

**Atomic Structure**

1. Arrange the following particles in increasing order of value of  $e/m$  ratio: Electron (e) proton (p) neutron (n) and  $\alpha$  - particle ( $\alpha$ ) -

- (a) n, p, e,  $\alpha$       (B) n,  $\alpha$ , p, e      (C) n, p,  $\alpha$ , e      (D) e, p, n,  $\alpha$

Ans. (B)

2. When the atoms of gold sheet are bombarded with a beam of  $\alpha$  - particles, only a few  $\alpha$  - particles get deflected whereas most of them go straight undeflected. This is because -

- (A) The force of attraction on the  $\alpha$  - particles by the oppositely charged electron is not sufficient  
(B) The nucleus occupies much smaller volume as compared to the volume of atom  
(C) The force of repulsion on fast moving  $\alpha$  - particles is very small  
(D) The neutrons in the nucleus do not have any effect on  $\alpha$  - particles.

Ans

3. Rutherford's experiment on scattering of alpha particles showed for the first time that atom has -

- (A) Electrons      (B) Protons      (C) Nucleus      (D) Neutrons

Ans. (C)

4. The wavelength of two photons are  $2000\text{\AA}$  and  $4000\text{\AA}$  respectively. What is the ratio of their energies

- (A)  $1/4$       (B) 4      (C)  $1/2$       (D) 2

Ans. (D)

5. There are three energy levels in an atom. How many spectral lines are possible in its emission spectra

- (A) One      (B) Two      (C) Three      (D) Four

Ans. (C)

6. Which of the following transitions will emit the photons of highest frequency in hydrogen atom

- (A) From  $n = 1$  to  $n = 2$   
(B) From  $n = 2$  to  $n = 1$   
(C) From  $n = 2$  to  $n = 6$   
(D) From  $n = 6$  to  $n = 2$

Ans. (B)

7. The wave number of the first line of Balmer series of hydrogen is  $15200\text{ cm}^{-1}$ . The wave number of the first Balmer line of  $\text{Li}^{2+}$  ion is -

- (A)  $15200\text{ cm}^{-1}$       (B)  $60800\text{ cm}^{-1}$       (C)  $76000\text{ cm}^{-1}$       (D)  $136800\text{ cm}^{-1}$

Ans. (D)

8. The energy of electron in first Bohr's orbit of H - atom is - 13.6 eV. What will be its potential energy in  $n = 4^{\text{th}}$  orbit -

- (A) - 13.6 eV      (B) - 3.4 eV      (C) - 0.85 eV      (D) - 1.70 eV

Ans. (D)

9. The frequency of first line of Balmer series in hydrogen atom is  $\nu_0$ . The frequency of corresponding line emitted by singly ionised helium atom is -

- (A)  $2\nu_0$       (B)  $4\nu_0$       (C)  $\nu_0/2$       (D)  $\nu_0/4$

Ans. (B)

10. Splitting of spectral line in presence of a magnetic field is called -

- (A) Stark effect      (B) Zeeman effect      (C) Raman effect      (D) Compton effect

Ans. (B)

11. If the planck's constant  $h = 6.6 \times 10^{-34}$ Js, the de- Broglie wavelength of a particle having momentum of  $3.3 \times 10^{-24}$ kg m s<sup>-1</sup> will be -

- (A) 0.002 Å      (B) 0.02 Å      (C) 0.2 Å      (D) 2Å

Ans. (D)

12. K.E. of the electron is  $4.55 \times 10^{-25}$ J. Its de Broglie wave length is -

- (A) 4700 Å      (B) 8300 Å      (C) 7200 Å      (D) 7400 Å

Ans. (C)

13. If uncertainty in position and momentum are equal, the uncertainty in velocity is -

- (A)  $\sqrt{h/2\pi}$       (B)  $\frac{1}{2m}\sqrt{h/\pi}$       (C)  $\sqrt{h/\pi}$       (D) None

Ans. (B)

14. If uncertainty in the position of an electron is zero, the uncertainty in its momentum would be

- (A) Zero      (B)  $< h/(4\pi)$       (C)  $> h/(4\pi)$       (D) Infinite

Ans. (D)

15. Electron density in an orbital is correctly described by -

- (A)  $\Psi^2$       (B)  $\Psi$       (C)  $|\Psi^2|\Psi$       (D) None

Ans. (A)

16. The maximum number of atomic orbitals associated with a principal quantum number 5 is -

- (A) 9      (B) 12      (C) 16      (D) 25

Ans. (D)

17. Which of the following statements is not correct -

- (A) The shape of an atomic orbital depends on the azimuthal quantum number  
(B) The orientation of an atomic orbital depends on the magnetic quantum number  
(C) The energy of an electron in an atomic orbital of multi electron atom depends on the principal quantum number  
(D) The number of degenerate atomic orbitals of one type depends on the values of azimuthal and magnetic quantum numbers

Ans. (C)

18. Correct set of four quantum numbers for the outermost electron of rubidium ( $Z = 37$ ) is

- (A) 5, 0, 0,  $\frac{1}{2}$       (B) 5,1,0,1/2      (C) 5,1,1,1/2      (D) 6,0,0,1/2

Ans. (A)

19. If the electronic structure of oxygen atom is written as  $1s^2, 2s^2$  it would violate -

- (A) Hund's rule      (B) Paulis exclusion principle  
(B) Both Hund's and Pauli's principles      (D) None of these

Ans. (A)

20. The energy of an electron of  $2p_y$  orbital is -

- (A) Greater than  $2p_x$  orbital  
(B) Less than  $2p_z$  orbital  
(C) Equal to 2s orbital  
(D) Same as that of  $2p_x$  and  $2p_z$  orbitals

Ans. (D)

## Periodic Table

1. The number of elements in fourth long period is -

- (A) 18                      (B) 8                      (C) 32                      (D) 10

Ans. (A)

2. which of the following elements having highest density -

- (A) K                      (B) Fe                      (C) V                      (D) Ti

Ans. (B)

3. Which element has highest atomic volume-

- (A) Ra                      (B) Cs                      (C) Fr                      (D) None of these

Ans. (C)

4. what will be the atomic volume when we move left to right along the second period -

- (A) Increases                      (B) First increases then decreases  
(C) Decreases and then increases                      (D) None of these

Ans. (C)

5. Which of the following have highest vander wall's radius -

- (A) F<sub>2</sub>                      (B) Cl<sub>2</sub>                      (C) Br<sub>2</sub>                      (D) None

Ans. (C)

6. Which of the following atom has smallest size -

- (A) He                      (B) F                      (C) H                      (D) None of these

Ans. (C)

7. Which of the following atom has largest size -

- (A) Cs                      (B) Fr                      (C) Kr                      (D) Xe

Ans. (B)

8. In C, N, O F which of the following order is correct for I.P -

- (A) F > O > C > N    (B) O > F > N > C    (C) F > N > O > C    (D) N > F > O > C

Ans. (C)

9. Which of the following has highest metallic character -

Element	I.P.
(A) 1	16.2 eV
(B) 2	1.5 eV
(C) 3	12.2 eV
(D) 4	10.5 eV

Ans. (B)

10. Which of the following element has highest reducing strength -

- (A) F                      (B) Cl                      (C) Br                      (D) I

Ans. (D)

11. Which of the following element has the highest value of electron affinity -

- (A) Fluorine                      (B) Chlorine                      (C) Bromine                      (D) Iodine

Ans. (B)

12. Give the correct order of electronegativity of central atom in following compounds -

CH <sub>3</sub> - CH <sub>3</sub> ,	CH <sub>2</sub> = CH <sub>2</sub>	CH ≡ CH
(a)	(b)	(c)

The correct order is -

- (A) a > b > c    (B) C > a > b    (C) c > b > a    (D) b > c > a

Ans. (C)

13. what will be the electropositive character when we move from left to right in a period  
 (A) Increases (B) Decreases (C) No change (D) First increases then decreases  
 Ans. (B)
14. which is not the correct order of electronegativity –  
 (A)  $\text{Cl} > \text{S} > \text{P} > \text{Si}$  (B)  $\text{Si} > \text{Al} > \text{Mg} > \text{Na}$  (C)  $\text{F} > \text{Cl} > \text{Br} > \text{I}$  (D) None of these  
 Ans. (D)

## Chemical Bonding

1. Which of the following is/are electron deficient compounds -  
 (A)  $\text{NaBH}_4$  (B)  $\text{B}_2\text{H}_6$  (C)  $\text{AlCl}_3$  (D)  $\text{C}_3\text{H}_8$   
 Ans. (B, C)
2. Out of following which has maximum value of lattice energy -  
 (A)  $\text{NaF}$  (B)  $\text{NaCl}$  (C)  $\text{NaBr}$  (D)  $\text{NaI}$   
 Ans. (A)
3. Out of the following which one have strongest bond -  
 (A)  $\text{KCl}$  (B)  $\text{Cl}_2$  (C)  $\text{HF}$  (D)  $\text{CCl}_4$   
 Ans. (A)
4. Which of the following is most covalent -  
 (A)  $\text{AlF}_3$  (B)  $\text{AlCl}_3$  (C)  $\text{AlBr}_3$  (D)  $\text{AlI}_3$   
 Ans. (D)
5. Among  $\text{LiCl}$ ,  $\text{BeCl}_2$ ,  $\text{BCl}_3$  and  $\text{CCl}_4$ , the covalent bond character follows the order -  
 (A)  $\text{LiCl} < \text{BeCl}_2 > \text{BCl}_3 > \text{CCl}_4$  (B)  $\text{LiCl} > \text{BeCl}_2 < \text{BCl}_3 < \text{CCl}_4$   
 (C)  $\text{LiCl} < \text{BeCl}_2 < \text{BCl}_3 < \text{CCl}_4$  (D)  $\text{LiCl} > \text{BeCl}_2 > \text{BCl}_3 > \text{CCl}_4$   
 Ans. (C)
6. Which one has a co - ordinate bond  
 (A)  $\text{Al}_2\text{Cl}_6$  (B)  $\text{BF}_3$  (C)  $\text{NaCl}$  (D)  $\text{O}_2$   
 Ans. (A)
7.  $\text{NH}_3$  and  $\text{BF}_3$  combine readily because of the formation of -  
 (A) A covalent bond (B) A hydrogen bond  
 (C) A co - ordinate bond (D) An ionic bond  
 Ans. (C)
8. I following which central atom has different hybridisation than other -  
 (A)  $\text{Cl}_2\text{O}$  (B)  $\text{OF}_2$  (C)  $\text{H}_2\text{O}$  (D)  $\text{SO}_2$   
 Ans. (D)
9. In following hydrocarbon which one has 75% p character and 25% s charater -  
 (A)  $\text{C}_2\text{H}_4$  (B)  $\text{C}_2\text{H}_2$  (C)  $\text{CH}_4$  (D)  $\text{CH}_2$   
 Ans. (C)
10. Out of following which ion is planar  
 (A)  $\text{CO}_3^{2-}$  (B)  $\text{NH}_4^+$  (C)  $\text{BF}_4^-$  (D) None  
 Ans. (A)
11. Molecular shapes of  $\text{SF}_4$ ,  $\text{CF}_4$  and  $\text{XeF}_4$  are -

- (A) The same with 2, 0 and 1 I.p of electrons respectively  
 (B) The same with 1, 1 and 1 I.p. of electrons respectively  
 (C) Different with 0, 1 and 2 I.p. of electrons respectively  
 (D) Different with 1, 0 and 2 I.p of electrons respectively

Ans. (D)

12. T - type shape is exhibited by the molecule

- (A)  $ClF_3$  (B)  $CHCl_3$  (C)  $CCL_4$  (D)  $PCl_5$

Ans. (A)

13. Compound with maximum ionic character is formed from -

- (A) Na and Cl (B) Cs and F (C) Cs and I (D) Na and F

Ans. (B)

14. Compound having highest M. Pt-

- (A)  $BeCl_2$  (B)  $MgCl_2$  (C)  $CaCl_2$  (D)  $SrCl_2$

Ans. (D)

15. Out of following which one has maximum ionic character -

- (A)  $NaCl$  (B)  $KCl$  (C)  $CaCl_2$  (D)  $MgCl_2$

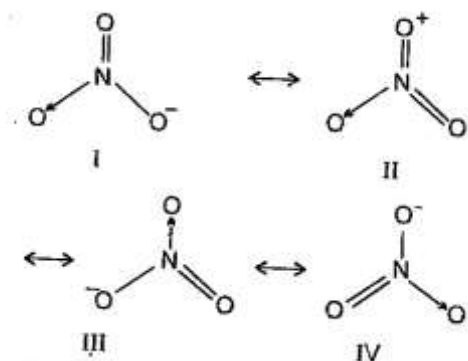
Ans. (B)

16. The geometry of  $H_2S$  and its dipole moment are-

- (A) Angular and non - zero (B) Angular and zero  
 (C) Linear and non-zero (D) Linear and zero

Ans. (A)

17. Which of the following lewis structure do not contribute in resonance -



- (A) I (B) II (C) III (D) IV

Ans. (B)

18. Allyl cyanide has -

- (A) 9 sigma bonds and 4 pi bonds  
 (B) 9 sigma bonds, 3 pi bonds and 1 lonepairs  
 (C) 8 sigma bond and 5 pi bonds  
 (D) 8 sigma bonds, 3 pi bonds and 4 non-bonding electrons

Ans. (B)

19. Which can not be explained by VBT

- (A) Overlapping (B) Bond formation  
 (C) Paramagnetic nature of oxygen (D) Shapes of molecules

Ans. (C)

20. The hybridization of carbon atoms ion  $C - C$  single bond of  $H - C \equiv C - CH = CH_2$  is

- (A)  $sp^3 - sp^3$  (B)  $sp^2 - sp$  (C)  $sp - sp^2$  (D)  $sp^3 - sp$

Ans. (C)

21. The hybridization and geometry of  $\text{BrF}_3$  molecule are –

- (A)  $sp^3d$  and distorted trigonal bipyramidal  
 (B)  $sp^3d^2$  and Tetragonal  
 (C)  $sp^3d$  and bent  
 (D) *None*

Ans. (A)

22. Which does not have  $sp$  hybridized underlined atom –

- (A)  $\underline{\text{Xe}}\text{F}_2$  (B)  $\underline{\text{C}}_2\text{H}_2$  (C)  $\underline{\text{C}}\text{O}_2$  (D)  $\underline{\text{Be}}\text{H}_2$

Ans. (A)

23. The bond order of  $\text{N}_2^-$  anion is –

- (A) 1 (B) 2 (C) 2.5 (D) 3

Ans. (C)

24. Which of the following has maximum bond strength –

- (A)  $\text{O}_2^-$  (B)  $\text{O}_2^+$  (C)  $\text{O}_2$  (D)  $\text{O}_2^{2-}$

Ans. (B)

25. Which have odd bond order –

- (A)  $\text{O}_2^+$  (B)  $\text{O}_2^-$  (C)  $\text{NO}$  (D) all

Ans. (D)

26. Which one of the following does not have intermolecular H – bonding –

- (A)  $\text{H}_2\text{O}$  (B) o – Nitrophenol (C) HF (D)  $\text{CH}_3$

Ans. (B)

27. maximum number of H – bonds that can be formed by a water molecule is –

- (A) 2 (B) 3 (C) 4 (D) 6

Ans. (C)

28. In which molecule is the Vander Walls force likely to be most important in determining m.p. and b.p

- (A)  $\text{ICl}$  (B)  $\text{Br}_2$  (C)  $\text{H}_2\text{S}$  (D) CO

Ans. (B)

## Stoichiometry

1. When the same amount of zinc is treated separately with excess to sulphuric acid and excess to sodium hydroxide, the ratio of volumes evolved is

- (a) 1:1 (b) 1:2 (c) 2:1 (d) 9:4

Solution: (a)

2. 2.76g of silver carbonate on being strongly heated yields a residue weighing

- (a) 2.16 g (b) 2.48 g (c) 2.32g (d) 2.64g

Solution: (c)

3. A gaseous mixture contains oxygen and nitrogen in the ratio of 1: 4 by weight. Therefore, the ratio of their number of molecules is

- (a) 1:4 (b) 1:8 (c) 7:32 (d) 3:16

Solution: (c)

4. The total number of electrons in one molecule of carbon dioxide is  
(a) 22 (b) 44 (c) 66 (d) 88

Solution: (a)

5. The number of neutrons in dipositive zinc ion with mass number 70 is  
(a) 34 (b) 36 (c) 38 (d) 40

Solution: (d)

6. The largest number of molecules is in  
(a) 36 g of water (b) 28 g of carbon monoxide  
(c) 46 g of ethyl alcohol (d) 54 g of nitrogen pentoxide

Solution: (a)

7. If 0.50 mol  $BaCl_2$  is mixed with 0.20 mol of  $Na_3PO_4$ , the maximum number of moles of  $Ba_3(PO_4)_2$  that can be formed is

(a) 0.70 (b) 0.50 (c) 0.20 (d) 0.10

Solution: (d)

8. A molal solution is one that contains one mole of a solute in  
(a) 1000 g of the solvent (b) one litre of the solvent  
(c) one litre of the solution (d) 22.4 litres of the solution

Solution: (a)

9. the equivalent weight of  $MnSO_4$  is half its molecular weight when it is converted to

(a)  $Mn_2O_3$  (b)  $MnO_2$  (c)  $MnO_4^-$  (d)  $MnO_4^{2-}$

Solution: (b)

10. In which mode of expression, the concentration of solution remains independent of temperature?

(a) molarity (b) normality (c) formality (d) molality

Solution: (d)

11. The number of moles of  $KMnO_4$  that will be needed to react completely with one mole of ferrous oxalate in acidic solution is

(a)  $\frac{3}{5}$  (b)  $\frac{2}{5}$  (c)  $\frac{4}{5}$  (d) 1

Solution: (a)

12. The normality of 0.3 M phosphorous acid ( $H_3PO_3$ ) is

(a) 0.1 (b) 0.9 (c) 0.3 (d) 0.6

Solution: (d)

13. The reaction  $3ClO_{(aq)}^- \rightarrow ClO_{3(aq)}^- + 2Cl_{(aq)}^-$  is an example of

(a) oxidation reaction (b) reduction reaction  
(c) disproportionation reaction (d) decomposition reaction

Solution: (c)

14. An aqueous solution of 6.3 g of oxalic acid dehydrate is made up to 250 ml. the volume of 0.1 N  $NaOH$  required to completely neutralize 10 ml of this solution is

(a) 40 ml (b) 20 ml (c) 10 ml (d) 4 ml

Solution: (a)

15. In the standardization of  $Na_2S_2O_3$  using  $K_2Cr_2O_7$  by idometry, the equivalent weight of  $K_2Cr_2O_7$  is

(a) (molecular weight)/2 (b) (molecular weight)/6  
(c) (molecular weight)/3 (d) same as molecular weight

Solution: (b)

16. How many moles of electron weight one kilogram ?

(a)  $6.023 \times 10^{23}$

(b)  $\frac{1}{9.108} \times 10^{31}$

(c)  $\frac{6.023}{9.108} \times 10^{54}$

(d)  $\frac{1}{9.108 \times 6.023} \times 10^8$

Solution: (d)

17. Which has maximum number of atoms?

(a) 24 g of C (12)

(b) 56 g of Fe (56)

(c) 27 g of Al (27)

(d) 108 g of Ag (108)

Solution: (a)

18. Mixture X containing 0.02 mol of  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$  and 0.02 mol of  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$  was prepared in 2 litre of solution1 litre of mixture X + excess  $\text{AgNO}_3 \rightarrow \text{Y}$ 1 litre of mixture X + excess  $\text{BaCl}_2 \rightarrow \text{Z}$ 

No. of moles of Y and Z are

(a) 0.01, 0.01

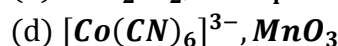
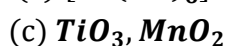
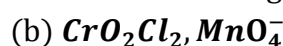
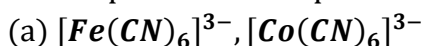
(b) 0.02, 0.01

(c) 0.01, 0.02

(d) 0.02, 0.02

Solution: (a)

19. The pair of the compounds in which both the metals are in the highest possible oxidation state is



Solution: (b)

20. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is

(a) 3

(b) 4

(c) 5

(d) 6

Solution: (d)

## Gaseous State

1. At a constant temperature when the pressure of certain mass of gas is doubled, its volume is -

(A) Double

(B) Halved

(C) Increases

(D) Remains same

Ans. (B)

2. How many times the temp. of a gas would increase when the RMS velocity of gas molecules in a closed vessel of fixed volume is increased from  $5 \times 10^4 \text{ cms}^{-1}$  to  $10 \times 10^4 \text{ cms}^{-1}$ 

(A) 4 times

(B) 16 times

(C) 2 times

(D) 8 times

Ans. (A)

3. How many litres would 5 moles of  $\text{H}_2$  occupy at  $25^\circ\text{C}$  and 2 atm pressure -

(A) 61.20 litres

(B) 61.09 litres

(C) 30.50 litres

(D) 30.60 litres

Ans. (B)

4. A certain mass of gas occupies a volume of 10 litres at 300 K and 1 atm. Pressure. Which of the following changes does not produce a change in the volume of the gas -

(A) Pressure doubles and absolute temperature halved

(B) Doubling of both pressure and absolute temperature

(C) Pressure unchanged and absolute temperature halved

(D) Pressure halved and absolute temperature doubled

Ans. (B)

5. Equal weights of ethane and hydrogen are mixed in an empty container at  $25^{\circ}\text{C}$ . Determine the fraction of the total pressure exerted by hydrogen –

- (A) 16/30                      (B) 15/16                      (C) 30/16                      (D) 16/15

Ans. (B)

6. 2.8 g of  $\text{N}_2$ , 2.8 g  $\text{CO}$ , 4.4 g  $\text{CO}_2$  are found to exert a pressure of 700 Torr. Find partial pressure of  $\text{N}_2$  gas in the mixture –

- (A) 280.8 Torr.              (B) 233.3 Torr.              (C) 300 Torr.              (D) None of these

Ans. (B)

7. 50 ml of  $\text{H}_2$  diffuses in 20 minutes. 45 ml of  $\text{O}_2$  under same conditions diffuses in –

- (A) 220 min.              (B) 32 min.              (C) 72 min.              (D) 64 min.

Ans. (C)

8. Which of the following gases has the highest rate of diffusion –

- (A)  $\text{NH}_3$                       (B)  $\text{NO}_2$                       (C)  $\text{CO}_2$                       (D)  $\text{O}_2$

Ans. (A)

9. A bottle of dry  $\text{NH}_3$  and a bottle of dry HCl connected through a long tube are opened simultaneously at both ends. The white ammonium chloride ring first formed will be –

- (A) Near the ammonia bottle                      (B) Near the hydrogen chloride bottle  
(C) At the centre of the tube                      (D) Through out the length of the tube

10. Calculate average kinetic energy, in joules of the molecules in 8.0 g of methane at  $27^{\circ}\text{C}$  –

- (A) 8169.75 Joules      (B) 1869.75 Joules      (C) 6189.57 Joules      (D) 9186.57 joules

Ans. (B)

11. Calculate the RMS velocity of a gas with average velocity 45475 cm/sec –

- (A) 45.475 cm/sec.      (B) 92.131 cm/sec.      (C) 49.330 cm/sec.      (D) 20.259 cm/sec.

Ans. (C)

12. Which of the following expression does not give RMS velocity

- (A)  $\left(\frac{3P}{d}\right)^{\frac{1}{2}}$                       (B)  $\left(\frac{3P}{DM}\right)^{\frac{1}{2}}$                       (C)  $\left(\frac{3RT}{M}\right)^{\frac{1}{2}}$                       (D)  $\left(\frac{3PV}{M}\right)^{\frac{1}{2}}$

Ans. (B)

13. At a given temperature and volume, the pressure of a gas obeying Vander Waal's gas is –

- (A) Equal to that of an ideal gas                      (B) Less than that of an ideal gas  
(C) More than that of an ideal gas                      (D) None of the above

Ans. (B)

14. In vander Waal's equation of state for a non ideal gas, the term that account for intermolecular forces is –

- (A)  $\left(P + \frac{a}{V^2}\right)$                       (B)  $(V - b)$                       (C)  $RT$                       (D)  $RT^{-1}$

Ans. (A)

15. The values of van der Waal's constant for the gases  $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{NH}_3$ , and  $\text{CH}_4$  are 1.360, 1.350, 4.170 and  $2.252 \text{ L}^2 \text{ atm mol}^{-2}$  respectively. The gas which cannot be easily liquefied is –

- (A)  $\text{NH}_3$                       (B)  $\text{CH}_2$                       (C)  $\text{N}_2$                       (D)  $\text{H}_2$

Ans. (C)

16. Which set of conditions represents the easiest way to liquefy a gas-

- (A) Low temp. and high pressure                      (B) High temp. and low pressure  
(C) High temp. and high pressure                      (D) Low temp. and low pressure

Ans. (A)

## Liquid Solutions

Choose the correct option/s. one or more options may be correct

1. According to Raoult's law the relative decrease in the solvent vapor pressure over the solution is equal to

- (a) The mole fraction of the solvent
- (b) The mole fraction of the solute
- (c) The number of moles of the solute
- (d)  $i$  times the mole fraction of the solute which undergoes dissociation or association in the solvent ( $i$  = vant' Hoff factor)

Solution: b, d

2. The pressure of the water vapor of a solution containing a nonvolatile solute is 2% below that of the vapor of pure water. The molality of the solution is

- (a) 1.134
- (b) 0.1134
- (c) 1.051
- (d) 0.0975

Solution: a

3. Which of the following statements are correct for a binary solution which shows negative deviation from Raoult's law?

- (a) The negative deviation from linearity diminishes and tends to zero as the concentration of the solution component approaches unity
- (b) When solutions form their volumes are smaller than the sum of the volumes of their components
- (c) Heat is released during the formation of the solution
- (d) Heat is evolved during the formation of the solution

Solution: a, b, c

4. Which of the following aqueous solutions has the highest boiling point ?

- (a)  $0.1 - M KNO_3$
- (b)  $0.1 - M Na_3PO_4$
- (c)  $0.1 - M BaCl_2$
- (d)  $0.1 - M K_2SO_4$

Solution: b

5. Which of the following have been arranged in decreasing order of freezing point?

- (a)  $0.05 - M KNO_3 > 0.04 - M CaCl_2 > 0.140 - M \text{ sugar} > 0.075 - M CuSO_4$
- (b)  $0.04 - M BaCl_2 > 0.140 - M \text{ sucrose} > 0.075 - M CuSO_4 > 0.05 - M KNO_3$
- (c)  $0.075 - M CuSO_4 > 0.140 - M \text{ sucrose} > 0.04 - M BaCl_2 > 0.05 - M KNO_3$
- (d)  $0.075 - M CuSO_4 > 0.05 - M NaNO_3 > 0.140 - M \text{ sucrose} > 0.04 - M BaCl_2$

Solution: a

6. Among the following, the solution which shows the highest osmotic pressure is

- (a)  $0.05 - M NaCl$
- (b)  $0.10 - M BaCl_2$
- (c)  $0.05 - M FeCl_3$
- (d)  $0.05 - M Na_2SO_4$

Solution: b

7. The osmotic pressures of equimolar solutions of  $BaCl_2$ ,  $NaCl$  and  $C_{12}H_{22}O_{11}$  will be in the order

- (a)  $NaCl > C_{12}H_{22}O_{11} > BaCl_2$
- (b)  $BaCl_2 > NaCl > C_{12}H_{22}O_{11}$
- (c)  $NaCl > BaCl_2 > C_{12}H_{22}O_{11}$
- (d)  $C_{12}H_{22}O_{11} > NaCl > BaCl_2$

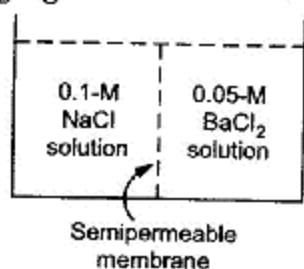
Solution: b

8. Ten grams of glucose ( $\pi_1$ ), 10 g of urea ( $\pi_2$ ) and 10 g of sucrose ( $\pi_3$ ) are dissolved in 250 mL of water at 300 K. ( $\pi$  = osmotic pressure of solution). The relationship between the osmotic pressure of the solutions is

- (a)  $\pi_1 > \pi_2 > \pi_3$
- (b)  $\pi_3 > \pi_1 > \pi_2$
- (c)  $\pi_2 > \pi_1 > \pi_3$
- (d)  $\pi_2 > \pi_3 > \pi_1$

Solution: c

9. Study the following figure, and choose the correct options



(a) There will be no movement of any solution across the membrane

(b)  $BaCl_2$  will flow towards the  $NaCl$  solution

(c)  $NaCl$  will flow towards the  $BaCl_2$  solution

(d) The osmotic pressure of  $0.1 - M NaCl$  is higher than the osmotic pressure of  $0.05 - M BaCl_2$ , assuming complete dissociation of electrolyte

Solution: b, d

10. Which of the following pairs of solutions can be expected to be isotonic at the same temperature?

(a)  $0.1 - M urea$  and  $0.1 - M NaCl$  (b)  $0.1 - M urea$  and  $0.2 - M MgCl_2$

(c)  $0.1 - M NaCl$  and  $0.1 - M Na_2SO_4$  (d)  $0.1 - M Ca(NO_3)_2$  and  $0.1 - M Na_2SO_4$

Solution: d

11. If a solute undergoes dimerization and trimerization, the minimum values of the van't Hoff factors are

(a) 0.50 and 1.50

(b) 1.50 and 1.33

(c) 0.50 and 0.33

(d) 0.25 and 0.67

Solution: c

12. In which of the following pairs of solutions will the values of the van't Hoff factor be the same?

(a)  $0.05 - M K_4[Fe(CN)_6]$  and  $0.10 - M FeSO_4$

(b)  $0.10 - M K_4[Fe(CN)_6]$  and  $0.05 - M FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$

(c)  $0.20 - M NaCl$  and  $0.10 - M BaCl_2$

(d)  $0.05 - M FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$  and  $0.02 - M$

$KCl \cdot MgCl_2 \cdot 6H_2O$

Solution: b, d

13. A solution containing  $0.8716 \text{ mol L}^{-1}$  of sucrose at 298 K is iso-osmotic with a solution of sodium chloride containing  $0.5 \text{ mol L}^{-1} NaCl$ . The degree of dissociation of  $NaCl$  is

(a) 0.743

(b) 0.894

(c) 0.876

(d) 0.943

Solution: a

14. An aqueous solution of  $NaCl$  freezes at  $-0.186^\circ C$ . given that  $K_b^{H_2O} = 0.512 \text{ kg mol}^{-1}$  and  $K_f^{H_2O} = 1.86 \text{ K kg mol}^{-1}$ . The elevation in boiling point of this solution is

(a) 0.0585 K

(b) 0.0512 K

(c) 1.864 K

(d) 0.0265 K

Solution: b

## Solid State

1. Potassium metal crystallizes in the form of a body-centered cubic structure. The number of nearest-neighbor atoms for each potassium atom in the solid is

- (a) Four                      (b) Six                      (c) Twelve                      (d) Eight

Solution: d

2. A compound contains two types of atoms-X and Y. it crystallizes in a cubic lattice with atoms X at the corners of the unit cell and atoms Y at the body centers. The simplest possible formula of this compound is

- (a)  $X_8Y$                       (b)  $X_2Y$                       (c)  $XY$                       (d)  $XY_8$

Solution: c

3. The fluorite structure shows 8:4 coordination. Which of the following solids show fluorite-like lattices?

- (a)  $CaF_2$                       (b)  $SrCl_2$  (c)  $BaF_2$                       (d)  $ThO_2$

Solution: a, b

4.  $NiO$  adopts a rock-salt structure. The coordination number of the  $Ni^{2+}$  ion is

- (a) Two                      (b) Four                      (c) Twelve                      (d) Six

Solution: d

5. The h.c.p. and c.c.p. structure for a given element would be expected to have

- (a) The same coordination number (b) The same density  
(c) The same packing fraction                      (d) All of the above

Solution: d

6. Which of the following expressions is correct for a  $CsCl$  unit cell with lattice parameter  $a$ ?

- (a)  $r_{Cs}^+ + r_{Cl}^- = 2a$                       (b)  $r_{Cs}^+ + r_{Cl}^- = \frac{a}{\sqrt{2}}$   
(c)  $r_{Cs}^+ + r_{Cl}^- = \frac{\sqrt{3}}{2}a$                       (d)  $r_{Cs}^+ + r_{Cl}^- = \frac{3a}{2}$

Solution: c

7. In a  $ZnS$  structure

- (a) All the octahedral sites are occupied  
(b) All the tetrahedral sites are occupied  
(c) Only one-eighth of the tetrahedral sites are occupied  
(d) Only 5/3 of the tetrahedral sites are occupied

Solution: b

8. Which of the following statements are correct for the rock-salt structure?

- (a) The tetrahedral sites are smaller than the octahedral sites  
(b) The octahedral sites are occupied cations and the tetrahedral sites are empty  
(c) The radius ratio is 0.732  
(d) The radius ratio is 0.999

Solution: a, c

9. When the radius ratios lie between 0.732 and 0.414, the arrangement of the crystal is

- (a) Tetrahedral                      (b) Octahedral  
(c) Linear                      (d) Cubic

Solution: b

10. The Schottky defect arises due to

- (a) A cation vacancy in the crystal lattice  
(b) An anion vacancy in the crystal lattice

(c) Cation as well as anion vacancy in the crystal lattice

(d) All of these

Solution: c

11. If a cation leaves a site in a solid lattice, and is located at an interstitial position, the lattice defect is a/an

(a) Interstitial defect

(b) Valancy defect

(c) Frenkel defect

(d) Schottky defect

Solution: c

12. Which of the following statements are correct?

(a) The coordination number of each type of ion in a **CsCl** crystal is eight

(b) A metal that crystallizes in a b.c.c. structure has a coordination number of twelve

(c) A unit cell of an ionic crystal shares some of its ions with other unit cells

(d) The length of the unit cell in **NaCl** is 552 pm (given that  $r_{Na^+} = 95 \text{ pm}$  and  $r_{Cl^-} = 181 \text{ pm}$ )

Solution: a, c

13. Iron crystallizes in a b.c.c. system with a lattice parameter of **2.861 Å**. Calculate the density of iron in the b.c.c. system (atomic weight of **Fe = 56**,  $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )

(a) **7.92 g mL<sup>-1</sup>**

(b) **8.96 g mL<sup>-1</sup>**

(c) **2.78 g mL<sup>-1</sup>**

(d) **6.72 g mL<sup>-1</sup>**

Solution: a

14. The effective nuclear charge of **Na<sup>+</sup>** and **F<sup>-</sup>** ions are 6.50 and 4.50 respectively. If

$r_{Na^+} + r_{F^-} = 231 \text{ pm}$ , calculate the radii of the **Na<sup>+</sup>** ion and **F<sup>-</sup>** ion

(a)  $r_{Na^+} = 94.5 \text{ pm}$ ,  $r_{F^-} = 46.5 \text{ pm}$

(b)  $r_{Na^+} = 94.5 \text{ pm}$ ,  $r_{F^-} = 136.5 \text{ pm}$

(c)  $r_{Na^+} = 136.5 \text{ pm}$ ,  $r_{F^-} = 94.5 \text{ pm}$

(d)  $r_{Na^+} = 36.0 \text{ pm}$ ,  $r_{F^-} = 92.0 \text{ pm}$

Solution: b

## Chemical equilibrium

1. Which one is heterogenous reaction-

(A)  $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(B)  $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(C)  $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

(D) None

Ans. (C)

2. A chemical reaction is said to attain equilibrium when -

(A) Reactants get completely converted into products

(B) Same amount of reaction and product are formed

(C) The rate of forward reaction becomes equal to the rate of backward reaction

(D) Concentration of reaction and products are same

Ans. (C)

3. Which statements is true for chemical equilibrium -

(A) State of reversible reaction at which concentration of reactant become equal to concentration of product

(B) State of reversible reaction at which concentration of reactant become half or product

(C) State of reversible reaction at which exchange free energy becomes positive

(D) State of reversible reaction at which concentration of reaction and concentration of product becomes unchanged

Ans. (D)

4. For a gas reaction,  $3H_2(g) + N_2(g) \rightleftharpoons 2NH_3(g)$ , the partial pressure of  $H_2$  and  $N_2$  are 0.4 and 0.8 atmosphere, respectively. The total pressure of the entire system is 2.8 atmosphere. What will be the value of  $K_p$  if all the concentration are given in atmosphere? What will be the value of  $K_p$  if all the concentration are given in atmosphere

(A)  $32 \text{ atm}^{-2}$  (B)  $20 \text{ atm}^{-2}$  (C)  $50 \text{ atm}^{-2}$  (D)  $80 \text{ atm}^{-2}$

Ans. (C)

5. If 1 mole of acetic acid and 1 mole of ethyl alcohol are mixed together and the reaction proceeds to the equilibrium, the concentration of acetic acid and water are found to be  $1/3$  and  $2/3$  mole respectively. The equilibrium constant will be

(A) 2.0 (B) 3.0 (C) 6.0 (D) 4.0

Ans. (D)

6. The reaction  $A+B \rightleftharpoons C + D$  proceeds to right hand side upto 99.9%. the equilibrium constant  $K$  for the reaction will be

(A)  $10^4$  (B)  $10^5$  (C)  $10^6$  (D)  $10^8$

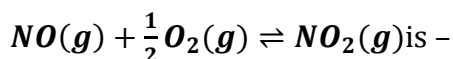
Ans. (C)

7. The equilibrium constant for the esterification of  $CH_3COOH$  and  $C_2H_5OH$  at room temperature is 4. How much ester will be present in the mixture if 120 g of  $CH_3COOH$  and 92 g of  $C_2H_5OH$  are taken

(A) 110 g (B) 122 g (C) 120 g (D) 117 g

Ans. (D)

8. For the reaction,  $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$ ,  $K_c = 1.8 \times 10^{-6}$  at  $185^\circ C$ . At  $185^\circ C$ , the value of  $K_c$  for the reaction -



(A)  $0.9 \times 10^6$  (B)  $7.5 \times 10^2$  (C)  $1.95 \times 10^{-3}$  (D)  $1.95 \times 10^3$

Ans. (B)

9.  $K_p$  for the reaction  $A(g) + 2B(g) \rightleftharpoons 3C(g) + D(g)$ ; is 0.05 atm. What will be its  $K_c$  at 1000 K in terms of R -

(A)  $\frac{5 \times 10^{-5}}{R}$  (B)  $\frac{R}{5 \times 10^{-5}}$  (C)  $5 \times 10^{-5} R$  (D) None of these

Ans. (A)

10. In which of the following reaction, the value of  $K_p$  will be equal to  $K_c$  -

(A)  $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$  (B)  $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(C)  $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$  (D)  $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

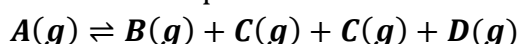
Ans. (A)

11. The vapour density of  $N_2O_4$  at a certain temperature is 30. The percentage dissociation of  $N_2O_4$  at this temperature is -

(A) 55.5% (B) 60% (C) 70% (D) 53.3%

Ans. (D)

12. An unknown compound A dissociation at  $500^\circ C$  to give products as follows-



Vapour density of the equilibrium mixture is 50 when it dissociate to the extent to 10% what will be the molecular weight of compound A -

(A) 120 (B) 130 (C) 134 (D) 140

Ans. (A)

13. The equilibrium constant for the reaction  $H_2(g) + S(s) \rightleftharpoons H_2S(g)$ ; is 18.5 at 935 K and 9.25 at 1000 K respectively. The enthalpy of the reaction will be –

- (A)  $-68000.05 \text{ J mol}^{-1}$  (B)  $-71080.57 \text{ J mol}^{-1}$   
 (C)  $-80071.75 \text{ J mol}^{-1}$  (D)  $57080.75 \text{ J mol}^{-1}$

Ans. (B)

14. Consider the reaction  $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ ; in closed container at equilibrium. What would be the effect of addition of  $CaCO_3$  on the equilibrium concentration of  $CO_2$  –

- (A) Increases (B) Decreases (C) Remains unaffected  
 (D) Data is not sufficient to predict it

Ans. (C)

15. In the melting of ice, which one of the condition will be more favorable

- (A) High temperature and high pressure (B) Low temperature and low pressure  
 (C) Low temperature and high pressure (D) High temperature and low pressure

Ans. (A)

16. In the reaction  $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) + X \text{ cal}$ , most favourable condition of temperature and pressure for greater yield of  $SO_3$  are –

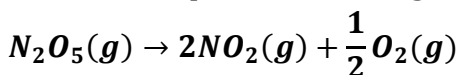
- (A) Low temperature and low pressure (B) High temperature and low pressure  
 (C) High temperature and high pressure (D) Low temperature and high pressure

Ans. (D)

## Chemical Kinetics

Choose the correct option/s. one or more options may be correct

1. The decomposition of nitrogen pentoxide can be represented as

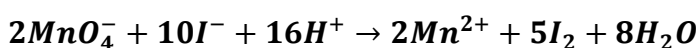


The rate of the reaction can be expressed as

- (a)  $-\frac{d[N_2O_5]}{dt} = 2 \frac{d[NO_2]}{dt} = \frac{1}{2} \frac{d[O_2]}{dt} = k[N_2O_5]$   
 (b)  $\frac{1}{2} \frac{d[N_2O_5]}{dt} = \frac{1}{2} \frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt} = k[N_2O_5]$   
 (c)  $-\frac{d[N_2O_5]}{dt} = \frac{1}{2} \frac{d[NO_2]}{dt} = 2 \frac{d[O_2]}{dt} = k[N_2O_5]$   
 (d)  $-\frac{d[N_2O_5]}{dt} = \frac{1}{2} \frac{d[NO_2]}{dt} = 2 \frac{d[O_2]}{dt} = k[N_2O_5]$

Solution: c

2. The instantaneous rate of disappearance of the  $MnO_4^-$  ion in the following reaction is  $4.56 \times 10^{-3} \text{ M s}^{-1}$



The rate of appearance of  $I_2$  is

- (a)  $1.14 \times 10^{-3} \text{ M s}^{-1}$  (b)  $5.7 \times 10^{-3} \text{ M s}^{-1}$   
 (c)  $4.56 \times 10^{-4} \text{ M s}^{-1}$  (d)  $1.14 \times 10^{-2} \text{ M s}^{-1}$

Solution: d

3. Which of the following statements are correct?

- (a) The order of reaction is the sum of the components of all the concentration terms in the rate equation  
 (b) The order of reaction with respect to one reactant is the ratio of the change of logarithm of the rate of the reaction to the change in the logarithm of the concentration of the particular reactant, keeping the concentrations of all other reactants constant  
 (c) Orders of reactions can be whole number or fractional numbers  
 (d) The order of a reaction can only be determined from the stoichiometric equation for the reaction

Solution: a, b, c

4. For a reaction  $I^- + OCl^- \rightarrow IO^- + Cl^-$ , in an aqueous medium, the rate of reaction is given by

$$\frac{d[IO^-]}{dt} = k \frac{[I^-][OCl^-]}{[OH^-]}$$

The overall order of the reaction is

- (a) -1                      (b) 1                      (c) zero                      (d) 2

Solution: b

5. The unit of the rate of reaction is the same as that of the rate constant for a

- (a) zero-order reaction                      (b) first-order reaction  
 (c) second-order reaction                      (b) half-order reaction

Solution: a

6. The half-life periods of decomposition of  $PH_3$  for different initial pressures are given below

$p(\text{torr})$	707	79	37.5
$t_{1/2}(\text{min.})$	84	84	84

The order of the reaction is

- (a) one                      (b) zero                      (c) half                      (d) two

Solution: a

7. In a chemical reaction  $A \rightarrow B$ , it is found that the rate of reaction doubles when the concentration of A is increased four times. The order of the reaction with respect to A is

- (a) zero                      (b) half                      (c) one                      (d) two

Solution: b

8. Which of the following reactions is of the first order?

- (a) The decomposition of ammonium nitrate in an aqueous solution  
 (b) The inversion of cane-sugar in the presence of an acid  
 (c) The acidic hydrolysis of ethyl acetate  
 (d) All radioactive decays

Solution: a, b, c, d

9. Calculate the half-life of the first-order reaction



If the initial pressure of  $C_2H_4O(g)$  is 80 mm and the total pressure at the end of 20 minutes is 120 mm

- (a) 40 min                      (b) 120 min                      (c) 20 min                      (d) 80 min

Solution: c

10. For a reaction following first-order kinetics, which of the following statements are correct?

- (a) The time taken for the concentration of 75% of the reaction complete to is twice  $t_{1/2}$   
 (b) A plot of the reciprocal of the concentration of the reactants against time gives a straight line

- (c) The degree of dissociation is equal to  $(1 - e^{-kt})$   
 (d) A plot of  $[A]_0/[A]$  versus time gives a straight line

Solution: c

11. The activation energy of a reaction may be lowered by  
 (a) decreasing the temperature (b) increasing the temperature  
 (c) adding a catalyst (d) decreasing the potential energy

Solution: c

12. In an exothermic reaction  $X \rightarrow Y$ , the activation energy is  $100 \text{ kJ mol}^{-1}$  of X. the enthalpy of the reaction is  $140 \text{ kJ mol}^{-1}$ . The activation energy of the reverse reaction  $Y \rightarrow X$  is

- (a)  $40 \text{ kJ mol}^{-1}$  (b)  $340 \text{ kJ mol}^{-1}$   
 (c)  $240 \text{ kJ mol}^{-1}$  (d)  $100 \text{ kJ mol}^{-1}$

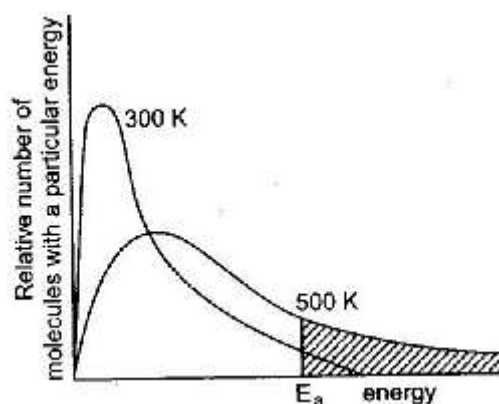
Solution: c

13. The rate constant, the activation energy and the Arrhenius parameter of a chemical reaction at  $25^\circ\text{C}$  are  $8.0 \times 10^{-4} \text{ s}^{-1}$ ,  $112 \text{ kJ mol}^{-1}$  and  $4 \times 10^{15} \text{ s}^{-1}$  respectively. The value of the rate constant as  $T \rightarrow \infty$  is

- (a)  $8 \times 10^{16} \text{ s}^{-1}$  (b)  $4 \times 10^4 \text{ s}^{-1}$   
 (c)  $4 \times 10^{15} \text{ s}^{-1}$  (d)  $112 \times 10^{12} \text{ s}^{-1}$

Solution: c

14. The distribution of molecular energy at two temperature is as shown in the following graph



Which of the following conclusions are correct?

- (a) The number of molecules with energy  $E_a$  or greater is proportional to the shaded area for each temperature  
 (b) The number of molecules with energy  $E_a$  or less is proportional to the shaded area for each temperature  
 (c) The number of molecules with energy  $E_a$  is the mean of all temperatures  
 (d) The graph follows the Maxwell-Boltzmann energy distribution law

Solution: a, d

15. It is often stated that, near the room temperature, a reaction rate doubles if the temperature increases by  $10^\circ\text{C}$ . Calculate the activation energy of a reaction that obeys this rule exactly

- (a) 12.4 kcal (b) 24.8 kcal (c) 6.2 kcal (d) 49.6 kcal

Solution: a

16. Which of the following statements is correct for the activation energy of a reaction?

- (a) It increases with increase in temperature  
 (b) When activation energy is zero the rate constant is temperature-dependent  
 (c) It decreases with decrease in temperature  
 (d) It is nearly independent of temperature, over a wide range

Solution: d

## Chemical Energetics

1. A sample of gas is compressed by an average pressure of 0.50 atmosphere so as to decrease its volume from  $400 \text{ cm}^3$  to  $200 \text{ cm}^3$ . During the process 8.00 J of heat flows out to surrounding. Calculate the change in internal energy of the system.

Ans. = 2.13 Joule

2. The heat of combustion of naphthalene ( $\text{C}_{10}\text{H}_8(\text{s})$ ) at constant volume was measured to be  $-5133 \text{ kJ mol}^{-1}$  at 298 K. Calculate the value of enthalpy change (Given  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ).

Ans. = 5137955.14 Joule

3. Determine the enthalpy change for the reaction

$\text{CH}_4(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{CH}_3\text{Cl}(\text{g}) + \text{HCl}(\text{g})$  bond energies for  $\text{C}-\text{H}$ ,  $\text{C}-\text{Cl}$ ,  $\text{Cl}-\text{Cl}$ ,  $\text{H}-\text{Cl}$  are 412, 338, 242, 431 kJ/mol. Respectively.

Ans. = -115 kJ/mol.

4. What is the true regarding complete combustion of gaseous isobutene -

(A)  $\Delta H = \Delta E$       (B)  $\Delta G > \Delta E$       (C)  $\Delta H = \Delta E = 0$       (D)  $\Delta H < \Delta E$

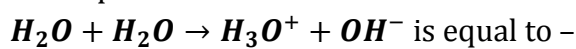
Ans. (D)

5. Negative value of  $\Delta H$  will be observed in the

(A) Enthalpy of formation      (B) Enthalpy of solution  
(C) Enthalpy of combustion      (D) Enthalpy of melting

Ans. (C)

6.  $\Delta H$  for the process:



(A) Heat of hydration of the salt  
(B) Heat of neutralization of strong acid and strong base  
(C) Heat of neutralization of weak acid and weak base  
(D) Zero

Ans. (B)

7. The enthalpy of formation of ammonia at 298K is  $\Delta H_f^0 = -46.11 \text{ kJ mol}^{-1}$

This value is applicable to this equation -

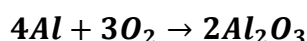
(A)  $\frac{1}{2} \text{N}_2(\text{g}) + 3/2 \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{g})$       (B)  $\text{N}(\text{g}) + 3\text{H}(\text{g}) \rightarrow \text{NH}_3(\text{g})$   
(C)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$       (D)  $\frac{1}{2} \text{N}_2(\text{g}) + 3/2 \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{l})$

Ans. (B)

8. How much heat is produced when 4.50g methane gas is burnt in a constant pressure system.

Ans. =  $\frac{-802 \times 4.5}{16} = 225.6 \text{ KJ}$

9.  $\Delta H_f^0$  for  $\text{Al}_2\text{O}_3$  is  $-1670 \text{ KJ}$ . Calculate the enthalpy change for the reaction



Ans. =  $-3340 \text{ KJ}$

10. The specific heat of iodine vapours and solid are 0.031 and 0.055 Cal/g respectively. If heat of sublimation of iodine is 24 Cal/g at  $200^\circ$ , what is its value at  $250^\circ\text{C}$ .

Ans.  $\Delta H_2 = 22.8 \text{ Cal/g}$

11. Calculate the heat of neutralization by mixing 200ml of 0.1 M  $\text{H}_2\text{SO}_4$  and 200 ml of 0.2 M KOH if heat generated by the mixing is 2.3 KJ.

Ans. =  $\frac{2.3 \times 1000}{40} \text{ kJ} = 57.5 \text{ kJ}$

12. Calculate the enthalpy change ( $\Delta H$ ) for the following reaction  $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2 + 2H_2O(g)$  given average bond energies of various bonds i.e.  $C-H, C \equiv C, O=O, C=O, O-H$  as 414, 810, 499, 724 and 460 KJ/mol respectively.

Ans. = - 1861 KJ

13. The enthalpies of formation of  $N_2O$  and NO are 82 and 90 kJ  $mol^{-1}$ , respectively. The enthalpy [KJ] of the reaction:

$2N_2O(g) + O_2(g) \rightarrow 4NO(g)$  would be -

(A) - 16 (B) 196 (C) 8 (D) 88

Ans. (B)

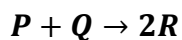
14. Heat of reaction are given as:

$C(gr) + \frac{1}{2}O_2 \rightarrow CO, \Delta H = -110.5 KJ$  and  $CO + \frac{1}{2}O_2 \rightarrow CO_2, \Delta H = -283.2 KJ$  Predict the heat of reaction.

$C(gr) + O_2 \rightarrow CO_2$   
 (A) - 393.7 kJ (B) +393.7 KJ (C) - 172.7 kJ (D) +172.7 kJ

Ans. (A)

15. The gaseous endothermic reaction:



At  $27^\circ C$  takes place spontaneously, because

(A)  $\Delta H < 0; \Delta S < 0$  (B)  $\Delta H > 0; \Delta S > 0$  (C)  $\Delta H < 0; \Delta S > 0$  (D)  $\Delta H > 0; \Delta S < 0$

Ans. (B)

16. Calculate the standard free energy change for the reaction

$N_2(g) + 3H_2(g) \rightarrow 2NH_3$  at 298 K

Given  $\Delta H^0 = -92.4 KJ$  and  $\Delta S^0$

$$= -1983 JK^{-1}$$

Ans. = -33.306 KJ.

17. Which of the following statement is incorrect

- (A) Entropy is a measure of disorder  
 (B) Entropy is not a state function  
 (C) Entropy is expressed in the units of  $JK^{-1} mol^{-1}$   
 (D) The spontaneous process always accompanies the decrease in free energy

18. For an adiabatic process-

- (A) Entropy increases  
 (B) Entropy decreases  
 (C) Entropy does not change  
 (D) Sometimes entropy increases sometimes decreases

Ans. (C)

19. What is the entropy of Cu - Zn alloy as compared to pure copper -

- (A) Less (B) More (C) Equal (D) All the above are wrong

Ans. (B)