

MULTIPLE CHOICE QUESTIONS

Duration : Two Hours

Maximum Marks : 100

SUBJECT : PHYSICS

[Q. 1 to 30 carry one mark each]

- A train approaching a railway platform with a speed of 20 ms^{-1} starts blowing the whistle. Speed of sound in air is 340 ms^{-1} . If the frequency of the emitted sound from the whistle is 640 Hz, the frequency of sound to a person standing on the platform will appear to be

A. 600 Hz B. 640 Hz C. 680 Hz D. 720 Hz
- A straight wire of length 2 m carries a current of 10A. If this wire is placed in a uniform magnetic field of 0.15 T making an angle of 45° with the magnetic field, the applied force on the wire will be

A. 1.5 N B. 3 N C. $3\sqrt{2}$ N D. $\frac{3}{\sqrt{2}}$ N
- What is the phase difference between two simple harmonic motions represented by $x_1 = A \sin\left(\omega t + \frac{\pi}{6}\right)$ and $x_2 = A \cos(\omega t)$?

A. $\frac{\pi}{6}$ B. $\frac{\pi}{3}$ C. $\frac{\pi}{2}$ D. $\frac{2\pi}{3}$
- Heat is produced at a rate given by H in a resistor when it is connected across a supply of voltage V. If now the resistance of the resistor is doubled and the supply voltage is made $\frac{V}{3}$ then the rate of production of heat in the resistor will be

A. $\frac{H}{18}$ B. $\frac{H}{9}$ C. 6H D. 18H
- Two elements A and B with atomic numbers Z_A and Z_B are used to produce characteristic x-rays with frequencies ν_A and ν_B respectively. If $Z_A : Z_B = 1:2$, then $\nu_A : \nu_B$ will be

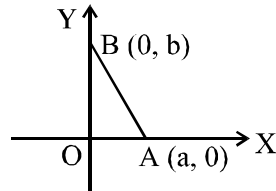
A. $1:\sqrt{2}$ B. 1:8 C. 4:1 D. 1:4
- The de Broglie wavelength of an electron moving with a velocity $\frac{C}{2}$ ($C =$ velocity of light in vacuum) is equal to the wavelength of a photon. The ratio of the kinetic energies of electron and photon is

A. 1:4 B. 1:2 C. 1:1 D. 2:1
- Two infinite parallel metal planes, contain electric charges with charge densities $+\sigma$ and $-\sigma$ respectively and they are separated by a small distance in air. If the permittivity of air is ϵ_0 then the magnitude of the field between the two planes with its direction will be

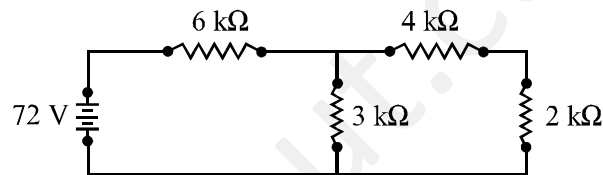
A. $\frac{\sigma}{\epsilon_0}$ towards the positively charged plane B. $\frac{\sigma}{\epsilon_0}$ towards the negatively charged plane

C. $\frac{\sigma}{(2\epsilon_0)}$ towards the positively charged plane D. 0 and towards any direction.

18. Water is flowing through a very narrow tube. The velocity of water below which the flow remains a streamline flow is known as
 A. Relative velocity B. Terminal velocity C. Critical velocity D. Particle velocity
19. If the velocity of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$, the time taken (in nanosecond) to travel through a glass plate of thickness 10 cm and refractive index 1.5 is
 A. 0.5 B. 1.0 C. 2.0 D. 3.0
20. A charge $+q$ is placed at the origin O of X-Y axes as shown in the figure. The work done in taking a charge Q from A to B along the straight line AB is



- A. $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a-b}{ab} \right)$ B. $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b-a}{ab} \right)$ C. $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b}{a^2} - \frac{1}{b} \right)$ D. $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a}{b^2} - \frac{1}{b} \right)$
21. What current will flow through the $2\text{k}\Omega$ resistor in the circuit shown in the figure?

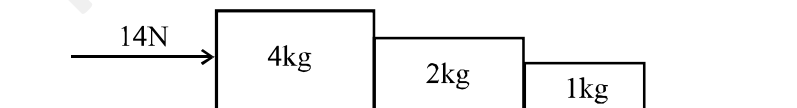


- A. 3 mA B. 6 mA C. 12 mA D. 36 mA
22. In a region, the intensity of an electric field is given by $\vec{E} = 2\hat{i} + 3\hat{j} + \hat{k}$ in NC^{-1} . The electric flux through a surface $\vec{S} = 10\hat{i} \text{ m}^2$ in the region is
 A. $5 \text{ Nm}^2\text{C}^{-1}$ B. $10 \text{ Nm}^2\text{C}^{-1}$ C. $15 \text{ Nm}^2\text{C}^{-1}$ D. $20 \text{ Nm}^2\text{C}^{-1}$
23. The dimension of angular momentum is
 A. $\text{M}^0\text{L}^1\text{T}^{-1}$ B. $\text{M}^1\text{L}^2\text{T}^{-2}$ C. $\text{M}^1\text{L}^2\text{T}^{-1}$ D. $\text{M}^2\text{L}^1\text{T}^{-2}$
24. If $\vec{A} = \vec{B} + \vec{C}$ and \vec{A} , \vec{B} , \vec{C} have scalar magnitudes of 5, 4, 3 units respectively then the angle between \vec{A} and \vec{C} is
 A. $\cos^{-1} \left(\frac{3}{5} \right)$ B. $\cos^{-1} \left(\frac{4}{5} \right)$ C. $\frac{\pi}{2}$ D. $\sin^{-1} \left(\frac{3}{4} \right)$
25. A particle is travelling along a straight line OX. The distance x (in metres) of the particle from O at a time t is given by $x = 37 + 27t - t^3$ where t is time in seconds. The distance of the particle from O when it comes to rest is
 A. 81 m B. 91 m C. 101 m D. 111 m
26. A particle is projected from the ground with a kinetic energy E at an angle of 60° with the horizontal. Its kinetic energy at the highest point of its motion will be
 A. $\frac{E}{\sqrt{2}}$ B. $\frac{E}{2}$ C. $\frac{E}{4}$ D. $\frac{E}{8}$

27. A bullet on penetrating 30 cm into its target loses its velocity by 50%. What additional distance will it penetrate into the target before it comes to rest?
- A. 30 cm B. 20 cm C. 10 cm D. 5 cm.
28. When a spring is stretched by 10 cm, the potential energy stored is E. When the spring is stretched by 10 cm more, the potential energy stored in the spring becomes
- A. 2E B. 4E C. 6E D. 10E
29. Average distance of the Earth from the Sun is L_1 . If one year of the Earth = D days, one year of another planet whose average distance from the Sun is L_2 will be
- A. $D\left(\frac{L_2}{L_1}\right)^{\frac{1}{2}}$ days B. $D\left(\frac{L_2}{L_1}\right)^{\frac{3}{2}}$ days C. $D\left(\frac{L_2}{L_1}\right)^{\frac{2}{3}}$ days D. $D\left(\frac{L_2}{L_1}\right)$ days
30. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities $v_1 \text{ ms}^{-1}$ and $v_2 \text{ ms}^{-1}$ respectively making angles of 30° and 60° with respect to the original direction of motion of A. The ratio $\frac{v_1}{v_2}$ will be
- A. $\frac{\sqrt{3}}{4}$ B. $\frac{4}{\sqrt{3}}$ C. $\frac{1}{\sqrt{3}}$ D. $\sqrt{3}$

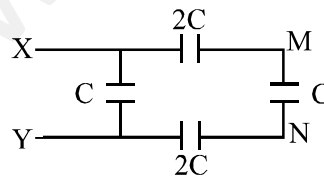
Q. 31 to 40 carry two marks each

31. When a certain metal surface is illuminated with light of frequency ν , the stopping potential for photoelectric current is V_0 . When the same surface is illuminated by light of frequency $\frac{\nu}{2}$, the stopping potential is $\frac{V_0}{4}$. The threshold frequency for photoelectric emission is
- A. $\frac{\nu}{6}$ B. $\frac{\nu}{3}$ C. $\frac{2\nu}{3}$ D. $\frac{4\nu}{3}$
32. Three blocks of mass 4kg, 2kg, 1kg respectively are in contact on a frictionless table as shown in the figure. If a force of 14N is applied on the 4kg block, the contact force between the 4kg and the 2kg block will be



- A. 2N B. 6N C. 8N D. 14N
33. Let L be the length and d be the diameter of cross section of a wire. Wires of the same material with different L and d are subjected to the same tension along the length of the wire. In which of the following cases, the extension of wire will be the maximum?
- A. L = 200cm, d = 0.5mm B. L = 300cm, d = 1.0mm
 C. L = 50cm, d = 0.05mm D. L = 100cm, d = 0.2mm

34. An object placed in front of a concave mirror at a distance of x cm from the pole gives a 3 times magnified real image. If it is moved to a distance of $(x+5)$ cm, the magnification of the image becomes 2. The focal length of the mirror is
- A. 15cm B. 20cm C. 25cm D. 30cm
35. 22320 cal heat is supplied to 100g of ice at 0°C . If the latent heat of fusion of ice is 80cal g^{-1} and latent heat of vaporization of water is 540 cal g^{-1} , the final amount of water thus obtained and its temperature respectively are
- A. 8g, 100°C B. 100g, 90°C C. 92g, 100°C D. 82g, 100°C
36. A progressive wave moving along x-axis is represented by $y = A \sin\left[\frac{2\pi}{\lambda}(vt - x)\right]$. The wavelength (λ) at which the maximum particle velocity is 3 times the wave velocity is
- A. $A/3$ B. $2A/(3\pi)$ C. $(3/4)\pi A$ D. $(2/3)\pi A$
37. Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$, they have the same number of nuclei. The ratio of number of nuclei of A to that of B will be $(1/e)^2$ after a time interval of
- A. $\frac{1}{\lambda}$ B. $\frac{1}{2\lambda}$ C. $\frac{1}{3\lambda}$ D. $\frac{1}{4\lambda}$
38. A magnetic needle is placed in a uniform magnetic field and is aligned with the field. The needle is now rotated by an angle of 60° and the work done is W . The torque on the magnetic needle at this position is
- A. $2\sqrt{3}W$ B. $\sqrt{3}W$ C. $\frac{\sqrt{3}}{2}W$ D. $\frac{\sqrt{3}}{4}W$
39. In the adjoining figure the potential difference between X and Y is 60V. The potential difference the points M and N will be



- A. 10V B. 15V C. 20V D. 30V
40. A body when fully immersed in a liquid of specific gravity 1.2 weighs 44gwt. The same body when fully immersed in water weighs 50 gwt. The mass of the body is
- A. 36g B. 48g C. 64g D. 80g

SUBJECT : CHEMISTRY**Q. 41 to 70 carry one mark each**

41. Which one of the following characteristics belongs to an electrophile?
- It is any species having electron deficiency which reacts at an electron rich C-centre
 - It is any species having electron enrichment, that reacts at an electron deficient C-centre
 - It is cationic in nature
 - It is anionic in nature
42. Which one of the following methods is used to prepare Me_3COEt with a good yield?
- Mixing EtONa with Me_3CCl
 - Mixing Me_3CONa with EtCl
 - Heating a mixture of (1:1) EtOH and Me_3COH in presence of conc. H_2SO_4
 - Treatment of Me_3COH with EtMgI
43. 58.5 gm of NaCl and 180gm of glucose were separately dissolved in 1000ml of water. Identify the correct statement regarding the elevation of boiling point (b.p.) of the resulting solutions.
- NaCl solution will show higher elevation of b.p.
 - Glucose solution will show higher elevation of b.p.
 - Both the solution will show equal elevation of b.p.
 - The b.p. elevation will be shown by neither of the solutions
44. Equal weights of CH_4 and H_2 are mixed in an empty container at 25°C . The fraction of the total pressure exerted by H_2 is
- A. $\frac{1}{9}$ B. $\frac{1}{2}$ C. $\frac{8}{9}$ D. $\frac{16}{17}$
45. Which of the following will show a negative deviation from Raoult's law?
- Acetone-benzene
 - Acetone-ethanol
 - Benzene-methanol
 - Acetone-chloroform
46. In a reversible chemical reaction at equilibrium, if the concentration of any one of the reactants is doubled, then the equilibrium constant will
- also be doubled
 - be halved
 - remains the same
 - becomes one-fourth
47. Identify the correct statement from the following in a chemical reaction.
- The entropy always increases
 - The change in entropy along with suitable change in enthalpy decides the fate of a reaction
 - The enthalpy always decreases
 - Both the enthalpy and the entropy remain constant

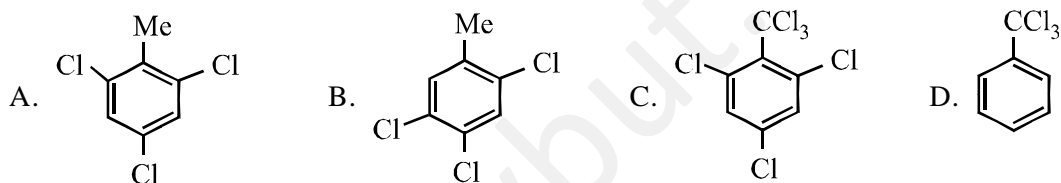
48. Which one of the following is wrong about molecularity of a reaction?
- It may be whole number or fractional
 - It is calculated from reaction mechanism
 - It is the number of molecules of the reactants taking part in a single step chemical reaction
 - It is always equal to the order of elementary reaction.
49. Upon treatment with I_2 and aqueous NaOH, which of the following compounds will form iodoform?
- $CH_3CH_2CH_2CH_2CHO$
 - $CH_3CH_2COCH_2CH_3$
 - $CH_3CH_2CH_2CH_2CH_2OH$
 - $CH_3CH_2CH_2CH(OH)CH_3$
50. Upon treatment with $Al(OEt)_3$ followed by usual reaction (work up), CH_3CHO will produce
- only $CH_3COOCH_2CH_3$
 - a mixture of CH_3COOH and EtOH
 - only CH_3COOH
 - only EtOH
51. Friedel-Craft's reaction using MeCl and anhydrous $AlCl_3$ will take place most efficiently with
- Benzene
 - Nitrobenzene
 - Acetophenone
 - Toluene
52. Which one of the following properties is exhibited by phenol?
- It is soluble in aq. NaOH and evolves CO_2 with aq. $NaHCO_3$
 - It is soluble in aq. NaOH and does not evolve CO_2 with aq. $NaHCO_3$
 - It is not soluble in aq. NaOH but evolves CO_2 with aq. $NaHCO_3$
 - It is insoluble in aq. NaOH and does not evolve CO_2 with aq. $NaHCO_3$
53. The basicity of aniline is weaker in comparison to that of methyl amine due to
- hyperconjugative effect of Me-group in $MeNH_2$
 - resonance effect of phenyl group in aniline
 - lower molecular weight of methyl amine as compared to that of aniline
 - resonance effect of $-NH_2$ group in $MeNH_2$
54. Under identical conditions, the S_N1 reaction will occur most efficiently with
- tert-butyl chloride
 - 1-chlorobutane
 - 2-methyl-1-chloropropane
 - 2-chlorobutane
55. Identify the method by which Me_3CCO_2H can be prepared.
- Treating 1 mol of $MeCOMe$ with 2 mole of $MeMgI$
 - Treating 1 mol of $MeCO_2Me$ with 3 moles of $MeMgI$
 - Treating 1 mol of $MeCHO$ with 3 moles of $MeMgI$
 - Treating 1 mol of dry ice with 1 mol of Me_3CMgI
56. Li occupies higher position in the electrochemical series of metals as compared to Cu since
- the standard reduction potential of Li^+ / Li is lower than that of Cu^{2+} / Cu
 - the standard reduction potential of Cu^{2+} / Cu is lower than that of Li^+ / Li
 - the standard oxidation potential of Li^+ / Li is lower than that of Cu / Cu^{2+}
 - Li is smaller in size as compared to Cu

57. ${}_{11}\text{Na}^{24}$ is radioactive and it decays to
 A. ${}_{9}\text{F}^{20}$ and α -particles B. ${}_{13}\text{Al}^{24}$ and positron C. ${}_{11}\text{Na}^{23}$ and neutron D. ${}_{12}\text{Mg}^{24}$ and β -particles
58. The paramagnetic behaviour of B_2 is due to the presence of
 A. 2 unpaired electrons in π_b MO B. 2 unpaired electrons in π^* MO
 C. 2 unpaired electrons in σ^* MO D. 2 unpaired electrons in σ_b MO
59. A 100 ml 0.1 (M) solution of ammonium acetate is diluted by adding 100 ml of water. The pH of the resulting solution will be (pK_a of acetic acid is nearly equal to pK_b of NH_4OH)
 A. 4.9 B. 5.0 C. 7.0 D. 10.0
60. In 2-butene, which one of the following statements is true ?
 A. $\text{C}_1 - \text{C}_2$ bond a $\text{sp}^3\text{-sp}^3$ σ -bond B. $\text{C}_2 - \text{C}_3$ bond a $\text{sp}^3\text{-sp}^2$ σ -bond
 C. $\text{C}_1 - \text{C}_2$ bond a $\text{sp}^3\text{-sp}^2$ σ -bond D. $\text{C}_1 - \text{C}_2$ bond a $\text{sp}^2\text{-sp}^2$ σ -bond
61. The well known compounds, (+) – lactic acid and (–) – lactic acid, have the same molecular formula, $\text{C}_3\text{H}_6\text{O}_3$. The correct relationship between them is
 A. constitutional isomerism B. geometrical isomerism
 C. identicalness D. optical isomerism
62. The stability of $\text{Me}_2\text{C} = \text{CH}_2$ is more than that of $\text{MeCH}_2\text{CH} = \text{CH}_2$ due to
 A. inductive effect of the Me group
 B. resonance effect of the Me group
 C. hyperconjugative effect of the Me group
 D. resonance as well as inductive effect of the Me group
63. Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle?
 A. $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$ B. $\Delta x \cdot \Delta v \geq \frac{h}{4\pi m}$ C. $\Delta E \cdot \Delta t \geq \frac{h}{4\pi}$ D. $\Delta E \cdot \Delta x \geq \frac{h}{4\pi}$
64. The stable bivalency of Pb and trivalency of Bi is
 A. due to d contraction in Pb and Bi
 B. due to relativistic contraction of the 6s orbitals of Pb and Bi, leading to inert pair effect
 C. due to screening effect
 D. due to attainment of noble liquid configuration
65. The equivalent weight of $\text{K}_2\text{Cr}_2\text{O}_7$ in acidic medium is expressed in terms of its molecular weight (M) as
 A. $\frac{M}{3}$ B. $\frac{M}{4}$ C. $\frac{M}{6}$ D. $\frac{M}{7}$
66. Which of the following is correct?
 A. radius of $\text{Ca}^{2+} < \text{Cl}^- < \text{S}^{2-}$ B. radius of $\text{Cl}^- < \text{S}^{2-} < \text{Ca}^{2+}$
 C. radius of $\text{S}^{2-} = \text{Cl}^- = \text{Ca}^{2+}$ D. radius of $\text{S}^{2-} < \text{Cl}^- < \text{Ca}^{2+}$

67. CO is practically non-polar since
- the σ -electron drift from C to O is almost nullified by the π -electron drift from O to C
 - the σ -electron drift from O to C is almost nullified by the π -electron drift from C to O
 - the bond moment is low
 - there is a triple bond between C and O
68. The number of acidic protons in H_3PO_3 are
- 0
 - 1
 - 2
 - 3
69. When H_2O_2 is shaken with an acidified solution of $\text{K}_2\text{Cr}_2\text{O}_7$ in presence of ether, the ethereal layer turns blue due to the formation of
- Cr_2O_3
 - CrO_4^{2-}
 - $\text{Cr}_2(\text{SO}_4)_3$
 - CrO_5
70. The state of hybridization of the central atom and the number of lone pairs over the central atom in POCl_3 are
- $sp, 0$
 - $sp^2, 0$
 - $sp^3, 0$
 - $dsp^2, 1$

Q. 71 to 80 carry two marks each

71. By passing excess $\text{Cl}_2(\text{g})$ in boiling toluene, which one of the following compounds is exclusively formed?



72. An equimolar mixture of toluene and chlorobenzene is treated with a mixture of conc. H_2SO_2 and conc. HNO_3 . Indicate the correct statement from the following.
- p-nitrotoluene is formed in excess
 - equimolar amounts of p-nitrotoluene and p-nitrochlorobenzene are formed
 - p-nitrochlorobenzene is formed in excess
 - m-nitrochlorobenzene is formed in excess
73. Among the following carbocations : $\text{Ph}_2\text{C}^+\text{CH}_2\text{Me}$ (I), $\text{PhCH}_2\text{CH}_2\text{CH}^+\text{Ph}$ (II), $\text{Ph}_2\text{CHCH}^+\text{M}$ (III) and $\text{Ph}_2\text{C}(\text{Me})\text{CH}_2^+$ (IV), the order of stability is
- $\text{IV} > \text{II} > \text{I} > \text{III}$
 - $\text{I} > \text{II} > \text{III} > \text{IV}$
 - $\text{II} > \text{I} > \text{IV} > \text{III}$
 - $\text{I} > \text{IV} > \text{III} > \text{II}$
74. Which of the followings is correct?
- Evaporation of water causes an increase in disorder of the system
 - Melting of ice causes a decrease in randomness of the system
 - Condensation of steam causes an increase in disorder of the system
 - There is practically no change in the randomness of the system when water is evaporated

75. On passing 'C' Ampere of current for time 't' sec through 1 litre of 2(M)CuSO₄ solution (atomic weight of Cu = 63.5), the amount 'm' of Cu (in gm) deposited on cathode will be
- A. $m = \frac{Ct}{(63.5 \times 96500)}$ B. $m = \frac{Ct}{(31.25 \times 96500)}$
- C. $m = \frac{(C \times 96500)}{(31.25 \times t)}$ D. $m = \frac{(31.25 \times C \times t)}{96500}$
76. If the 1st ionization energy of H atom is 13.6 eV, then the 2nd ionization energy of He atom is
- A. 27.2 eV B. 40.8 eV C. 54.4 eV D. 108.8 eV
77. The weight of oxalic acid that will be required to prepare a 1000 ml $\left(\frac{N}{20}\right)$ solution is
- A. 126/100 gm B. 63/40 gm C. 63/20 gm D. 126/20 gm
78. 20 ml 0.1 (N) acetic acid is mixed with 10 ml 0.1 (N) solution of NaOH. The pH of the resulting solution is (pK_a of acetic acid is 4.74)
- A. 3.74 B. 4.74 C. 5.74 D. 6.74
79. In the brown ring complex $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4$, nitric oxide behaves as
- A. NO⁺ B. neutral NO molecule
- C. NO⁻ D. NO²⁻
80. The most contributing tautomeric enol form of MeCOCH₂CO₂Et is
- A. CH₂ = C(OH)CH₂CO₂Et B. MeC(OH) = CHCO₂Et
- C. MeCOCH = C(OH)OEt D. CH₂ = C(OH)CH = C(OH)OEt
-

PHYSICS

1. $v = \left(\frac{v}{v - u_s} \right) v_0$

$$v = \left(\frac{340}{340 - 20} \right) 640 = 680$$

Ans. C.

2. $F = ilB \sin \theta$
 $= 10 \times 2 \times 0.15 \sin 45^\circ$
 $= \frac{3}{\sqrt{2}} \text{ N}$

Ans. D.

3. $x_1 = A \sin \left(\omega t + \frac{\pi}{6} \right)$

$$x_2 = A \cos \omega t = A \sin \left(\omega t + \frac{\pi}{2} \right)$$

$$\Delta \phi = \frac{\pi}{2} - \frac{\pi}{6} = \frac{\pi}{3}$$

Ans. B.

4. $H = \frac{V^2}{R}$

$$H' = \frac{\left(\frac{V}{3} \right)^2}{2R}$$

$$H' = \frac{H}{18}$$

Ans. A.

5. $v \propto z^2$
 $\Rightarrow v_A : v_B :: 1 : 4$

Ans. D.

$$6. \lambda_c = \frac{h}{m_c \frac{C}{2}}, \quad \lambda_p = \frac{h}{m_p c}$$

$$\Rightarrow \frac{m_e}{m_p} = 2$$

$$\frac{k_e}{k_p} = \frac{\frac{1}{2} m_c v_c^2}{\frac{1}{2} m_p v_p^2} = \frac{1}{2}$$

Ans. B.

$$7. E = \frac{\sigma}{2 \epsilon_0} + \frac{\sigma}{2 \epsilon_0} = \frac{\sigma}{\epsilon_0} \text{ towards negative charged plate}$$

Ans. B.

$$8. \mu mg = ma$$

$$a = \mu g = 0.2 \times 10 = 2 \text{ m/sec}^2.$$

Ans. D.

$$9. 1011001 \text{ (binary number)}$$

Its decimal equivalent is equal to

$$2^0 + 0 + 0 + 2^3 + 2^4 + 2^6$$

$$= 1 + 8 + 16 + 64 = 89$$

Ans. C.

$$10. v_1 = \frac{(2n-1)}{4l_1} v$$

$$v_2 = \frac{n}{2l_2} v$$

$$v_1 = v_2 \Rightarrow \frac{l_1}{l_2} = \frac{3}{4}$$

Ans. D.

$$11. R \text{ increases with temperature and slope of } V - i \text{ graph gives resistance}$$

Ans. B.

12. $(m + 1)$ vernier division
 = m no. of main scale division.
 1 division on vernier scale
 = $\left(\frac{m}{m+1}\right)$ division on main scale.

$$\text{Vernier constant} = \left(1 - \frac{m}{m+1}\right)d$$

$$= \frac{d}{m+1}$$

Ans. A.

13. $y = \frac{1}{2}gt^2$

$$80 = \frac{1}{2} \times 10 \times t^2$$

$$t = 4 \text{ sec.}$$

$$x = v \times t$$

$$= 8 \times 4$$

$$= 32 \text{ meter.}$$

Ans. C.

14. Since Wheat stone bridge is balanced.

$$\frac{1}{10} = \frac{1}{x} + \frac{1}{30}$$

$$x = 15\Omega$$

Ans. D.

15. $R = \frac{V^2}{P} = \frac{200 \times 200}{50}$

$$P' = \frac{V'^2}{R} = \frac{100 \times 100 \times 50}{200 \times 200} = 12.5 \text{ W}$$

Ans. C.

16. $\frac{x-10}{130-10} = \frac{40}{100}$

$$x = 58^\circ$$

Ans. D.

$$17. \quad \varepsilon = \frac{d\phi}{dt} = 8t + 6$$

at $t = 2$ sec.

$$\varepsilon = 22 \text{ volt.}$$

Ans. A.

18. **Ans. C.**

$$19. \quad t = \frac{d}{\frac{c}{\mu}} = \frac{10 \times 10^{-2}}{2 \times 10^8} = 0.5 \times 10^{-9} \text{ sec.}$$

Ans. A.

$$20. \quad W = q\Delta V$$

$$= q \left[\frac{Q}{4\pi\epsilon_0 b} - \frac{Q}{4\pi\epsilon_0 a} \right]$$

$$= \frac{Qq}{4\pi\epsilon_0} \left(\frac{a-b}{ab} \right)$$

Ans. A.

$$21. \quad i = \frac{72}{8 \times 10^3} = 9 \times 10^{-3} \text{ Amp}$$

$$i \times 6 = (9 - i) \times 3$$

$$i = 3 \text{ milli ampere.}$$

Ans. A.

$$22. \quad \phi = \vec{E} \cdot \vec{S} = 20 \text{ Nm}^2 \text{ C}^{-1}$$

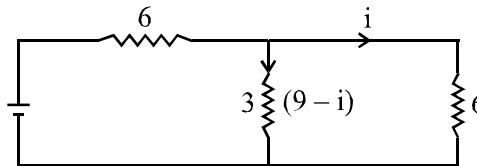
Ans. D.

$$23. \quad \vec{L} = \vec{r} \times \vec{p}$$

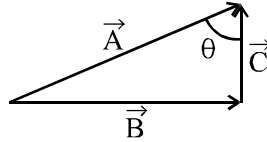
$$= [L] [MLT^{-1}]$$

$$= [ML^2T^{-1}]$$

Ans. C.



24. $\theta = \cos^{-1} \left(\frac{|\vec{C}|}{|\vec{A}|} \right) = \cos^{-1} \left(\frac{3}{5} \right)$



Ans. A.

25. $v = \frac{dx}{dt} = 27 - 3t^2$

$v = 0. \Rightarrow 27 - 3t^2 = 0$
 $t = 3 \text{ sec.}$

$x = 37 + 27 \times 3 - (3)^3$
 $= 91 \text{ meter.}$

Ans. B.

26. At ground. $E = \frac{1}{3} mu^2$

At highest point

$k' = \frac{1}{2} m(u \cos 60^\circ)^2$

$k' = \frac{E}{4}$

Ans. C.

27. $v^2 = u^2 + 2as$

$\frac{u^2}{4} = u^2 + 2a \times 30 \times 10^{-2} \dots\dots\dots (1)$

$0 = \frac{u^2}{4} + 2a \times x \dots\dots\dots (2)$

Solving (1) & (2)

$x = 10 \text{ cm.}$

Ans. C.

28. $E = \frac{1}{2} k(10 \times 10^{-2})^2$

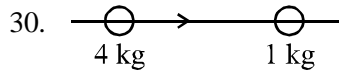
$E' = \frac{1}{2} k(20 \times 10^{-2})^2 = 4E$

Ans. B.

29. $T^2 \propto R^3$.

$$\Rightarrow T = D \left(\frac{L_2}{L_1} \right)^{\frac{3}{2}}$$

Ans. B.



Along y-axis momentum remains zero

$$4v_1 \sin 30^\circ = v_2 \sin 60^\circ$$

$$\frac{v_1}{v_2} = \frac{\sqrt{3}}{4}$$

Ans. A.

31. $h\nu = h\nu_0 + eV_0$ (1)

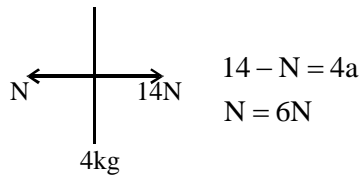
$$\frac{h\nu}{2} = h\nu_0 + \frac{eV_0}{4}$$
 (2)

Solving (1) & (2)

$$\nu_0 = \frac{\nu}{3}$$

Ans. B.

32. $a = \frac{F}{m} = \frac{14}{7} = 2 \text{ m/sec}^2$

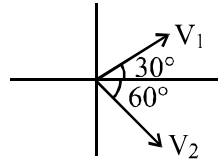


Ans. B.

33. $\Delta l = \frac{F \times l}{A \times Y} = \frac{4L}{\pi d^2}$

$$\Rightarrow \Delta l \propto \frac{L}{d^2}$$

Ans. C.



34. $v_1 = 3x$

$$v_2 = 2(x+5)$$

$$\frac{1}{-x} + \frac{1}{-3x} = \frac{1}{f} \dots (1)$$

$$\frac{1}{-(x+5)} + \frac{1}{-2(x+5)} = \frac{1}{f} \dots (2)$$

solving (1) & (2)

$$f = 30 \text{ cm}$$

Ans. D.

35. Heat required to convert ice to water at 100°C .

$$Q = m \times L + ms\Delta T = 18000 \text{ cal.}$$

$$\text{Amount of heat left} = 4320 \text{ cal.}$$

$$\Rightarrow m \times L = 4320$$

$$m = 8 \text{ g steam.}$$

Ans. C.

36. $(v_p)_{\max} = \frac{2\pi}{\lambda} v A$

$$(v_p)_{\max} = 3v$$

$$\lambda = \frac{2\pi}{3} A$$

Ans. D.

37. $N_A = N_0 e^{-\lambda t}$

$$N_B = N_0 e^{-\lambda t}$$

$$\frac{N_A}{N_B} = \frac{1}{e^2} = \frac{1}{e^{4\lambda t}}$$

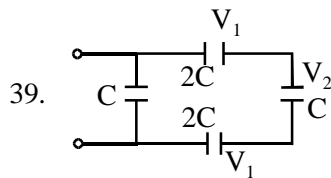
$$t = \frac{1}{2\lambda}$$

Ans. B.

38. $W = MB (1 - \cos 60) = \frac{MB}{2}$

$$|T| = MB \sin 60 = \sqrt{3} W$$

Ans. B.



$$2C \times V_1 = C \times V_2 \quad (\text{since capacitors are in series})$$

$$2V_1 = V_2 \quad \dots (1)$$

$$V_1 + V_2 + V_1 = 60 \quad \dots (2)$$

solving (1) & (2)

$$V_2 = 30 \text{ V}$$

Ans. D.

40. $W = mg - V\rho g$

$$44 = m - 1.2 V \quad \dots (1)$$

$$50 = m - V \quad \dots (2)$$

solving (1) & (2)

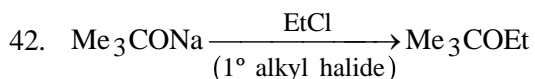
$$m = 80 \text{ g}$$

Ans. D.

CHEMISTRY

41. Electrophiles are electron deficient species (neutral or cationic).

Ans. A.



Ans. B.

43. Because molality for both is same and 'i' value for NaCl is 2 while for glucose it is 1.

Ans. A.

44. Ratio of no. of moles of CH_4 : H_2

$$= \frac{x}{16} : \frac{x}{2}$$

$$= 1 : 8$$

$$\text{Hence partial pressure of hydrogen} = \frac{8}{9} \times P_{\text{total}}$$

Ans. C.

45. Acetone and chloroform will show a negative deviation due to $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3 \cdots \cdots \text{H} - \text{CCl}_3$ association after mixing.

Ans. D.

46. Because equilibrium constant is independent of conc. of any species.

Ans. C.

47. Because $\Delta G_{(T, P)} = \Delta H - T\Delta S$ determines the course of a chemical reaction.

Ans. B.

48. Because molecularity of a reaction can never be fractional.

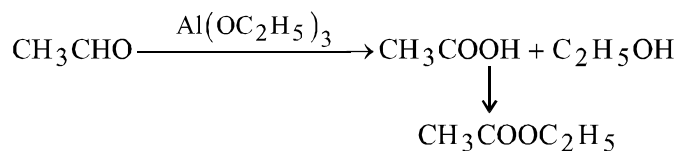
Ans. A.

49. Because $\text{CH}_3\text{CH}_2\text{CH}_2 - \underset{\text{OH}}{\overset{\text{H}}{\text{C}}} - \text{CH}_3$ when oxidised form $\text{CH}_3\text{CH}_2\text{CH}_2 - \overset{\text{O}}{\parallel} - \text{CH}_3$ which contains

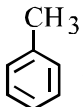
a keto-methyl group.

Ans. D.

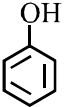
50. It is an example of Tischenko reaction



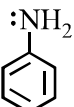
Ans. A.

51. Because in . The alkyl group is electron donating.

Ans. D.

52. Because  reacts with NaOH, but is not sufficiently acidic to evolve CO_2 from NaHCO_3 .

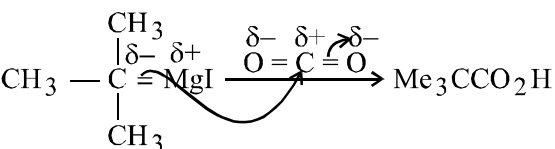
Ans. B.

53. Because  the N-lone pair in aniline is involved in the ring resonance.

Ans. B.

54. tert-butyl chloride because the S_{N}^1 reaction is most effective in 3° carbon.

Ans. A.

55. 

Ans. D.

56. Because Li^+ has least tendency to get converted to Li

Ans. A.

57. ${}_{11}^{24}\text{Na} \rightarrow {}_{12}^{24}\text{Mg} + {}_{-1}^0\text{e}$

because for stable $\frac{n}{p}$ ratio.

Ans. D.

58. $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \pi_{2p_x}^1 \pi_{2p_y}^1$.

So there are 2e's in π -bonding molecular orbital

Ans. A.

59. Because for ammonium acetate which is a soln of weak acid-weak base, pK_a of $\text{CH}_3\text{COOH} = pK_b$ of NH_4OH .

Ans. C.

60. $\begin{array}{c} | & | & | & | \\ -\text{C}_2 & - & \text{C}_2 & = & \text{C} & - & \text{C} & - \\ | & & & & | & & & \end{array}$

because C_1 is a sp^3 -carbon and C_2 is a sp^2 -carbon.

Ans. C.

61. They are optical isomers which rotate the plane of polarised light in opposite direction.

Ans. D.

62. $\begin{array}{c} \text{H}_3\text{C} & & \text{H} \\ & \diagdown & / \\ & \text{C} = & \text{C} \\ & / & \diagdown \\ \text{H}_3\text{C} & & \text{H} \end{array}$ has 6-hyperconjugative forms while. $\begin{array}{c} \text{H} \\ | \\ \text{CH}_3\text{CH}_2-\text{C} \\ / \quad \backslash \\ \text{H} \quad \text{C} = \text{C} \\ \quad \quad \backslash \quad / \\ \quad \quad \text{H} \quad \text{H} \end{array}$ has 2 hyper-conjugative forms.

Ans. C.

63. $\Delta E \cdot \Delta x \geq \frac{h}{4\pi}$

Ans. D.

64. Because inert-pair effect is prominent in group 14 and 15 element.

Ans. B.

65. Equivalent mass of $\text{K}_2\text{Cr}_2\text{O}_7 \xrightarrow{\text{H}^+} \text{Cr}^{3+} = \frac{M}{6}$ because no. of e^- s transfer is 3 for each Cr and 6 for two Cr-atoms.

Ans. C.

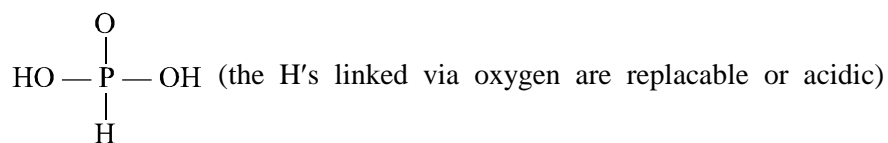
66. $\text{Ca}^{2+} < \text{Cl}^- < \text{S}^{2-}$ because for isoelectronic species, more the atomic number, lesser the size.

Ans. A.

67. $:\text{C} \begin{array}{c} \leftarrow \pi \\ \xrightarrow{\sigma} \\ \xrightarrow{\pi} \end{array} \text{O}:$ because the C — O σ moment and O — C π -moment cancels out each other.

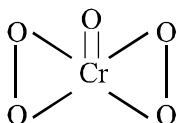
Ans. A.

68. The no. of acidic protons in H_3PO_2 is 2.



Ans. C.

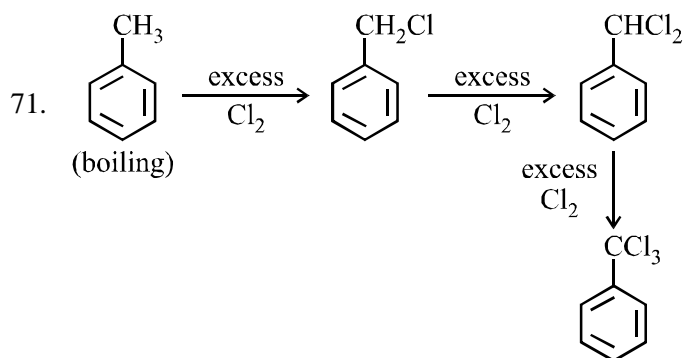
69. Because of the formation of CrO_5 .



Ans. D.

70. $\begin{array}{c} \text{O} \\ || \\ \text{Cl} - \text{P} - \text{Cl} \\ | \\ \text{Cl} \end{array} \rightarrow \text{sp}^3$ hybridised with no lone pair.

Ans. C.

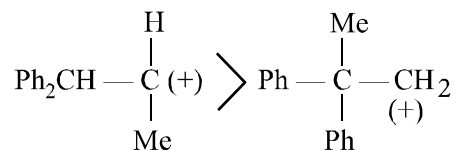
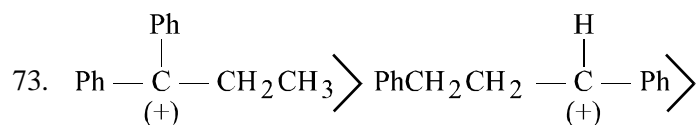


Higher temp favours side-chain substitution.

Ans. D.

72. Because is more reactive than and will add NO_2^+ at para position.

Ans. A.



because 3° benzylic $>$ 2° benzylic $>$ 2° $>$ 1° .

Ans. B.

74. Because when water is converted into steam, its disorder or randomness increases.

Ans. A.

$$75. m = \frac{ECt}{F} = \frac{\frac{63.5}{2} \times C \times t}{96500}$$

$$= \frac{31.75 \times C \times t}{96500}$$

Wrongly given as 31.25 in place of 31.75 in J.E.E. paper.

Ans. D.

$$76. \text{2nd ionization energy} = 13.6 \times \frac{2^2}{1^2}$$

$$= 54.4 \text{ eV.}$$

Ans. C.

$$77. 1000 \text{ ml } \frac{N}{20} \equiv 50 \text{ ml (N)}$$

$$= 0.5 \text{ gm eq.} = 0.05 \times \frac{126}{2} = \frac{63}{20} \text{ gm}$$

Ans. C.

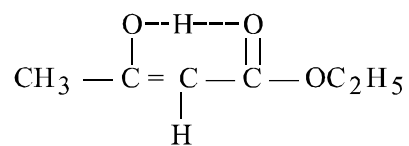
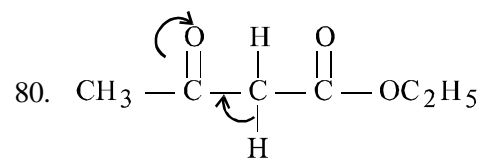
$$78. \text{pH} = \text{pK}_a + \log \frac{\text{salt}}{\text{base}} = 4.74 + \log \frac{1}{1}$$

$$= 4.74.$$

Ans. B.

79. Because in Fe-complexes. NO behaves as NO^+ .

Ans. A.



Ans. B.
