Sen
 (b) Dr. Manmohan Singh
 (c) G. Madhuban Nayer
 (d) Dr. A.P.J. Abdul Kalam
19. Maggi brand of noodles is owned by
 (a) Nestle
 (b) Britannia
 (c) HLL
 (d) ITC
20. Which of the following items is a major item of Indian export?
 (a) Computer chips
 (b) Textile garments
 (c) Car engines
 (d) Dairy products

Answers

Physics

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (b) | 3. (a) | 4. (c) | 5. (d) | 6. (c) | 7. (c) | 8. (d) | 9. (d) | 10. (c) |
| 11. (a) | 12. (b) | 13. (a) | 14. (a) | 15. (d) | 16. (c) | 17. (c) | 18. (a) | 19. (b) | 20. (b) |
| 21. (d) | 22. (a) | 23. (a) | 24. (b) | 25. (d) | 26. (b) | 27. (a) | 28. (c) | 29. (d) | 30. (c) |
| 31. (c) | 32. (b) | 33. (d) | 34. (d) | 35. (c) | 36. (c) | 37. (c) | 38. (c) | 39. (b) | 40. (b) |
| 41. (d) | 42. (a) | 43. (b) | 44. (a) | 45. (a) | 46. (b) | 47. (a) | 48. (d) | 49. (a) | 50. (b) |
| 51. (b) | 52. (a) | 53. (c) | 54. (b) | 55. (a) | 56. (c) | 57. (a) | 58. (d) | 59. (b) | 60. (d) |

Chemistry

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (c) | 2. (d) | 3. (d) | 4. (c) | 5. (c) | 6. (a) | 7. (c) | 8. (d) | 9. (d) | 10. (a) |
| 11. (c) | 12. (a) | 13. (d) | 14. (b) | 15. (c) | 16. (d) | 17. (c) | 18. (d) | 19. (b) | 20. (c) |
| 21. (d) | 22. (d) | 23. (d) | 24. (c) | 25. (b) | 26. (b) | 27. (d) | 28. (a) | 29. (c) | 30. (d) |
| 31. (c) | 32. (d) | 33. (a) | 34. (d) | 35. (b) | 36. (a) | 37. (c) | 38. (c) | 39. (b) | 40. (a) |
| 41. (a) | 42. (a) | 43. (c) | 44. (d) | 45. (a) | 46. (c) | 47. (a) | 48. (a) | 49. (b) | 50. (d) |
| 51. (a) | 52. (b) | 53. (d) | 54. (d) | 55. (c) | 56. (d) | 57. (d) | 58. (a) | 59. (a) | 60. (b) |

Biology

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (c) | 3. (b) | 4. (d) | 5. (d) | 6. (d) | 7. (a) | 8. (c) | 9. (b) | 10. (c) |
| 11. (a) | 12. (b) | 13. (a) | 14. (d) | 15. (d) | 16. (c) | 17. (b) | 18. (a) | 19. (b) | 20. (b) |
| 21. (b) | 22. (a) | 23. (b) | 24. (a) | 25. (c) | 26. (d) | 27. (a) | 28. (b) | 29. (d) | 30. (b) |
| 31. (d) | 32. (d) | 33. (b) | 34. (b) | 35. (c) | 36. (c) | 37. (d) | 38. (b) | 39. (d) | 40. (c) |
| 41. (c) | 42. (a) | 43. (d) | 44. (a) | 45. (a) | 46. (a) | 47. (a) | 48. (c) | 49. (d) | 50. (c) |
| 51. (a) | 52. (c) | 53. (b) | 54. (b) | 55. (a) | 56. (c) | 57. (a) | 58. (c) | 59. (a) | 60. (d) |

General Knowledge

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

Hints & Solutions

Physics

1. For third maxima, $x = \frac{3D\lambda}{d}$

$$= \frac{3 \times 2 \times 5000 \times 10^{-10}}{0.2 \times 10^{-3}}$$

$$= \frac{6 \times 5 \times 10^{-7}}{2 \times 10^{-4}}$$

$$= 15 \text{ mm} = 1.5 \text{ cm}$$

2. The given arrangement of nine plates is equivalent to the parallel combination of 8 capacitors.

The capacity of each capacitor,

$$C = \frac{\epsilon_0 A}{d}$$

$$= \frac{8.854 \times 10^{-12} \times 5 \times 10^{-4}}{0.885 \times 10^{-2}} = 0.5 \text{ pF}$$

Hence, the capacity of 8 capacitors
 $= 8C = 8 \times 0.5 = 4 \text{ pF}$

4. In an AC circuit, the coil of high inductance and negligible resistance used to control current, is called the choke coil. The power factor of such a coil is given by

$$\cos \phi = \frac{R}{\sqrt{R^2 + \omega^2 L^2}}$$

$$\approx \frac{R}{\omega L} \quad (\text{as } R \ll \omega L)$$

As $R \ll \omega L$, $\cos \phi$ is very small. Thus, the power absorbed by the coil is very small. The only loss of energy is due to hysteresis in the iron core, which is much less than the loss of energy in the resistance that can also reduce the current if placed instead of the choke coil.

5. Angle of deviation $\delta = (n - 1)A$

Dispersion produced by both the prism will be equal

$$(n_1 - 1)A_1 = (n_2 - 1)A_2$$

$$A_2 = \frac{(n_1 - 1)A_1}{(n_2 - 1)} = \frac{(1.54 - 1) \times 4}{(1.72 - 1)} = 3^\circ$$

Hence, the angle of prism P_2 is 3°

6. Energy of photon, $E = \frac{hc}{\lambda}$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{590 \times 10^{-9}}$$

$$= \frac{6.63 \times 3}{59} \times 10^{-18}$$

Light energy produced per second $= \frac{90}{100} \times 10$
 $= 9 \text{ W}$

Number of photons emitted per sec

$$= \frac{9 \times 59}{6.63 \times 3 \times 10^{-18}} = 2.67 \times 10^{19}$$

7. Energy = 200 MeV
 $= 200 \times 1.6 \times 10^{-19} \times 10^6$
 $= 200 \times 1.6 \times 10^{-13}$

Power $P = 1000 \text{ kW}$
 $= 1000 \times 10^3 \text{ W}$

Rate of disintegration = $\frac{\text{Power}}{\text{Energy}}$

$$= \frac{10^6}{200 \times 1.6 \times 10^{-13}}$$

$$= 3.125 \times 10^{16} \text{ per second}$$

8. Induced emf $E = IR$

or $I = \frac{E}{R}$

and $E = \frac{d\phi}{dt}$

$$\therefore I = \frac{d\phi}{dt R}$$

Induced charge $q = I \cdot dt$
 $= \frac{d\phi}{R}$

If speed is doubled, then dt decrease, hence, E, I increases, but q will not increase.

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9. Temporary magnet is made from soft iron while magnet of loudspeaker is made permanent magnet.

10. For tangent galvanometer

$$\frac{\mu_0 n i}{2r} = H \tan \theta$$

$$n \propto H \tan \theta$$

$$\frac{n_1}{n_2} = \frac{\tan \theta_1}{\tan \theta_2}$$

$$\frac{n_1}{n_2} = \frac{\tan 60^\circ}{\tan 45^\circ} = \frac{\sqrt{3}}{1}$$

11. Magnetic moment = 10^4 J/T

$$B = 4 \times 10^{-5} \text{ T}, \theta = 60^\circ$$

Work done in moving the magnet in uniform magnetic field.

$$W = MB(1 - \cos \theta)$$

$$= 10^4 \times 4 \times 10^{-5} (1 - \cos 60^\circ)$$

$$= 0.2 \text{ J}$$

12. Given, $L = 10 \text{ H}$, $R = 5 \Omega$, $E = 5 \text{ V}$ and $t = 2 \text{ s}$.

Current in R - L circuit

$$I = I_0(1 - e^{-Rt/L})$$

$$I = \frac{E}{R}(1 - e^{-Rt/L})$$

$$= \frac{5}{5}(1 - e^{-5 \times 2/10})$$

$$I = (1 - e^{-1})$$

13. Speed of rocket after 5 s.

$$v = u - gt$$

$$0 = u - 9.8 \times 5$$

$$= 49 \text{ m/s}$$

From

$$h = ut - \frac{1}{2}gt^2$$

$$= 0 - \frac{1}{2} \times 9.8 \times (5)^2$$

$$= \frac{245}{2} \text{ m}$$

When engine is turned off

$$v^2 = u^2 - 2gh$$

$$0 = u^2 - 2gh$$

$$h = \frac{u^2}{2g} = \frac{49 \times 49}{2 \times 9.8} = \frac{245}{2} \text{ m}$$

Maximum height from earth surface

$$= h_1 + h_2 = \frac{245}{2} + \frac{245}{2} = 245 \text{ m}$$

14. Work = force \times displacement

$$= F_s \cdot d$$

$$= F_s d \cos \theta$$

$$= \mu R d \cos \theta \quad (F_s = \mu R)$$

$$W = \mu mg d \cos \theta \quad (R = mg)$$

$$= 0.5 \times 60 \times 9.8 \times 2 \cos 60^\circ$$

$$= 294 \text{ J}$$

15. Initially the force on the sphere is equal due to both -ve and + ve charge.

\therefore Net force = 0

On displacing the sphere towards the +ve charge, force on sphere due to +ve charge will be more than due to the -ve positive charge, because it is nearer.

So, sphere will move further to the charge.

16. We know that capacitor offers infinite resistance for DC source. (Battery is DC source)

Current taken from the cell

$$i = \frac{E}{R + r}$$

$$= \frac{2.5}{1 + 1 + 0.5} = 1 \text{ amp}$$

Potential drop across capacitor

$$V = E - ir$$

$$= 2.5 - 1 \times 0.5 = 2 \text{ V}$$

The current in 2Ω resistor is zero.

Charge on capacitor

$$Q = CV$$

$$= 5 \times 2$$

$$= 10 \mu\text{C}$$

17. Given, $n = 50$, $r = \frac{10}{2} = 5 \text{ cm} = 5 \times 10^{-2} \text{ m}$

$R = 5 \Omega$ and $H = 0.314$ gauss

For circular coil, $H = \frac{\mu_0 2\pi ni}{4\pi r}$

or $i = \frac{4\pi rH}{\mu_0 2\pi n}$
 $= \frac{5 \times 10^{-2} \times 0.314 \times 10^{-4}}{10^{-6} \times 2 \times 3.14 \times 50}$
 $= 5 \times 10^{-2} \text{ A}$

$V = iR$
 $= 5 \times 10^{-2} \times 5 = 0.25 \text{ V}$

Magnetic field produced due to the coil is normal to the plane of coil so the plane of the coil should be normal to the magnetic meridian.

Hence choice (c) is correct.

18. Resonating frequency

$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$LC = \frac{1}{4\pi^2 f^2}$$

Dimension of $LC = \text{Dimension of } \frac{1}{4\pi^2 f^2}$
 $= [M^0 L^0 T^2]$

19. Wavelength $\lambda = 0.7078 \text{ \AA}$

Energy $E = \frac{hc}{\lambda}$

$$\frac{z^2}{n^2} = \frac{hc}{\lambda}$$

$$\frac{z_1^2}{z_2^2} = \frac{\lambda_2}{\lambda_1}$$

$$\frac{(42)^2}{(30)^2} = \frac{\lambda_2}{0.7078}$$

$$\lambda = 1.3873 \text{ \AA}$$

20. Initially body is at rest.

\therefore Initial momentum $p_1 = m \times 0$

$$p_1 = 0$$

Final momentum $p_2 = mv$

$$= 0.5 \times 98 = 49 \text{ N}$$

Change in momentum $= p_2 - p_1$

$$= 49 - 0 = 49 \text{ N-s}$$

21. Resolving power of telescope

$$= \frac{1.22\lambda}{d}$$

$d = \text{diameter of object lens} = 0.1 \text{ m,}$

and $\lambda = 6000 \times 10^{-10}$

$$\therefore \text{Resolving power} = \frac{1.22 \times 6000 \times 10^{-10}}{0.1}$$

$$= 7.32 \times 10^{-6}$$

$$\approx 6 \times 10^6 \text{ radians approximately}$$

22. Condition for achromatic combination

$$\frac{\omega}{\omega'} = -\frac{f}{f'}$$

$$\frac{5}{3} = -\frac{(-15)}{f'}$$

$$\Rightarrow f' = 9 \text{ cm}$$

Focal length is positive, so it is convex.

23. Let distance between two charges is x .

The force between them.

$$F = \frac{1}{4\pi\epsilon_0} \frac{q(Q-q)}{x^2}$$

x is constant, so for maximum force $q(Q-q)$ should be maximum.

$$\frac{d}{dq} \{q(Q-q)\} = 0$$

$$Q - 2q = 0$$

$$\Rightarrow \frac{Q}{q} = 2$$

24. If A_0 is the area of orifice at the bottom below the free surface and A that of vessel, time t taken to the emptied the tank,

$$t = \frac{A}{A_0} \sqrt{\frac{2H}{g}}$$

$$t_1 = \sqrt{\frac{H_1}{H_2}}$$

$$t_2 = \sqrt{\frac{H_1}{H_1/2}}$$

$$\Rightarrow \frac{t}{t_2} = \sqrt{2}$$

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$$t_2 = \frac{t}{\sqrt{2}} = \frac{10}{\sqrt{2}} = 5\sqrt{2} \approx 7 \text{ min}$$

25. Archimedes' upward thrust will be absent for a fluid, if there were no gravity.

26. $A \cdot B = AB \cos \theta$

Let **A** and **B** be two vectors, then from definition of scalar product, we have

$$A \cdot B = AB \cos \theta$$

Given, $A = 4i + 4j - 4k$

$$B = 3i + j + 4k$$

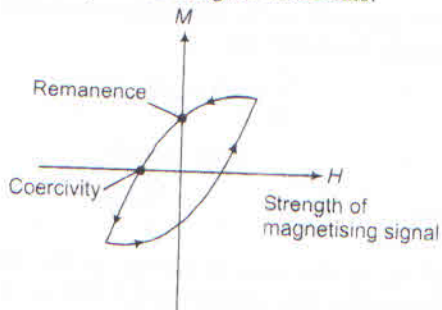
$$A \cdot B = (4i + 4j - 4k) \cdot (3i + j + 4k) = 12 + 4 - 16 = 0$$

$$\Rightarrow A \cdot B = 0$$

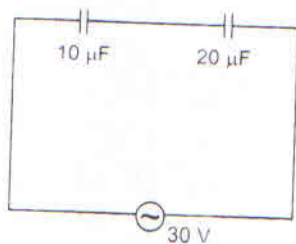
$$\Rightarrow AB \cos \theta = 0$$

$$\Rightarrow \theta = 90^\circ$$

27. A good permanent magnet should produce a high magnetic field with a low mass, and should be stable against the influences which would demagnetize it. The desirable properties of such magnets are typically stated in terms of the remanence and coercivity of the magnet materials.



28. The equivalent capacitance, for capacitors in series is



$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{10} + \frac{1}{20}$$

$$\Rightarrow C_s = \frac{20}{3} \mu\text{F}$$

Also, $q = CV = \frac{20}{3} \times 30 = 200 \mu\text{C}$

This charge on the two capacitors in series is same.

Hence, $q' = 200 \mu\text{C}$, $q'' = 200 \mu\text{C}$

29. The magnetic field at *P* is

$$B = \frac{\mu_0 n I}{2} (\cos \theta + \cos \theta)$$

where *n* is number of turns, *I* the current.

Given, $n = 100$, $I = 5 \text{ A}$ and $\theta = 45^\circ$

$$B = \frac{\mu_0 \times 100 \times 5}{2} \times \frac{2}{\sqrt{2}}$$

$$\Rightarrow B = 250 \sqrt{2} \mu_0$$

30. From ideal gas equation

$$pV = nRT \quad \dots(i)$$

where, *p* is pressure, *V* the volume, *R* the gas constant, *T* the absolute temperature.

For isobaric process

$$Q = nC_p \Delta T \quad \dots(ii)$$

$$W = p \Delta V \quad \dots(iii)$$

where, C_p is specific heat at constant pressure.

From Eqs. (i), (ii) and (iii), we get

$$\begin{aligned} \frac{Q}{W} &= \frac{nC_p \Delta T}{nR \Delta T} \\ &= \frac{C_p}{R} \\ &= \frac{\gamma}{\gamma - 1} \end{aligned}$$

31. As there is no effect of change in pressure on velocity of sound in air, and velocity $\propto \sqrt{T}$, therefore, when temperature is doubled, velocity becomes $330\sqrt{2} \text{ m/s}$.

32. With reference to this theory the velocity of the observer is neglected w.r.t. the light velocity.

33. Impedence, $Z = \sqrt{R^2 + X_L^2}$
 Here, $R = 4\Omega$, $X_L = L\omega$
 $= 3 \times 10^{-3} \times 1000\Omega$
 $= 3\Omega$

Then, $Z = \sqrt{(4)^2 + (3)^2}$
 or $Z = \sqrt{16 + 9} = \sqrt{25}$
 or $Z = 5\Omega$

Hence, current, $I_0 = \frac{E_0}{Z}$
 $= \frac{4}{5} = 0.8\text{ A}$

34. $I_{\max} = I_1 + I_2 + 2\sqrt{I_1 I_2}$
 $= I + 4I + 2\sqrt{I \times 4I}$
 $= 5I + 2 \times 2I$
 $= 5I + 4I = 9I$
 $I_{\min} = I + 4I - 2\sqrt{I \times 4I}$
 $= 5I - 4I = I$

35. $\lambda = \frac{hc}{eV} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19} \times 50 \times 10^3}$
 $\lambda = \frac{19.8 \times 10^{-26}}{80 \times 10^{-16}}$
 $= 0.25 \text{ \AA}$

36. The energy gap between conduction band and valence band is 0.07 eV, which is very small. So, the electrons very easily go from valence band to conduction band by gaining the little energy. Hence, the material is a conductor.

37. $\omega = \frac{2\pi}{T}$
 $= \frac{2\pi}{365 \times 24 \times 3600} = 199 \times 10^{-7} \text{ rad/s}$
 $W = K_f - K_i = 0 - \frac{1}{2}mv^2$ ($v = \omega R$)
 $= \frac{1}{2} \times 6 \times 10^{24} \times (1.5 \times 10^{11} \times 199 \times 10^{-7})^2$
 $= -2.7 \times 10^{33} \text{ J}$

38. Particle velocity $= \frac{d}{dt}(x)$
 $= \frac{d}{dt} \left[x_0 \sin 2\pi \left(nt - \frac{x}{\lambda} \right) \right]$
 $= 2\pi n x_0 \cos 2\pi \left(nt - \frac{x}{\lambda} \right)$

Particle velocity will be maximum when $\cos 2\pi \left(nt - \frac{x}{\lambda} \right)$ is maximum i.e. 1.

Wave velocity $= \frac{\lambda}{T} = n\lambda$

Now, $2\pi n x_0 = 4n\lambda$

$$\lambda = \frac{2\pi n x_0}{4n}$$

$$= \frac{\pi x_0}{2}$$

39. By Stefan's law

$$Q = \sigma T^4$$

The rate of dissipation of heat by a body emissivity e is given by

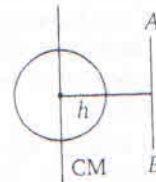
$$Q' = e\sigma T'^4$$

Here $T' = 2T$ and $e = 0.25$

$$Q' = 0.25 \times \sigma(2T)^4$$

$$Q' = 4\sigma T^4 = 4Q$$

40.



$$T_{AB} = I_{CM} + Mh^2$$

$$MK_{AB}^2 = MK_{CM}^2 + Mh^2$$

$$K_{AB}^2 = K_{CM}^2 + h^2$$

Given, $K_{AB} = 10 \text{ cm}$, $h = 6 \text{ cm}$

Putting them, we get

$$K_{CM} = 8 \text{ cm}$$

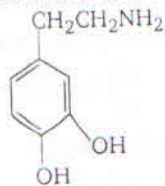
43. Momentum of earth + ball system will remain constant were inelastic.

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45. In a small drop, the force due to surface tension is very large as compared to its weight and hence it is spherical in shape. A big drop becomes oval in shape due to its large weight. The surface tension of liquid decreases with increase of temperature.
46. C_p can be less than C_v for those substances which contract on heating like for water from 0 to 4°C.
47. Bulk modulus of elasticity measures how good the body is to regain its original volume on being compressed. Therefore, it represents incompressibility of the material.
48. A body displaces as much amount of liquid as the actual weight of the body to float it. In case of floating, no net downward force acts on the body.
49. It is hotter over the top of a fire than at the same distance on the sides, because hot air i.e., thermal radiation being light moves up.
50. A monoatomic gas molecules (like the consists of a single atom. It can have translational motion in any direction in space. Thus, it has 3 translational degrees of freedom $f = 3$ (all translational)
It can also rotate but due to its small moment of inertia rotational kinetic energy is neglected. The molecules of a diatomic gas (like O_2 , CO_2 , H_2) cannot only move bodily but also rotate about any one of the three coordinate axes. Hence it can have only two rotational degrees of freedom. Thus, a diatomic molecule has 5 degree of freedom 3 translational and 2 rotational.
51. In stationary wave, total energy associated with it is twice the energy of each of incidence and reflected wave. Large amount of energy are stored equally in standing waves and became trapped with the waves. Hence, there is no transmission of energy through the waves.
52. Free electrons present in the metal are moving randomly in all directions, in the absence of electric field. Hence, the average velocity of electron is zero. Because of if the current does not flow in the metal in the absence of electric field.
53. On increasing the temperature of metals, the resistance of metals increases. Therefore temperature coefficient of resistance of metals is positive.
On increasing the temperature of insulators, the resistance decreases. Therefore, temperature coefficient of resistance of insulator is negative.
54. The magnetic field at a point due to current flowing through an infinitely long conductor is given by
- $$B = \frac{\mu_0}{4\pi} \cdot \frac{2I}{a}$$
- where a is the distance of that point from conductor. Now according to right hand thumb rule it follows that magnetic field is in the form of concentric circles, whose centres lie on the straight conductor.
56. We know that centripetal and centrifugal forces act at the same time on two different bodies. Thus, they never cancel out.
57. Momentum $p = miv$
or $p \propto v$
So, the momentum is greater in a quicker collision between two bodies than in slower one.
58. Length of the day depends upon the angular speed of earth about it's own axis, the earth is not slowing down due to conservation of angular momentum.
59. We know that on α -particle carries 2 units of positive charge and four unit of mass. On α -decays, charge number of parent nucleus decreases by 2 units. As classification or grouping of elements is based on charge number, hence daughter nucleus shifts two places to the left from the parent nucleus.
60. When base region has larger width electron hole combination increase the base current. The output collector current decreases by the relation
- $$I_c = I_b + I_c$$

Chemistry

- Cr^{2+} ($Z = 24$):
 $[\text{Ar}] 3d^4 4s^0$; four unpaired electrons
 Fe^{2+} ($Z = 26$):
 $[\text{Ar}] 3d^6 4s^0$; four unpaired electrons
 Cr^{2+} and Fe^{2+} have same number of unpaired electrons hence they have the same value of magnetic moment.
- ${}_{88}\text{X}^{228} \longrightarrow {}_{85}\text{Y}^{216} + 3\alpha + 3\beta$
 IIA group VIIA group
- $\text{Acid}_1 + \text{Base}_2 \rightleftharpoons \text{Acid}_2 + \text{Base}_1$
 $\text{HPO}_3^{2-} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{PO}_3^{3-}$
 $\text{H}_2\text{PO}_4^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{HPO}_4^{2-}$
 $\text{H}_3\text{PO}_4 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{H}_2\text{PO}_4^{2-}$
- Dopamine is produced in several areas of the brain. If the amount of dopamine increases in the brain, the patient may be affected with Parkinson's disease. The IUPAC name of dopamine is 2-(3, 4-dihydroxyphenyl) ethylamine and its structure is as follows



- For Lyman series,

$$\frac{1}{\lambda} = R \left[\frac{1}{1^2} - \frac{1}{n_2^2} \right]$$

$$\frac{15R}{16} = R \left[\frac{1}{1^2} - \frac{1}{n_2^2} \right]$$

$$\frac{15R}{16R} = \left[\frac{n_2^2 - 1}{n_2^2} \right]$$

$$\frac{15}{16} = \frac{n_2^2 - 1}{n_2^2}$$

$$15n_2^2 = 16n_2^2 - 16$$

$$n_2^2 = 16$$

$$n_2 = 4$$

- Number of moles of ethyl alcohol = $\frac{138}{46} = 3$

$$\text{Number of moles of water} = \frac{72}{18} = 4$$

$$X_{\text{C}_2\text{H}_5\text{OH}} = \frac{3}{3+4}$$

$$= \frac{3}{7}$$

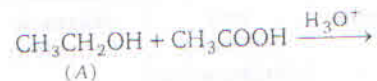
$$X_{\text{H}_2\text{O}} = \frac{4}{3+4}$$

$$= \frac{4}{7}$$

$$\frac{X_{\text{C}_2\text{H}_5\text{OH}}}{X_{\text{H}_2\text{O}}} = \frac{3/7}{4/7}$$

$$= \frac{3}{4}$$

- Polyhydroxy butyrate —CO— β -hydroxy valerate (PHBV) is a biodegradable polymer.



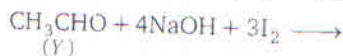
- Krypton is the inert gas which is used in miner's cap lamps.
- The reducing property of the hydrides of V A group increases from NH_3 to BiH_3 as $M-H$ bond length increases. (Where, $M = \text{N}, \text{P As}, \text{Sb}, \text{Bi}$)
 $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
 - The tendency to donate lone pair or basic strength decreases from NH_3 to BiH_3 .
 $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
 - Thermal stability of VA group hydrides decreases from NH_3 to BiH_3 .
 $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$

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(IV) Bond angle of VA group hydrides decreases from NH_3 to BiH_3 .



11. In CO_3^{2-} ion, the C-atom undergoes sp^2 -hybridisation. It has triangular planar structure while BF_4^- , NH_4^+ and SO_4^{2-} have tetrahedral structure.



13. Perchloric acid is not a peroxy acid while perphosphoric acid, pernitric acid and perdisulphuric acid are the examples of peroxy acid.

14. Gold sol is a lyophobic sol instead of a lyophilic sol. All other given statements are correct.

15. A species is said to be diamagnetic if all the electrons present in it are paired.

Species	Electrons	MO Electronic configuration	Magnetic behaviour
H_2	3	$\sigma 1s^2 \sigma^* 1s^1$	Paramagnetic
H_2^+	1	$\sigma 1s^1$	Paramagnetic
H_2^-	2	$\sigma 1s^2$	Diamagnetic
He_2^+	3	$\sigma 1s^2 \sigma^* 1s^1$	Paramagnetic



$$w = zQ$$

where w = amount of metal

$$= 5.12 \text{ kg}$$

$$= 5.12 \times 10^3 \text{ g}$$

z = electrochemical equivalent

$$= \frac{\text{equivalent weight}}{96500}$$

$$= \frac{\text{atomic mass}}{\text{electrons} \times 96500}$$

$$= \frac{\text{atomic mass}}{\text{electrons} \times 96500}$$

$$= \frac{27}{3 \times 96500}$$

$$5.12 \times 10^3 = \frac{27}{3 \times 96500} \times Q$$

$$Q = \frac{5.12 \times 10^3 \times 3 \times 96500}{27} \text{ C}$$

$$= 5.49 \times 10^7 \text{ C}$$



$$K_{sp} = [\text{M}^{2+}][\text{X}^-]^2$$

If solubility be s then

$$K_{sp} = (s)(2s)^2 = 4s^3$$

$$4s^3 = 4 \times 10^{-12}$$

$$\therefore s = 1 \times 10^{-4} \text{ M}$$

$$\therefore \text{M}^{2+} = s = 1 \times 10^{-4} \text{ M}$$

18. There are two different reactants (say A and B).



Thus, it is a bimolecular reaction.

$$\text{If } \frac{dx}{dt} = k[\text{A}][\text{B}]$$

it is second-order reaction

$$\text{If } \left(\frac{dx}{dt}\right) = k[\text{A}]$$

$$\text{or } = k[\text{B}]$$

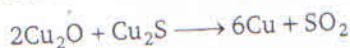
it is first order reaction.

Molecularity is independent of rate, but is the sum of the reacting substances thus it cannot be unimolecular reaction.

19. During electrolysis, noble metals (inert metals) like Ag, Au and Pt are not affected and separate as anode mud from the impure anode.

20. As we go down in the group, ionic character increases hence, melting point of halides should increase but NaCl has the highest melting point (800°C) due to its high lattice energy.

21. Following reaction takes place during bessemerisation



22. Variation of K_{eq} with temperature T is given by van't-Hoff equation.

$$\log K_{\text{eq}} = -\frac{\Delta H^\circ}{2.303 RT} + \frac{\Delta S^\circ}{R}$$

Slope of the given line is positive indicating that term A is positive thus ΔH° is negative.

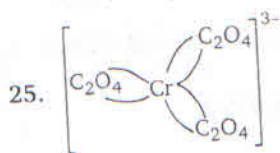
Thus, reaction is exothermic.

23. $\text{Hg}_2\text{Cl}_2 + 2\text{NH}_3 \rightarrow \underset{\text{white}}{\text{HgNH}_2\text{Cl}} + \underset{\text{black}}{\text{Hg}} + \text{NH}_4\text{Cl}$

24. $\text{K}_3[\text{Fe}(\text{CN})_6]$
cation anion

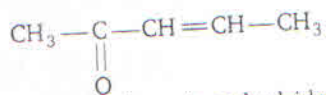
Oxidation state of Fe in anion = + 3

Thus, it is potassium hexacyanoferrate (III).



Mirror image is not superimposable, hence, optical isomerism is possible.

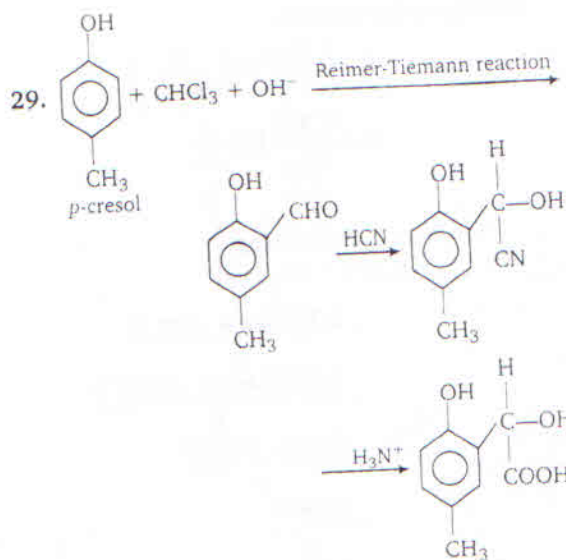
26. $\text{CH}_3-\overset{2^\circ}{\underset{\text{OH}}{\text{C}}}-\text{CH}=\text{CH}-\text{CH}_3 \longrightarrow$



Only suitable reagent is chromic anhydride in glacial acetic acid. Other will also effect (C=C) bond.

27. A codon is a specific sequence of three adjacent bases on a strand of DNA or RNA that provides genetic code information for a particular amino acid.

28. Hydrogen atom is in $1s^1$ and these $3s$, $3p$ and $3d$ -orbitals will have same energy w.r.t. $1s$ -orbital.



(—OH is more activating than —CH₃ in *o*, *p*-directing, thus, —CHO goes to *ortho* w.r.t. —OH).

30. Formation of XY is shown as



$$\Delta H = (\text{BE})_{X-X} + (\text{BE})_{Y-Y} - 2(\text{BE})_{X-Y}$$

If (BE) of $X-Y = a$

then (BE) or $(X-X) = a$

and (BE) of $(Y-Y) = \frac{a}{2}$

$$\Delta H_f(X-Y) = -200 \text{ kJ}$$

$$\therefore -400 \text{ (for 2 moles } XY) = a + \frac{a}{2} - 2a$$

$$-400 = -\frac{a}{2}$$

$$a = +800 \text{ kJ}$$

The bond dissociation energy of $X_2 = 800 \text{ kJ mol}^{-1}$

31.

	A	→	Product
initially	a		0
after time t	$(a - x)$		x
after $t_{1/4}$	$(a - \frac{a}{4})$		$\frac{a}{4}$

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For first-order kinetics

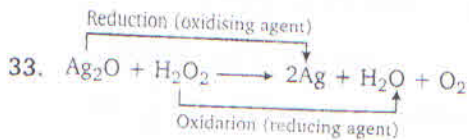
$$k = \frac{2.303}{t} \log \left(\frac{a}{a-x} \right)$$

$$k = \frac{2.303}{t_{1/4}} \log \frac{a}{\frac{3a}{4}}$$

$$\begin{aligned} t_{1/4} &= \frac{2.303 \log \frac{4}{3}}{k} \\ &= \frac{2.303(\log 4 - \log 3)}{k} \\ &= \frac{2.303(0.6020 - 0.4771)}{k} \\ &= \frac{2.303 \times 0.1249}{k} \\ &= \frac{0.2876}{k} \\ &= \frac{0.29}{k} \end{aligned}$$

32. Formula of sodium ferrocyanide, i.e., $\text{Na}_4[\text{Fe}(\text{CN})_6]$ suggests that it has four sodium atoms.

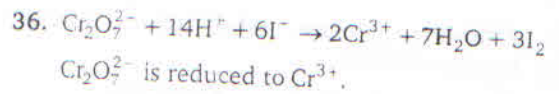
$$\begin{aligned} \text{Number of Na atoms} &= \text{number of moles} \\ &\times \text{number of atoms per molecule} \\ &\times \text{Avogadro number} \\ &= 2 \times 4 \times 6.023 \times 10^{23} \\ &= 48 \times 10^{23} \end{aligned}$$



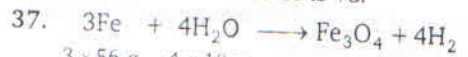
34. Antimony is used in making lead storage batteries because lead containing antimony is harder and more resistant to the action of acids than ordinary lead.

35. Total molarity = $\frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

$$\begin{aligned} &= \frac{1.5 \times 480 + 1.2 \times 520}{480 + 520} \\ &= 1.344 \text{ M} \end{aligned}$$



Thus, final state of Cr is +3.



$$3 \times 56 \text{ g} \quad 4 \times 18 \text{ g}$$

$$4 \times 18 \text{ g H}_2\text{O} \equiv 3 \times 56 \text{ g Fe}$$

$$\begin{aligned} \therefore 18 \text{ g H}_2\text{O} &\equiv \frac{3 \times 56}{4} \\ &\equiv 42 \text{ g} \end{aligned}$$

38. $W = 2.303nRT \log \frac{P_2}{P_1}$

$$= 2.303 \times 1 \times 8.314 \times 300 \times \log \frac{1}{10}$$

$$= 5744.1 \text{ J}$$

39. Alkyl halide on reaction with dry silver oxide give ether.



40. Given, $i = 25 \text{ mA} = 0.0025 \text{ A}$

$$t = 60 \text{ s}$$

$$Q = it$$

$$= 0.0025 \times 60$$

$$= 1.5 \text{ C}$$

number of electrons in 1.5 C

$$= \frac{Q \times \text{Avogadro number}}{96500}$$

$$= \frac{1.5 \times 6.023 \times 10^{23}}{96500}$$

$$= 9.36 \times 10^{18}$$



$2e^-$ are required to deposit 1 Ca atom.

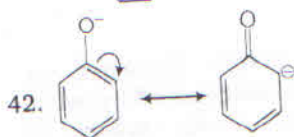
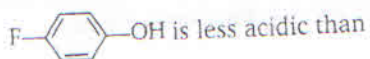
\therefore number of Ca atoms deposited

$$= \frac{\text{no. of electrons}}{2}$$

$$= \frac{9.36 \times 10^{18}}{2}$$

$$= 4.68 \times 10^{18}$$

41. —F has stronger +M effect than —Cl, thus,



ambident nucleophile

Thus, it gives two products, i.e., O-substituted and C-substituted with active alkyl halide.

43. Superoxides are the species having an O—O bond and O in an oxidation state of $-\frac{1}{2}$ (superoxide ion is O_2^-). Usually these are formed by active metals such as KO_2 , RbO_2 and CsO_2 . For the salts of larger anions (like O_2^-), lattice energy increases in a group. Since, lattice energy is the driving force for the formation of an ionic compound and its stability, the stability of the superoxides from 'K' to 'Cs' also increases.
44. A catalyst may increase or decrease the rate of reaction. In the presence of a catalyst, the activation energy of the reaction increases.
45. NaCl is less soluble in heavy water than in ordinary water because dielectric constant of ordinary water (i.e., 81) is more than that of heavy water (i.e., 80).
46. Equal moles of different substances contain same number of constituent particles but equal weights of different substances do not contain the same number of constituent particles.
47. A mixture of transition metals and their oxides is embedded in the inner support of catalytic converter. Because of which catalytic converter converts polluting exhaust gases into non-toxic gases.
48. Sulphate is consumed from electrolyte due to formation of lead sulphate, thus, density decreases.
49. Atomic size of silver is almost equal to that of gold due to lanthanide contraction.
50. $\Delta T_f \propto K_f \cdot m$
 $T_0 - T_f \propto K_f \cdot m$
 Thus, higher the molal depression constant, k_f of the solvent used, higher the freezing point of the solution.
51. Henry's law is applicable only for such gases which do not ionise in solvent, i.e., do not react with solvent.
52. H_2 molecule is more stable than HeH because bond order of $H_2 = 1$
 and that of HeH = $\frac{1}{2}$
 (Higher the bond order, more is the stability).
53. pH of a neutral solution is 7 at 298 K. On increasing temperature, more water dissociates, consequently $[H^+]$ increases, i.e., pH decreases.
54. In chemisorption, adsorption first increases with temperature and then decreases.
 The heat initially supplied acts as activation energy for the chemical reaction occurring between adsorbate and adsorbent.
55. Be has fully $2s^2$ -orbital which gives a relatively more stable electronic configuration.
56. Nitriding is a process of heating steel in an atmosphere of ammonia. It imparts a hard coating of iron nitride on the surface of steel.
57. Grignard reagents react with acid chlorides to form *tert*-alcohols but dialkyl cadmium does not. Moreover, Grignard reagents are more reactive than dialkyl cadmium.
58. Dipole moment of methyl cyanide is higher than the dipole moment of methyl isocyanide, i.e., the former one is more polar and thus, has the greater attractive forces. Thus, the boiling point of methyl cyanide is higher than the boiling point of methyl isocyanide.
59. At low pH, the ester group of aspirin gets hydrolysed to acid, which causes ulcer in the stomach.

60. *p*-dichlorobenzene is more symmetrical than *o*-isomer, so fits closely in the crystal lattice and hence, greater amount of energy is

needed to break the crystal lattice. Thus, *p*-isomer is less soluble than *o*-isomer.

Biology

- Nucleic acids (DNA and RNA) rich in carbon, hydrogen, oxygen, nitrogen and phosphorus are only capable of reproduction at their own, therefore considered as basic of life.
 - Parrot lives as long as 50 years in captivity and can go up 80 years in larger species.
 - Mutations were referred to as 'saltations' or sports by Hugo de Vries. Therefore, theory of mutation is also called 'theory of saltation'.
 - Amphibians are absent in Galapagos islands as they could not leave the mainland and travel to the island by crossing saline water.
 - Algae are photosynthesizers, few blue-green algae are chemosynthesizers while protozoans are heterotrophs.
 - Pigment system I of higher plants has main reaction centre P_{700} and pigment system II P_{680} . But, bacterial pigment system is sensitive to far red light P_{890} .
 - Diatoms have unique double shells made up of opaline silica.
 - Nosema* was discovered by Pasteur (1865) causing chronic disease pebrine in silkworms and nosema disease in honeybees.
 - Ergotamine tartarate constricts dilated blood vessels in the head, thereby relieving headache.
 - Neprolepis* sporangia arise without any order of development, therefore are called mixed type. Some species (*N. acutifolia*) have coenosori.
 - Pappus is the hairy structure which is a modification of calyx in family-Asteraceae (Compositae).
 - This group belongs to gymnosperms whereas Psilophyta and Lycopodiophyta are pteridophytes.
 - Vitamin- B_1 is a part of coenzyme for respiration. The deficiency causes beri-beri nerve and heart disorders. Vitamin-D deficiency causes rickets. Vitamin-E or tocopherol deficiency causes infertility, while vitamin-C deficiency causes scurvy or degeneration of teeth and blood vessels.
 - Proterospongia* is a colonial flagellate protozoan whose each cell resembles a choanocyte of Porifera.
 - Bilateral symmetry is exhibited by annelids and arthropods. All chordates and higher non-chordates have distinct polar axis. Above cnidarians all are triploblastic. Annelids and Arthropoda exhibit metamerism.
 - Richard Weisenberg (1972) reported the tubulin polymerization by addition of Mg^{2+} and Ca^{2+} . Microtubules could be disassembled and reassembled over and over by changing on concentration and lowering and raising the temperature.
 - $\frac{A+T}{G+C}$ is constant (Chargaff's rule) for a species and also $A = T$ and $G = C$.
- | | |
|-------------------|----------|
| 18. Enzyme | Metal |
| Urease | Nickel |
| Dehydrogenase | Zinc |
| Nitrate reductase | Vanadium |
- Stock is the one that receives the graft which has $2n = 48$. This would produce the root which will have $2n = 48$. The scion (graft) microspore mother cell with $2n = 24$ would produce microspores ($n = 12$).
 - Less than 0.1% of plasma membrane is perforated by pores which allows the ions to pass through.
 - Microspore mother cells have $2n$ condition like that of a fertilized egg (zygote).
 - Stephan Hales first mentioned that air and light are the factors which control growth. Ingen Housz was first to recognize the importance of light and chlorophyll. Von

- Mohl was first to describe the presence of chloroplast in plant tissue. Sach stated that the product of photosynthesis is starch.
23. In blending inheritance or incomplete inheritance the F_1 hybrid is mixture of characters of two parents. It gives 1 : 2 : 1 genotypic and phenotypic ratio in F_2 generation.
 24. The DNA found in satellite is metabolically inactive. Secondary constriction has 0.3% of the total amount of nuclear DNA.
 25. Sickle cell anaemia is an autosomal hereditary chronic form of anaemia in which abnormal sickle or crescent shaped erythrocytes are present.
 26. Translocation is brought about by elongation factor G which is also called as translocase.
 27. Feathery stigma is an adaptation for the flowers which are pollinated by wind.
 28. Family-Liliaceae is a monocot family, i.e., have trimerous inflorescence.
 29. Bone marrow is replaced by air spaces in birds to keep the body light and adapted to flight.
 30. Cell wall of the plants is freely permeable, whereas the plasma membrane is semipermeable.
 31. Dixon (1923) reported that the sieve tube contents move at the rate of 50 cm per hour while the simple diffusion of sugar molecules takes place at the rate of 0.2 mm per day.
 32. Epidermis of amphibians perform respiration. In *Moloch* (lizard), it acts as a blotting paper to absorb water and in all vertebrates, it is protective in nature.
 33. Pepsin is present in gastric juice. It acts on proteins at 1.2-1.8 pH and broken them to peptones.
 34. It is called as typical embryo sac, i.e., characteristic of *Polygonum*.
 35. The embryo sac present in the nucellus is also called as female gametophyte.
 36. IgG can only cross the placenta.
 37. The major threat to human population is population explosion and climatic changes including deforestation and pollution.
 38. In human, most of the strontium becomes concentrated in bones, which damage bone cells and marrow blood cells.
 39. 'Sake' in Japan and 'wang-tsin' are the alcoholic beverages made by action of *Aspergillus oryzae* or *Rhizopus* and later on *Saccharomyces* on rice.
 40. It is a chronic progressive weakness of voluntary muscles especially that of eyes and face.
 41. Glucose is never released in the liver after alcohol consumption, instead, a toxic substance acetaldehyde is formed.
 42. Printing ink contains cadmium and other toxic chemicals which are dangerous to health.
 43. Green plants are producers, not consumers. Microconsumers are microorganisms which feed on dead and decaying organism.
 44. Oogonia are found in the ovarian follicles and produce primary and secondary oocytes.
 45. Osteoporosis occurs normally after menopause in women. The oestrogen level decrease after menopause and the calcium balance in bones and blood disturbs resulting into osteoporosis.
 46. Phylloclades like *Rhus* and *Casuarina* have fleshy stem and spiny leaves which are adaptations for xerophytic habitat.
 47. Xylem tissue is responsible for the conduction of water and minerals in the plant. In hydrophytes, due to plenty of water in surroundings xylem does not serve to conduct water.
 48. The gene expresses a phenotype by synthesizing a protein or an enzyme which determines the character.
 49. Neurohypophysis is a part of pituitary gland which is situated at the base of brain.
 50. In cataract, cells in the lens degenerate. A person can see only near objects in myopia.
 51. Sinus venosus is found in primitive vertebrates.

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52. Beta cells secrete insulin.
53. *Monotropa* is a flowering saprophyte. Its roots are very branched and covered over by mycorrhizae fungus which is chiefly ectotrophic.
54. The outermost covering layer of bone is called periosteum.
55. The life cycle of organism generally end with the end of reproduction.
56. Reindeer moss is found in Tundra region.
57. The protein coat of TMV consists of 2130 identical protein subunits called capsomeres.
58. Laminaria is an alga and used as food.
59. Mesophytes cannot survive in extreme condition. Their roots are covered with for water and mineral absorption hair.
60. Lichens show mutualism. Epiphytes use other plants only as support and not for water and food supply.