PHYSICS

1. If Q be the amount of liquid (viscosity η) flowing per second through a capillary tube of radius r and length l under a pressure difference P, then which of the following relation is correct?

(A) $\frac{\pi Pr^4}{8\eta l}$ (B) $\frac{\pi Pl^4}{8\eta r}$

(C) $\frac{\pi Pr^5}{8\eta l^2}$ (D) none of these

2. The unit of $(\text{velocity})^2$ is equivalent to the unit of

A) $(\text{force})^2$ (B) latent heat

(C) energy (D) heat capacity

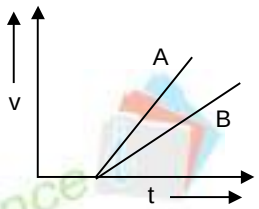
3. Figure shows the velocity time graphs of the two particles A and B. Which of the following statements is true

(A) their relative velocity is zero

(B) their relative velocity is the function of time

(C) if they starting from the same point they will never meet again

(D) both (B) and (C)



4. A man walks in rain with a velocity of 5 km/hr. The rain drops strike at him at an angle of 45^0 with the horizontal. The downward velocity of the rain drops will be

(A) 5 km/hr (B) 4 km/hr

(C) 3 km/hr (D) 1 km/hr

5. A particle is projected with $20\sqrt{2}$ m/sec making an, angle 45^0 with the horizontal the magnitude of the velocity of the particle at time t = 1 sec. after projection

(A) 25 m/sec (B) 20 m/sec

(C) 20 $\sqrt{2}$ m/sec (D) 10 m/sec

6. A particle is moving along the circular path with a speed v and speed start increasing uniformly with acceleration a then net acceleration of the particle at the initial moment

(A) $\sqrt{\left(\frac{v^2}{r}\right)^2 + a^2}$ (B) $\frac{v^2}{r}$

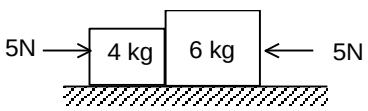
(C) a (D) $\sqrt{\left(\frac{v^2}{r}\right)^2 - a^2}$

7. The shortest time over which a car can be brought to rest by applying brakes is 10 second. If its speed is made two times, the car can be brought to rest in time t equal to

(A) 10 sec (B) 15 sec

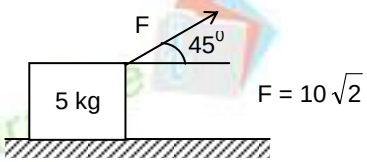
(C) 20 sec (D) 5 sec

8. Two blocks of mass 4 kg and 6 kg are placed in contact with each other on a frictionless horizontal surface as shown in figure. If we apply a force of 5N on 6 kg and another force of 5N on 4 kg in opposite direction. The contact force between 4 kg and 6 kg block is



(A) 5N (B) 4N
(C) 2N (D) zero

9. A block of mass 5 kg is kept at rest on a smooth horizontal plane. A force of $10\sqrt{2}$ N act on the block as shown in figure till its speed becomes 20 m/sec. Find the work done by this force during this time



(A) 500 Joule (B) 1000 Joule
(C) 250 Joule (D) 300 Joule

10. A heavy block of mass m is slowly placed on a conveyer belt moving with a speed V. The coefficient of friction between the block and belt is μ. Through what distance will the block slide on the belt

(A) $v / \mu g$ (B) $\frac{v^2}{\mu g}$

(C) $\frac{v}{2\mu g}$ (D) $\frac{v^2}{2\mu g}$

11. A fireman of mass 50 kg is holding a vertical pole. The coefficient of static friction between his hands and the pole is 0.5. If he is able to climb up the pole what is the minimum force with which he should press the pole with his hand
(A) 1000 N (B) 500 N
(C) 250 N (D) 350 N

12. A trolley of mass 100 kg is moving with 20 m/sec, sand is poured into it at the rate of 60 kg per minute. How much force is required to keep it moving with same speed
(A) 20 N (B) 10 N
(C) zero (D) 5 N

13. A body falls freely under gravity. Its velocity is V when it has lost potential energy equal to u. What is the mass of the body
(A) u^2 / V^2 (B) $2u^2 / V^2$
(C) $2u / V^2$ (D) u / V^2

14. A rod of mass m and length L is lying on a horizontal table. The work done in rising its one end $L / \sqrt{2}$ from the horizontal is

(A) $mgL / 2$ (B) $\frac{mgL}{2\sqrt{2}}$

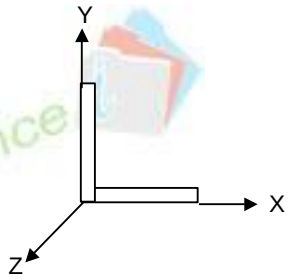
(C) mgL (D) $\frac{mgL}{4}$

15. If the coefficient of restitution be 0.5 what is the percentage loss of energy on each rebounding of a ball dropped from a height
(A) 12.5% (B) 25%
(C) 50% (D) 75%

16. Two man are carrying a uniform bar of length L, on their shoulders. The bar is held horizontally such that younger man gets one-third load. Suppose the younger man is at the end of the bar, what is the distance of the other man from that end
(A) L/3 (B) L/2

(C) 2L/3 (D) 3L/4

17. Two uniform thin identical rods each of mass M and length L are joined together to form a L shape, if this system is rotated about Z-axis as shown in figure then the moment of inertia of the system is



(A) $\frac{ML^2}{3}$ (B) $\frac{ML^2}{12}$

(C) $\frac{2ML^2}{3}$ (D) $\frac{2ML^2}{4}$

18. What is the maximum speed at which a car can turn round a curve of 30 m radius on a level road if the coefficient of friction between the tyres and the road is 0.4 and g = 10 m/sec^2
(A) 5 m/sec (B) 11 m/sec
(C) 17 m/sec (D) 21 m/sec

19. A body is moving along a circular path with constant speed. Which of the following statement about its motion is true
(A) the body is in equilibrium (B) no work is done on the body
(C) the tangential acceleration is not zero (D) the velocity of the body is constant

20. The mass of a planet is double the mass of earth and its radius is half as compared to that of the earth the acceleration due to gravity at the planet is. (Assuming g = 10 m/sec^2 on earth surface)
(A) 40 m/sec^2 (B) 20 m/sec^2
(C) 10 m/sec^2 (D) 80 m/sec^2

21. A satellite of mass m is orbiting around the earth at a height equal to the radius of the earth (R) from the earth surface. Its potential energy is given by
(A) – 2 mgR (B) – mgR
(C) $\frac{-mgR}{2}$ (D) $\frac{-mgR}{4}$

22. A projectile is fired making angle θ with the vertical. What is the ratio of potential energy to the kinetic energy of the projectile at the highest points of its path?
(A) $\sin^2\theta$ (B) $\cos^2\theta$
(C) $\cot^2\theta$ (D) $\tan^2\theta$

23. A rifle bullet loses 1/20 th of its velocity in passing through a plank. The least number of such planks required just to stop the bullet is
(A) 5 (B) 10
(C) 11 (D) 20

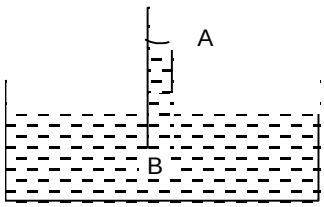
24. An iron bar of length L and area of cross-section A is heated from 20^0C to 80^0C. The bar is held between two rigid supports. It the stress developed in the bar be S, then S is
(A) independent of A and L (B) $S \propto 1/L$
(C) $S \propto A^2$ (D) $S \propto 1/A$

25. A long string is stretched by 0.2 cm. The energy stored per unit volume is 0.25 J/m^3. If it is stretched by 1.0 cm, the potential energy/unit volume stored in it will be
(A) 0.01 J/m^3 (B) 0.05 J/m^3
(C) 1.25 J/m^3 (D) 6.25 J/m^3

26. A body floats in water with one fourth of its volume above the surface of water. If placed in oil it floats with one third of its volume above the surface of oil. The specific gravity of the oil is
(A) 2/3 (B) 3/4
(C) 4/3 (D) 9/8

27. Liquid flows through a horizontal tube of variable diameter. The pressure is maximum where
(A) velocity is minimum (B) velocity is maximum
(C) diameter is maximum (D) both velocity and diameter are maximum

28. Figure shows a capillary tube dipped in a liquid of surface tension T. Which rises in it. If the radius of the tube be r and θ be the angle of contact then pressure difference between the points A and B is



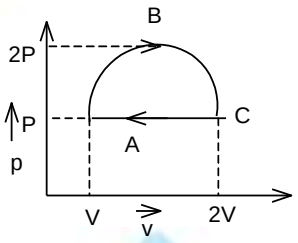
(A) $\frac{T}{r}\cos\theta$ (B) $\frac{2T}{r}\cos\theta$
(C) $Tr\cos\theta$ (D) $2T\,r\cos\theta$

29. A wooden cube floats in water with 2 cm of it above the water level. When a 200 g mass is placed on the cube, it just submerges in water. The length of each side of the cube is
(A) 6 cm (B) 8 cm
(C) 10 cm (D) 12 cm

30. For the hydrogen gas C_P/C_V is equal to a and for oxygen gas C_P/C_V is equal to b, the ratio of a and b is
(A) $\frac{25}{21}$ (B) $\frac{15}{12}$
(C) $\frac{7}{5}$ (D) $\frac{3}{5}$

31. One mole of an ideal gas requires 207 Joule heat to rise the temperature by 10 K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperature by the same 10 K the heat required is (Given the gas constant R = 8.3 J/mol K)
(A) 198.7 J (B) 29 J
(C) 215.3 J (D) 124 J

32. A sample of ideal monoatomic gas taken round the cycle ABCA as shown in figure. The work done during the cycle is



(A) $\frac{\pi PV}{2}$ (B) πPV
(C) πP^2 (D) πV^2

33. A perfect black body emits radiation at temperature $T_1{}^0K$. If it is to radiate 16 time the previous radiation. Its temperature T_2 will be
(A) $T_2 = 2T_1$ (B) $T_2 = 16T_1$
(C) $T_2 = 4T_1$ (D) $T_2 = 3T_1$

34. A gas is compressed at a constant pressure of 50 N/m^2 from a volume of $10m^3$ to a volume of $4m^3$. Energy of 100 Joule is then added to the gas by heating. Its internal energy is
(A) increased by 400 J (B) increased by 200 J
(C) increased by 100 J (D) decreased by 200 J

35. Steam is passed into 22 g of water at 20^0C. The mass of water that will be present when the water acquires a temperature of 90^0C (Lalent heat of steam is 540 cal/g) is
(A) 24.8 g (B) 24 g
(C) 36.6 g (D) 30.0 g

36. One glass of milk gives a boy 5000 calories. How much height he can climb by using this energy, if his efficiency is 28%? (mass of boy is 60 kg)
(A) 2.5 m (B) 5 m
(C) 10 m (D) 15 m

37. The rates of cooling of two identical liquids put in exactly similar calorimeters and kept in identical surroundings are the same if
(A) the masses of the liquid are equal
(B) equal masses of the liquids at the same temperature are taken.
(C) different volumes of the liquids
(D) equal volumes of the liquids at the same temperature are taken.

38. The kinetic energy of one gram molecule of a gas at normal temperature and pressure is (R = 8.31 J/mole – k)
(A) 0.56×10^4 J (B) 1.3×10^2 J
(C) 2.7×10^2 J (D) 3.4×10^3 J

39. The length and radii of two rods made of same material are in the ratio 1 : 2 and 2 : 3 respectively. If the temperature difference between the ends for the two rod be same, then in the steady state the amount of heat flowing per second through them will be in the ratio
(A) 1 : 3 (B) 4 : 3
(C) 8 : 9 (D) 3 : 2

40. The distance between two points differing in phase by 60^0 on a wave velocity 360 m/sec and frequency 500 HZ is
(A) 24 cm (B) 12 cm
(C) 6 cm (D) 1 cm

CHEMISTRY

1. What will be the % of N_2H_4 that has reacted with water in solution, when 0.32 gm of N_2H_4 are dissolved in water and the total volume was made 4L (given kb for $N_2H_4 = 6 \times 10^{-8}$ m)
(A) 3 % (B) 3.6 %
(C) 2 % (D) 0.489%

2. The reaction A + B $\rightleftharpoons$ C + D is studied in one liter vessel at 250 ^{0}C. The initial concentration of A was 3n and that of B was n. When equilibrium was attained equilibrium concentration of C was found to be equal to the equilibrium concentration of B then concentration of D at equilibrium will be
(A) $\frac{n}{2}$ (B) $\left(3n - \frac{1}{2}\right)$
(C) $\left(n - \frac{n}{2}\right)$ (D) n

3. Which of the following behaviour is true for an ideal binary liquid solution.
(A) plot of P_{total} v/s $1/Y_A$ (mole fraction of A in vapour phase) is linear.
(B) plot of P_{total} v/s $1/Y_B$ is linear.
(C) plot of $1/P_{total}$ vs $1/Y_A$ is linear.
(D) plot of P_{total} v/s $1/(Y_A)$ is linear.

4. For the reaction N_2O_4 (g) $\rightleftharpoons$ $2NO_2$ (g) the relation connecting the degree of dissociation (α) of N_2O_4 (g) with the equilibrium constant K_p is
(A) $\alpha = \frac{K_p/p}{4 + K_p/p}$ (B) $\alpha = \frac{K_p}{4 + K_p}$
(C) $\alpha = \left(\frac{K_p/p}{4 + K_p/p}\right)^{1/2}$ (D) $\alpha = \left(\frac{K_p}{4 + K_p}\right)^{1/2}$

5. A metal crystallizes into two cubic faces (FCC) and (BCC) whose unit cell lengths are 3.5 $\overset{0}{A}$ and 3.0 $\overset{0}{A}$ respectively. The ratio of densities of FCC and BCC will be
(A) 1.26 (B) 3.14
(C) 2.18 (D) 4.26

6. An organic compound crystallises in an orthorhombic system with two molecules per unit cell. The unit cell dimensions are 12.05, 15.05 and 2.69 $\overset{0}{A}$. If the density of the crystal is 1.419 g cm^{-3}, then molar mass of compound will be
(A) 207 g mol^{-1} (B) 209 g mol^{-1}
(C) 308 g mol^{-1} (D) 317 g mol^{-1}

7. 50gm of saturated aqueous solution of potassium chloride at 30 ^{0}C is evaporated to dryness, when 13.2 gm of dry KCl was obtained. The solubility of KCl in water at 30 ^{0}C is
(A) 35.87 g (B) 25.62 g
(C) 28.97 g (D) 27.81 g

8. $_{92}U^{235}$ belongs to group III B of periodic table. If it loses one α-particle, then the new element will belong to group.
(A) I B (B) III B
(C) II B (D) IV B

9. According to Bohr's theory the energy required for an electron in He^+ ion to be emitted from n = 2 state is
(A) 10.2 eV (B) 13.6eV
(C) 3.4 eV (D) 27.2 eV

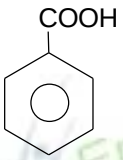
10. One mole of potassium dichromate completely oxidises which of the following number of mole(s) of ferrous oxalate in acidic medium.
(A) 1 (B) 4
(C) 2 (D) 6

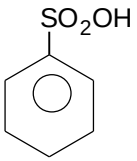
11. An alkane C_5H_{12} gives only one monochloro substitution product. It is
(A) 2,2-dimethyl propane (B) 3-methyl pentane
(C) Isopentane (D) Either of these

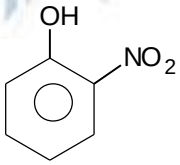
12. A chemist wishes to prepare a buffer solution of pH = 2.90 that efficiently resists a change in pH yet contains only small concentration of buffering agent. Which one of the following weak acid along with its salt would be best to use.
(A) m-clolorobenzoic acid (pK_a = 3.98) (B) Acetoacetic acid (pK_a = 3.58)
(C) 2, 5-dihydroxybenzoic acid (pK_a = 2.97) (D) p-chlorocinnamic acid (pK_a= 4.41)

13. C - Cl bond of cholorobenzene in comparision to C - Cl bond of methyl chloride is
(A) longer and weaker (B) Shorter and stronger
(C) Shorter and weaker (D) Longer and stronger

14. Which of the following is not soluble in sodium carbonate solution
(A) 

(B) 

(C) 

(D) 

15. The ion which when added to silver nitrate does not produce a precipitate.
(A) I^- (B) F^-
(C) CrO_4^{2-} (D) CO_3^{2-}

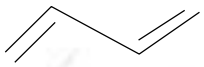
16 The first five ionization energies of an element are respectively 801, 2428, 3661, 25033 and 32836 in KJ/mol then the element could be
(A) A halogen (B) A third group element
(C) A noble gas (D) A second group element

17. The cumulated alkadiene is

(A) 

(B) 

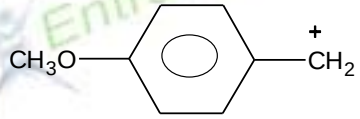
(C) 

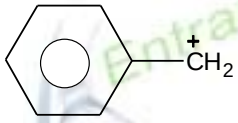
(D) 

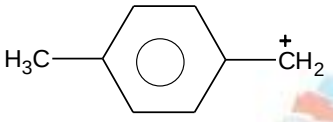
18. The dipole moments of diatomic molecules AB and CD are 10.41 and 10.27 Debye respectively while their bond distances are 2.82 & 2.67 $\overset{0}{A}$, respectively. Then
(A) Bonding is nearly covalent in both the molecules.
(B) Bonding is 100% ionic in both the molecule.
(C) AB has more ionic character than CD.
(D) AB has lesser ionic bond character than CD.

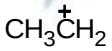
19. For the gas phase decomposition, $A \rightarrow 2B$, the rate constant is 6.93×10^{-3} min^{-1} at 300K. The percentage of A remaining at the end of 300 minutes is
(A) 75 (B) 50
(C) 25 (D) 12.5

20. Out of

1. 

2. 

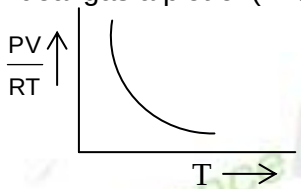
3. 

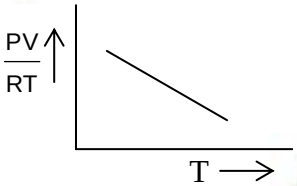
4. 

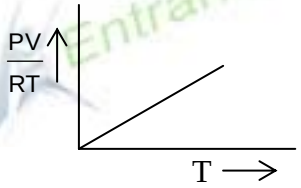
Relative stabilities order are
(A) 4 < 2 < 3 < 1 (B) 2 < 4 < 3 < 1
(C) 4 < 2 < 1 < 3 (D) 2 < 4 < 1 < 3

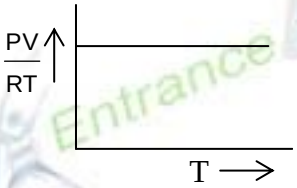
21. $K_w(H_2O)$ at 25^0C is 1×10^{-14}. Dissociation constant of $2H_2O \rightleftharpoons H_3O^+ + {}^-OH$ is
(A) 1.8×10^{-16} (B) 10^{-14}
(C) 55.5 (D) 18

22. For an ideal gas a plot of (PV/RT) v/s T will look like

(A) 

(B) 

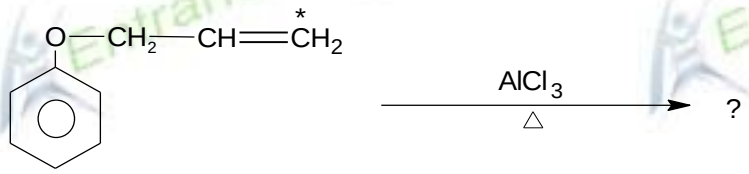
(C) 

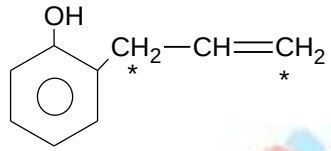
(D) 

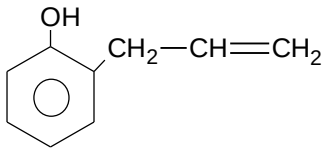
23. The pairs of compounds which cannot exist together in solution is
(A) $NaHCO_3$ and NaOH (B) Na_2CO_3 and NaOH

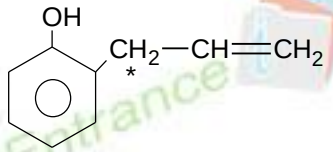
(C) Na_2CO_3 and $NaHCO_3$ (D) $NaHCO_3$ and NaCl

24. The hydration energy of Mg^{2+} is greater than
(A) Al^{3+} (B) Na^+
(C) Be^{2+} (D) Mg^{3+}

100. 

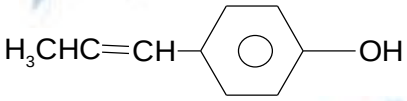
(A) 

(B) 

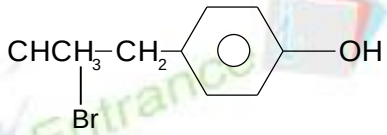
(C) 

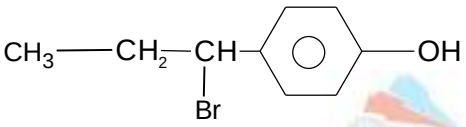
(D) none

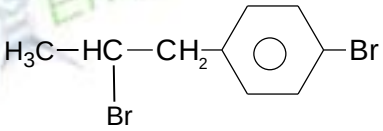
26. The reaction of

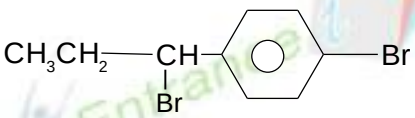


with HBr gives

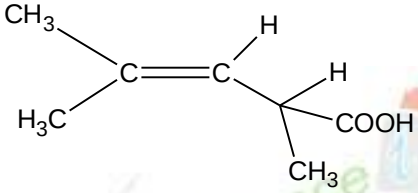
(A) 

(B) 

(C) 

(D) 

27. The structure shows



(A) geometrical isomerism (B) optical isomerism
(C) geometrical and optical isomerism (D) tautomerism

28. The standard reduction potential values of three metallic cations X, Y & Z are 0.52, -3.03 and -1.18 V respectively. The order of reducing power of corresponding metals is
(A) Y > Z > X (B) X > Y > Z
(C) Z > Y > X (D) Z > X > Y

29. $^{14}C_6$ is a beta – active nucleus. A sample of $^{14}CH_4$ gas kept in a closed vessel shows increase in pressure with time. This is due to the
(A) formation of $^{14}NH_3$ and H_2 (B) formation of $^{11}BH_3$ and H_2
(C) formation of $^{14}C_2H_4$ and H_2 (D) formation of $^{12}CH_3$, $^{14}NH_2$ and H_2

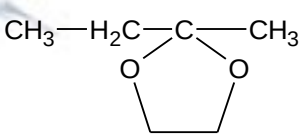
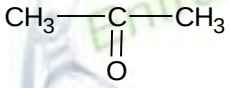
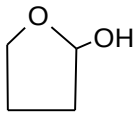
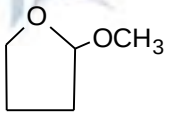
30. pK_a (NH_4^+) = 9.26. 500 mL of 0.01 M NH_4OH solution will have pH = 8.26 if X mol of $(NH_4)_2SO_4$ is added. X is
(A) 005 mol (B) 0.005 mol
(C) 0.025 mol (D) 0.10 mol

31. If the solubility of calcium phosphate (mol. Wt = M) in water at 25 ^{0}C is w gm/100 mL, its solubility product at 25 ^{0}C is
(A) $10^9\left(\frac{w}{M}\right)^5$ (B) $10^7\left(\frac{w}{M}\right)^5$
(C) $10^5\left(\frac{w}{M}\right)^5$ (D) $10^3\left(\frac{w}{M}\right)^5$

32. Among the following the compound that is both coloured and paramagnetic is
(A) $K_2Cr_2O_7$ (B) $(NH_4)_2[TiCl_6]$
(C) $VOSO_4$ (D) $K_3[Cu(CN)_4]$

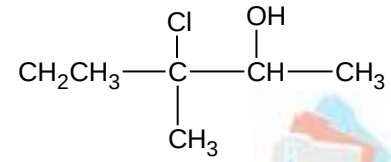
33. The Cl – C – Cl bond angle in 1, 1, 2, 2 – tetrachloro ethene and tetrachloro methane respectively will be about
(A) 120^0 and 109.5^0 (B) 90^0 and 109.5^0
(C) 109.5^0 120^0 (D) 109.5^0 and 90^0

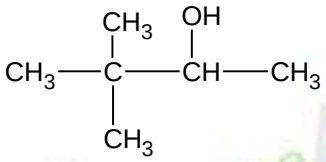
34. Which halide is not oxidized by MnO_2?
(A) F^- (B) Br^-
(C) Cl^- (D) I^-

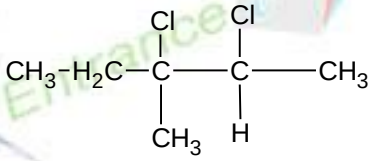
35. Which of the following would readily give Tollen's test?
(A) 
(B) 
(C) 
(D) 

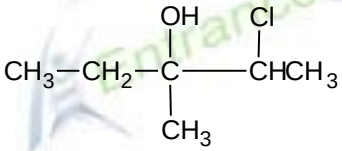
36. Ozonolysis of  gives
(A) Butane-1-4-dione (B) Butane-1-4-dial
(C) Butanoic acid (D) none

37. 3-methyl-2-pentene on reaction with HOCl gives

(A) 

(B) 

(C) 

(D) 

38. 30 gm $AgNO_3$ is added with 0.37 mole of KCl. The no. of moles of ppt produced will be [atomic wt. of Ag = 108]
(A) 0.37
(B) 0.1765
(C) 0.2572
(D) 0.739

39. What is the equivalent weight of MnO_2 when it reacts with dil. HCl and liberates Cl_2 gas [atomic weight of Cl = 35.5, Mn = 55]
(A) 43.5
(B) 87
(C) 21.75
(D) none of these

40. Oxidation no. of chlorine atoms in Ca(OCl)Cl
(A) – 1
(B) +1, – 1
(C) 0
(D) – 1, 0