PHYSICS

1. A body falls from rest, in the last second of its fall, it covers half of the total distance. Then the total time of its fall is
   (A) $2 + \sqrt{2}$ sec
   (B) $2 - \sqrt{2}$ sec
   (C) $2 \pm \sqrt{2}$
   (D) 4 sec

2. A force of 6 kgf and another force of 8 kg f can be applied to produce the effect of a single force equal to
   (A) 1 kgf
   (B) 16 kgf
   (C) 10 kgf
   (D) 0 kgf

3. From the top of the tower two bodies are projected horizontally with velocities 10 m/sec and 20 m/sec. They hit the ground in t_1 and t_2 seconds respectively. Then
   (A) $t_1 = 2t_2$
   (B) $t_2 = 2t_1$
   (C) $t_1 = t_2$
   (D) $t_1 = \sqrt{2} \, t_2$

4. A stone is tied at the end of a string 4m long and whirled in a circle in a vertical plane. The minimum speed of the stone at the lowest point for the circular motion to be just completed is
   (A) 14 m/sec
   (B) 7 m/sec
   (C) 6.3 m/sec
   (D) 28 m/sec

5. A particle P is moving in a circle of radius a with a uniform speed V, C is the center of the circle and AB is diameter. The angular velocity of P about A and C are in the ratio
   (A) 1 : 1
   (B) 1 : 2
   (C) 2 : 1
   (D) 4 : 1

6. A bird sits on a stretched telegraph wire. The additional tension produced in the wire is
   (A) zero
   (B) less than weight of the bird
   (C) equal to weight of the bird
   (D) greater than the weight of the bird

7. A block of mass 2 kg rests on a rough inclined plane making an angle of 30^0 with frictional coefficient between the block and the plane is 0.7. The frictional force on the block is
   (A) 9.8 N
   (B) $0.7 \times 9.8 \times \sqrt{3}$ N
   (C) $9.8 \sqrt{3}$ N
   (D) 9.8×0.7 N

8. A man of mass 60 kg records his weight on a weighing machine placed inside a lift. The ratio of weight of man recorded when lift is ascending up with a uniform speed of 2 m/sec to when it is descending down with a uniform speed 4 m/sec will be
   (A) 0.5
   (B) 1
   (C) 2
   (D) none

9. The potential energy of a particle executing linear simple harmonic motion is given V(x) = $\frac{1}{2}kx^2$, where k is force constant and is equal to 0.5 N/m. The amplitude of particle if its total energy is equal to 1 Joule
   (A) $2\sqrt{2}$ meter
   (B) 2meter

(C) $\sqrt{2}$ meter

(D) none of these

10. The period of revolution of a satellite around a planet of radius R is T. Period of revolution around another planet whose radius is 3R is
(A) T
(B) 3T
(C) 9T
(D) $3\sqrt{3}$ T

11. A synchronous relay satellite reflect TV-signals from one place to the other because its period of revolution is
(A) greater than the period of rotation of earth about its axis
(B) less than the period of rotation of earth
(C) equal to the period of rotation of earth
(D) equal to 86.4 minutes

12. The length of wire is increased by 1 mm on the application of given load. In a wire of the same material but of length and radius twice that of first, an application of the same force extension produced is
(A) 2 mm
(B) 0.5 mm
(C) 4 mm
(D) 0.25 mm

13. The radius of the soap bubble is r and the surface tension of a soap solution is T. Keeping the temperature constant the bubble is blown to twice its diameter. Necessary energy will be
(A) $24\pi r^2 T$
(B) $8\pi r^2 T$
(C) $12\pi r^2 T$
(D) $16\pi r^2 T$

14. A piece of ice having a stone frozen in it floats in a glass vessel filled with water. How will the level of water in the vessel change when the ice melts?
(A) the level will rise
(B) the level will not change
(C) the level will fall
(D) some water will flow out

15. Two pieces of different metals are suspended from the arms of a balance and are found to be in equilibrium when kept immersed in water. The mass of one piece is 32 gm and its density is 8 gm/cc. The density of the other is 5 gm/cc. Then the mass of the other piece is
(A) 28 gms
(B) 35 gms
(C) 31 gms
(D) 33.6 gms

16. Four massless springs of force constant k each are attached to a mass M is displaced in the horizontal direction, then the frequency of oscillation is
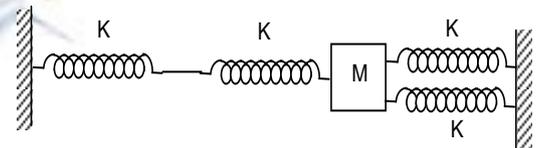
(A) $2\pi \sqrt{\dfrac{2M}{5k}}$
(B) $2\pi \sqrt{\dfrac{5k}{2M}}$
(C) $2\pi \sqrt{\dfrac{k}{5M}}$
(D) $2\pi \sqrt{\dfrac{k}{2M}}$

17. When the displacement is half of the amplitude, then what fraction of total energy of a simple harmonic oscillator is kinetic?
(A) 2/7
(B) 3/4
(C) 2/9
(D) 5/7

18. A sound wave is passing through an air column. During the consequent compressions and rarefactions
(A) Boyle's law is obeyed
(B) density of air remains constant
(C) bulk modulus of air oscillates
(D) there is no heat transfer

19. Two sounding bodies producing progressive waves are given by
$y_1 = 4 \sin 400\, \pi t$, $y_2 = 3 \sin 404\, \pi t$ are situated very near to the ears of a person. He will hear
(A) 2 beats /sec with intensity ratio 49/1
(B) 2 beats /sec with intensity ratio 4/3
(C) 4 beats/sec with intensity ratio 7/ 1
(D) 4 beats /sec with intensity ratio 4/3

20. A, B and C are three tuning forks. The frequency of A is 350 HZ. A and B produce 5 beats/sec, while B and C produce 4 beats/sec when A is loaded with wax, it produces 2 beats/sec with B and 6 beats/sec with C. The frequencies of B and C are
(A) 345, 341
(B) 355, 351
(C) 345, 349
(D) 355, 359

21. There are 4×10^{24} gas molecules in vessel at 50 K temperature. The pressure of the gas in the vessel is 0.03 atmosphere. The volume of the vessel is
(A) 0.1 m^3
(B) 2.0 m^3
(C) 0.45 m^3
(D) 0.98 m^3

22. A gas mixture consists of two moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is
(A) 4RT
(B) 15RT
(C) 3RT
(D) 11RT

23. A clock keeps correct time at 25^{0}C has a pendulum made of a metal. The temperature falls to 0^{0}C. If the coefficient of linear expansion of the metal is 1.9×10^{-5} / ^{0}C, then the number of seconds the clock gains per day is
(A) 10.12 sec
(B) 20.52 sec
(C) 30.75 sec
(D) 41 sec

24. A body in a room cools from 85^{0}C to 80^{0}C in 5 minutes. The time taken to cool from 80^{0}C to 75^{0}C is
(A) 5 minutes
(B) less than 5 minutes
(C) more 5 minute
(D) less or more than 5 minutes depending on the nature.

25. A carnot engine works between temperature 727^{0}C and 27^{0}C. The efficiency of the engine is
(A) 0 %
(B) 30 %
(C) 70 %
(D) 100 %

26. P – V graphs for two gases during adiabatic process are shown in the adjoining diagram plots 1 and 2 should correspond respectively to
(A) He and O$_2$
(B) O$_2$ and He
(C) He and Ar
(D) O$_2$ and N$_2$
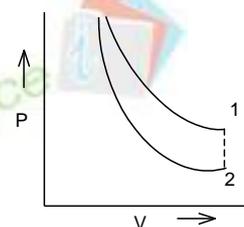
27. There are two identical vessels filled with equal amount of ice. The vessels are of different metals. If the ice melts in the two vessels in 20 and 35 minutes respectively, the ratio of the thermal conductivities of two metals is

(A) $\sqrt{1} : \sqrt{2}$ (B) 49:16
(C) 4 : 7   (D) 7 : 4

28. A small hole is made in the window shutter of a 6m wide room. The height of the image of a tree 30 m from the window formed on the opposite wall is 1m. Then the actual height of the tree is
(A) 5 m   (B) 10 m
(C) 15 m   (D) 2.5 m

29. There is a prism of refractive index equal to $\sqrt{2}$ and the refracting angle equal to 30^0 one of the refracting surfaces of the prism is polished. A beam of monochromatic light will retrace its path if its angle of incidence over the refracting surface of the prism
(A) 0^0 (B) 30^0
(C) 45^0 (D) 60^0

30. The focal length of a lens does not depend upon
(A) radius of curvature of the surfaces   (B) material of the lens
(C) refractive index of the outer medium   (D) the circumference of the lens

31. A double convex lens of focal length 20 cm is made of glass of refractive index 3/2. When placed completely in water ($a^\mu w = 4/3$), the focal length will be
(A) 80 cm   (B) 15 cm
(C) 17.7 cm   (D) 22.5 cm

32. A thin prism P_1 with angle 4^0 and made from glass ($\mu = 1.54$) is combined with another prism P_2 made of another glass of $\mu = 1.72$ to produce dispersion without deviation. The angle of prism P_2 is
(A) 53.3^0 (B) 4^0
(C) 3^0 (D) 2.6^0

33. The astronomical telescope consists of objective and eyepiece. The focal length of the objective is
(A) equal to that of the eye piece   (B) greater than of the eye piece
(C) shorter than that of eye piece   (D) five times shorter than that of eye piece

34. In young's experiments, the ratio of maximum and minimum intensities in the fringe system is 9 : 1. The ratio of amplitudes of coherent sources is
(A) 9 : 1   (B) 3 : 1
(C) 2 : 1   (D) 1 : 1

35. Two slits, 4 mm apart, are illuminated by light of wavelength 6000 A^0. What will be the fringe width on a screen placed 2m from the slits
(A) 0.12 mm   (B) 0.3 mm
(C) 3.0 mm   (D) 4.0 mm

36. Two fixed point charges + 4e and + e are separated by a distance 'a' .Where should a third point charge q be placed for it to be in equilibrium?
(A) 2a/3 from + 4e   (B) a/3 from + 4e
(C) a/4 from + e   (D) 3a/4 from + e

37. A uniform electric field pointing in positive x-direction exists in a region. Let A be the origin, B be the point on the x-axis at x = + 1 cm, C be the point on the y-axis at y = +1 cm. Then the potentials at the points A , B and C satisfy
(A) $V_A < V_B$ (B) $V_A > V_B$

(C) $V_A < V_C$ (D) $V_A > V_C$

38. A 2 microfarad capacitor of a TV is subjected to 4000 V potential difference. The energy stored in capacitor is
(A) 8 J   (B) 16 J
(C) 4 J   (D) 2×10^{-3} J

39. A wire of resistance 1 Ω is stretched to double its length. The resistance will become:
(A) 1/4   (B) 1
(C) 2   (D) 4

40. A current of 2 ampere passes through a cell of e.m.f. 1.5 volt having internal resistance of 0.15 ohm. The potential difference measured, in volt across both the ends of the cell will be
(A) 1.35   (B) 1.50
(C) 1.00   (D) 1.20

CHEMISTRY

1. 5 moles of a gas in a closed vessel was heated from 300K to 600K. The pressure of the gas doubled. The no. of moles of the gas at 600 K
    (A) 5 (B) 2.5
    (c) 10 (D) 20

2, If 5 L of H_2O_2 produces 50 L of O_2 at NTP, H_2O_2 is:
    (A) '50V' (B) '10V'
    (C) '5V' (D) None

3. 500 ml of a 0.1 N solution of $AgNO_3$ is added to 500mL of a 0.1N KCl solution. The concentration of nitrate in the resulting mixture is:
    (A) 0.1 N (B) 0.05 N
    (C) 0.01N (D) 0.2N

4   One faraday of current was passed through the electrolytic cells placed in series containing solution of Ag^+, Ni^{2+} and Cr^{3+} respectively. The ratio of amounts of Ag, Ni and Cr deposited will be: (At. wt. of Ag = 108, Ni = 59, Cr = 52)
    (A) 108 : 29.5 : 17.4 (B) 17.4 : 29.5 : 108
    (C) 1 : 2 : 3 (D) 3 : 2 :1

5. In the electrolysis of H_2O, 11.2 L of H_2 was liberated at cathode at NTP. How much O_2 will be liberated at anode under the same condition?
    (A) 11.2L (B) 22.4L
    (C) 5.6 L (D) 2.8L

6. Which of the following is disproportionation reaction:
    (A) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$ (B) $2ClO_3^- \longrightarrow 2Cl^- + 3O_2$
    (C) $CaCO_3 + 2H^+ \longrightarrow Ca^{2+} + H_2O + CO_2$ (D) none of these

7. A radioactive isotope having a half life of 3 days was received after 12 days. It was found that there were 3 gm of the isotope in the container. The initial weight of the isotope when it was packed: (antilog 1.203 = 16)
    (A) 12 gm (B) 24 gm
    (C) 36 gm (D) 48 gm

8. The ratio of the difference in energy between the first and second Bohr orbit to that between the second and third Bohr orbit is:
    (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{2}$
    (C) $\dfrac{4}{9}$ (D) $\dfrac{27}{5}$

9. A sample of rock from moon contains equal number of atoms of uranium and lead ($t_{1/2}$ for U = 4.5×10^9 Yrs).The age of rock would be:
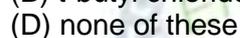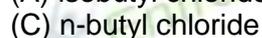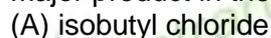
(A) 4.5×10^9 yrs   (B) 9×10^9 yrs.
(C) 13.5×10^9 yrs.   (D) 2.25×10^9 yrs.

10. For a d-electron, the orbital angular momentum is

(A) $\sqrt{6}\ \dfrac{h}{2\pi}$ (B) $\sqrt{2}\ \dfrac{h}{2\pi}$

(C) $\dfrac{h}{2\pi}$ (D) $2\dfrac{h}{2\pi}$

11. Which of the following relates light both as wave motion as well as particle?
(A) Diffraction and interference   (B) Photoelectric effect
(C) $E = mc^2$ (D) $E = h\nu$

12. A gaseous mixture of O_2 and X containing 20 mole % of X, diffuses through a small hole in 234 seconds while pure O_2 take 224 seconds to diffuse through the same hole. The molecular mass of mixture is:
(A) 34.9   (B) 46.6
(C) 32   (D) 44

13. Ratio of rms velocity to average velocity of gas molecules at a particular temperature is
(A) 1.086 : 1   (B) 1 : 1.086
(C) 2 : 1.086   (D) 1.086 : 2

14. Two grams of hydrogen diffuses from a container in 10 min. How many grams of oxygen would diffuse through the same container in the same time under similar condition ?
(A) 0.5 gm   (B) 4 gm.
(C) 6 gm   (D) 8 gm.

15. Vapour pressure of a solvent is 17.5 mm (Hg) while that of its dilute solution is 17.45 mm (Hg).The mole fraction of the solvent is
(A) 0.997   (B) 0.075
(C) 17.48   (D) 0.105

16. The osmotic pressure of the solution is given by relation

(A) $P = \dfrac{RT}{C}$ (B) $P = \dfrac{CT}{R}$

(C) $P = \dfrac{RC}{T}$ (D) $\dfrac{P}{C} = RT$

17. Glucose is added to 1L water to such an extent that $\Delta T_f / k_f$ becomes equal to 10^{-3}, the wt. of glucose ($C_6H_{12}O_6$) added is:
(A) 180gm   (B) 18 gm
(C) 1.8 gm   (D) 0.18 gm

18. An aqueous solution contains 5% and 10% of urea and glucose respectively (by wt). If K_f for water is 1.86. The freezing point of the solution is :
(A) –3.03 K   (B) –3.03 ^{0} C
(C) –6.06^{0}C   (D) None of these

19. Which of the following aqueous solution has osmotic pressure nearest to that of an equi-molar solution of $K_4[Fe(CN)_6]$?
(A) Na_2SO_4 (B) $BaCO_3$
(C) $Al_2(SO_4)_3$ (D) $C_6H_{12}O_5$

20. The decomposition of N_2O_4 into NO_2 is carried out at 280 K in $CHCl_3$. When equilibrium has been established 0.2 mole N_2O_4 and 2×10^{-3} mole of NO_2 are present in 2 Liter solution. The equilibrium constants for the reaction
$N_2O_4 \rightleftharpoons 2NO_2$ is:
(A) 1×10^{-2} (B) 2×10^{-3}
(C) 1×10^{-5} (D) 2×10^{-5}

21. For the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$, the partial pressure of CO_2 and CO are 4 and 8 atm. respectively. K_p for the reaction is:
(A) 16 (B) 2
(C) 0.5 (D) 4

22. The equilibrium constant for the reaction $Br_2 \rightleftharpoons 2Br$ at 500K and 700K are 1×10^{-10} and 1×10^{-5} respectively. The reaction is:
(A) endothermic (B) exothermic
(C) Fast (D) slow

23 1 mL of 0.01N HCl is added to 999 mL solution 0.1 N Na_2SO_4 .The pH of the resulting solution will
(A) 2 (B) 7
(C) 5 (D) 1

24. When equal volumes of the following solution are mixed, precipitation of AgCl $(K_{sp} = 2.8 \times 10^{-10})$ will occur only with:
(A) 10^{-4} M(Ag^+) and 10^{-4} M (Cl^-) (B) 10^{-4} M(Ag^+) and 10^{-5} M (Cl^-)
(C) 10^{-5} M(Ag^+) and 10^{-5} M (Cl^-) (D) in all cases

25. If the pk_b for the fluoride ion at 25° C is 10.83. The ionization constant of the HF in water at this temperature is :
(A) 1.74×10^{-5} (B) 3.52×10^{-3}
(C) 6.75×10^{-4} (D) 5.38×10^{-2}

26. Which of the following is most acidic:
(A) H_2O (B) H_2S
(C) H_2Se (D) H_2Te

27. Which one is correct?
(A) $\Delta G = \Delta H + T\Delta S$ (B) $\Delta G = \Delta H - T\Delta S$
(C) $\Delta G = \dfrac{\Delta H}{T\Delta S}$ (D) $\Delta G = \Delta H \times T\Delta S$

28. Maximum stable carbocation is:
(A) $CH_3 CH_2 \overset{+}{C}(OH) CH_3$ (B) $CH_3 CH_2 \overset{+}{C} H CH_3$
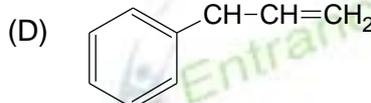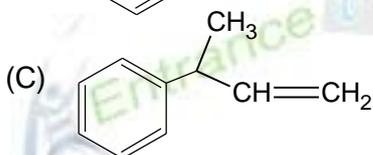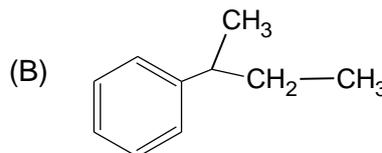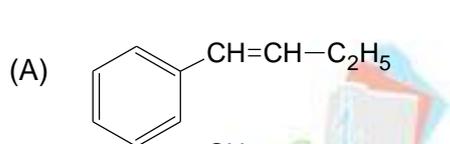(C) $CH_3 CH_2 \overset{+}{C} H_2$ (D) $CH_3 CH_2 CH_2 \overset{+}{C} H_2$

29. Maximum heat of hydrogenation:
    (A) $H_2C = CH - CH_3$ (B) $H_3C - CH = CH - CH_3$
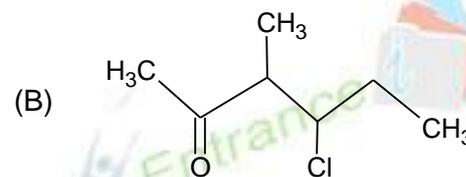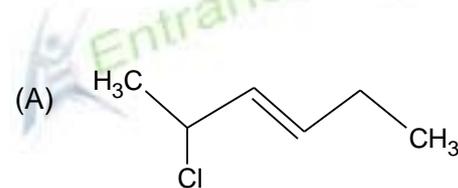   (C) $H_3C - \underset{\underset{CH_3}{|}}{C} = CH_2$ (D) $H_2C = CH_2$
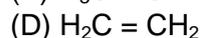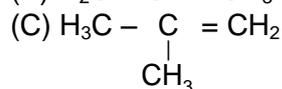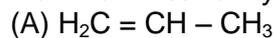
30. Major product in the chlorination of isobutane is:
    (A) isobutyl chloride   (B) t-butyl chloride
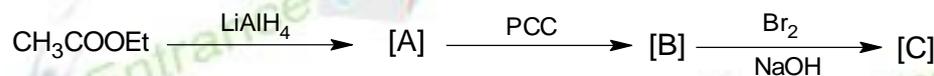   (C) n-butyl chloride   (D) none of these
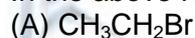
31. Identify A in the given sequence of reaction:

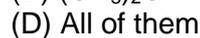
    (A)   (B)

    (C)   (D)

32.

    (A)   (B)

    (C)   (D)

33. $CH_3COOEt \xrightarrow{LiAlH_4} [A] \xrightarrow{PCC} [B] \xrightarrow[NaOH]{Br_2} [C]$
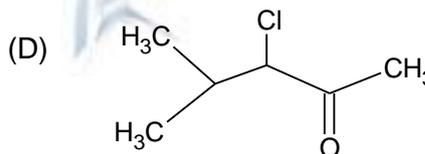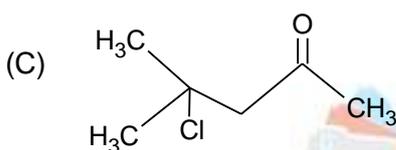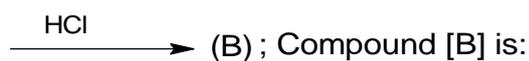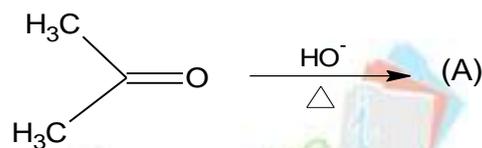
    In the above reaction the compound C is :
    (A) CH_3CH_2Br (B) CH_3COBr
    (C) $CHBr_3$ (D) CH_3COONa
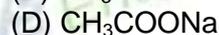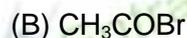
34. Carbyl amine reaction will be given by:
    (A) $CH_3CH_2NH_2$ (B) $(CH_3)_2CHNH_2$
    (C) $(CH_3)_3CNH_2$ (D) All of them
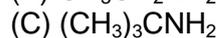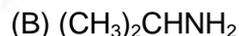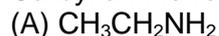
35. CCl_4 + KOH + phenol $\rightarrow$ X;
Which of the following is true for X:
(A) It gives effervescence with $NaHCO_3$ (B) Gives silver mirror with tollen's reagent.
(C) Does not give the blue colour with $FeCl_3$ (D) All of the above

36. In $[Cu(NH_3)_4]SO_4$, copper has following hybridization:
(A) dsp^2 (B) sp^3
(C) $sp^3 d$ (D)sp^2

37. The electro negativity of C, H, O, N and S are 2.5, 2.1, 3.5, 3.0 and 2.5 respectively. Which of following bond is most polar?
(A) O-H   (B) S-H
(C) N-H   (D) C-H

38. Which of the following has minimum no. of unpaired electrons?
(A) O_2 (B) O_2^+
(C) O_2^- (D) O_2^{2-}

39. Molecule having minimum dipole moment is:
(A) CH_3Cl (B) CH_2Cl_2
(C) $CHCl_3$ (D) CCl_4

40. ZnS can be existing in the ……….. structure other than zinc blend structure
(A) BCC   (B) Wurtzite
(C) Simple cubic   (D) Rock salt