TEST NO.3

1. The nature of positive rays depend on:

(a) The nature of electrode *(b)* The nature of discharge tube

(c) The nature of residual gas *(d)* All of the above

Explanatory Answer: (C)

Positive rays produced in the discharge tube are the cations of gas used in the tube. Different gases have different masses and e/m value. That is the reason why when gas in the tube is changed, nature of positive rays also changes.

- Nature of cathode do not disturb the nature of positive as well as cathode rays.
- Nature of the discharge tube may affect the colour of fluorescence produced.

2. The velocity of photon is:

(a) Independent of its wavelength

(b) Depends on its wavelength

(c) Equal to square of its amplitude

(d) Depends on its source.

Explanatory Answer: (A)

Velocity of photon (light) has a constant value of 3×10^8 ms^{-1}. It does not depend upon its

wavelength or source of light.

3. The wave number of the light emitted by a certain source is $2 \times 10^6\ m^{-1}$. The wavelength of this light will be:

(a) 500 nm *(b)* 500 m

(c) 200 nm *(d)* 5×10^7 m

Explanatory Answer: **(A)**

$\bar{V} = 2\times10^6\ m^{-1}$, $\lambda = ?$

$\lambda = \frac{1}{v}$ or $\lambda = \frac{1}{2\times10^6\ m^{-1}}$ $= 0.5 \times 10^{-6}$ m

$= 500 \times 10^{-3} \times 10^{-6}$ m

$= 500 \times 10^{-9}$ m . 1 nm $= 10^{-9}$ m

$\lambda = 500$nm

4. Rutherford's model of atom failed because:

(a) The atom did not have a nucleus and electrons

(b) It did not account for the attraction between protons and neutrons

(c) It did not account for the stability of the atom

(d) There is actually no space between the nucleus and the electrons

Explanatory Answer: **(C)**

Rutherford gave unstable picture of atom, because moving electron must be accelerated towards the nucleus and atom may collapse.

5. Bohr model of atom is contradicted by:

(a) Planck's quantum theory *(b)* Pauli's exclusion theory

(c) Heisenberg's uncertainty principle *(d)* All of the above

Explanatory Answer: **(C)**

Bohr calculated the both the momentum $\left(mvr = \frac{nh}{2\pi}\right)$ as well as position (radius or orbit) of electron at the same time. But according to Heisenberg, it is impossible to determine both the above values simultaneously and accurately. It was contradiction of Heisenberg with Bohr.

- Plank's theory was the basis of Bohr model.
- Dual nature of matter is extended form of Plank's theory.

6. Splitting of spectral lines when atoms are subjected to strong electric field is called:

(a) Zeeman effect *(b)* Stark effect

(c) Photoelectric effect *(d)* Compton effect

Explanatory Answer: **(B)**

Splitting of spectral line in magnetic field is called Zeeman effect and that in electric field is called Stark effect.

7. In the ground state of an atom, the electron is present:

(a) in the nucleus *(b)* in the second shell

(c) nearest to the nucleus *(d)* farthest from the nucleus

Explanatory Answer: **(C)**

When electrons are present nearest to the neucleus, this state is called as ground state.

8. Quantum number value for 2p orbitals are:

(a) $n = 2, l = 1$ *(b)* $n = 1, l = 2$

(c) $n = 1, l = 0$ *(d)* $n = 2, l = 0$

Explanatory Answer: **(A)**

For 2p subshell the values of n and l are 2 and l respectively.

9. Orbital having same energy is called:

(a) hybrid orbital *(b)* valence orbital
(c) degenerate orbital *(d)* d-orbital

Explanatory Answer: (C)

Orbitals with same energy are called degenerate orbitals. e.g., All the p-orbitals P_x, P_y, P_z are degenerate orbitals.

10. When 6d orbital is complete, the entering electron goes into:

(a) 7f *(b)* 7s *(c)* 7p *(d)* 7d

Explanatory Answer: (C)

		(n + 1)
For 6d	n = 6 , l = 2	8
7f	n = 7 , l = 3	10
7s	n = 7 , l = 0	7
7p	n = 7 , l = 1	8
7d	n = 7 , l = 2	9

The order of these orbital for filling of electrons.

7s>6d>7p>7d>7f

11. Keeping in view the size of atoms, which order is the correct one?

(a) Mg > Sr (b) Ba > Mg
(c) Lu > Ce (d) Cl > I

Explanatory Answer: (B)

In a group of the periodic table size increase and in period atomic size decrease from left to right

12. Mark the correct statement:

(a) Na^+ is smaller than Na atom.
(b) Na^+ is larger than Na atom.
(c) Cl^{-1} is smaller than Cl atom.
(d) Cl^- (ion) and Cl (atom) are equal in size.

Explanatory Answer: (A)

A cation is always smaller than parent atom while anion is always bigger than the parent atom.

13. Mark the correct statement:

(a) All lanthanides are present in the same group.
(b) All halogens are present in the same period.
(c) All the alkali metals are present in the same group.
(d) All the noble gases are present in the same period.

Explanatory Answer: (C)

Lanthanide = Period 6 Halogens = group VIIA
Alkali metals = group IA Noble gases = group VIIIA or O

14. Which statement is incorrect?

(a) All the metals are good conductor of electricity.
(b) All the metals are good conductor of heat.
(c) All the metals form positive ions. (d) All the metals form acidic oxides.

Explanatory Answer: (D)

All metals are conductor of heat and electricity, form positive ions by losing electrons and form basic oxides.

15. Which statement is correct?

(a) Hydrogen resembles in properties with I-A, IV-A and VII-A elements.
(b) Hydrogen resembles in properties with II-A, IV-A and V-A elements.
(c) Hydrogen resembles in properties with II-A, IV-A and VI-A elements.
(d) Hydrogen resembles in properties with II-A, III-A and VII-A elements.

Explanatory Answer: (A)

16. Mark the correct statement:
(a) The ionization energy of calcium is lower than that of barium.
(b) The ionization energy of calcium is lower than that of magnesium.
(c) The ionization energy of calcium is higher than that of beryllium.
(d) The ionization energy of calcium is lower than that of strontium.

Explanatory Answer: (B)

IE energy decreases downward in a group II Be>Mg>Ca>Sr>Ba.

17. Mark the correct statement:
(a) Electron affinity is a measure of energy required to remove the electron.
(b) Ionization energy is a measure of energy asked by removing an electron.
(c) Electron affinity is a measure of energy required to excite an electron.
(d) Electron affinity is measure of energy released by removing an electron.

Explanatory Answer: (B)

Electron affinity is the amount of energy released or absorbed when an electron is added to an atom.

18. Mark the incorrect statement:
(a) Metallic character increases down the group.
(b) Metallic character increases along a period.
(c) Metallic character decreases along a period.
(d) Metallic character remains the same down the group.

Explanatory Answer: (B)

Metallic characters increase downward in group and decreases across the period from left to right.

19. Mark the correct statement:
(a) Melting points of halogens decreases down the group.
(b) Melting points of halogens increase down the group.
(c) Melting points of halogens remain the same throughout the group.
(d) Melting points of halogens first increase and then decrease down the group.

Explanatory Answer: (B)

Melting point increases down the group due to increase in the polarizability of halogens. Polarizability increases by increasing atom size.

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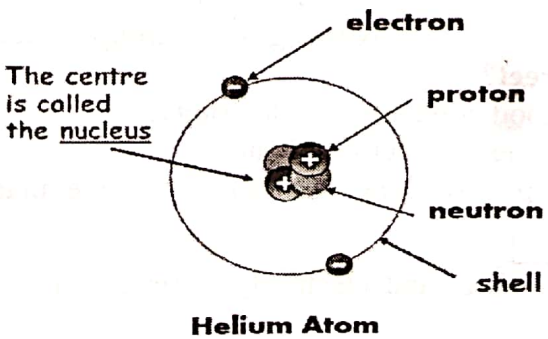
Atomic Structure – What do atoms look like?

Draw and label a helium atom



Helium Atom

TEST NO.4

1. **An ionic compound A^+B^- is most likely to be formed when**
   - *(a)* the ionization energy of A is high and electron affinity of B is low.
   - *(b)* the ionization energy of A is low and electron affinity of B is high.
   - *(c)* both the ionization energy of A and electron affinity of B are high.
   - *(d)* both the ionization energy of A and electron affinity of B are low.

Explanatory Answer: **(B)**

For ionic bond formation, one atom 'A' should have low ionization energy that can easily lose electron and second atom 'B' should be with high electron affinity that can easily gain electron.
This is Lewis concept.

2. **The number of bonds in nitrogen molecule is**
   - *(a)* one σ and one π
   - *(b)* one σ and two π
   - *(c)* three sigma only
   - *(d)* two σ and one π

Explanatory Answer: **(B)**

Bond order for N_2 molecule is three. It means three bonds between two nitrogen atoms. One bond between two atoms can be sigma, rest two bonds are always Pi. Hence, there is one σ and two π bonds in N_2 molecule.

3. **Which of the following statements is not correct regarding bonding molecular orbitals?**
   - *(a)* Bonding molecular orbitals possess less energy than atomic orbitals from which they are formed.
   - *(b)* Bonding molecular orbitals have low electron density between the two nuclei.
   - *(c)* Every electron in the bonding molecular orbitals contributes to the attraction between atoms.
   - *(d)* Bonding molecular orbitals are formed when the electron waves undergo constructive interference.

Explanatory Answer: **(B)**

According to MOT, atomic orbitals overlap to form molecular orbitlas. One with low energy than
atomic orbitals and high electron density. It is called bonding molecular orbital. It is responsible
for the attraction between two atoms. The other one with high energy than atomic orbitals and low electron density. It is called antibonding molecular orbital. It is responsible for repulsion between atoms.

4. **Which of the following molecules has zero dipole moment?**
   - *(a)* NH_3
   - *(b)* $CHCl_3$
   - *(c)* H_2O
   - *(d)* BF_3

Explanatory Answer: **(D)**

In case of BF_3, all the bond angles are of 120° and geometry is perfectly trigonal planner. Due to which all the dipole moments mutually cancel each other and resultant is zero.
In case of NH_3, the bond angel is 107.5° instead of 109.5°. Hence all the dipole moments are not cancelled and resultant is not zero ($\mu = 1.49D$) DIA
In case of $CHCl_3$, different atoms are attached to carbon atom. Dipole moments are not cancelled out and dipole moment is not zero ($\mu = 1.45$).

In case of H_2O, geometry is angular due to which individual dipole moments add up and resultant is not zero ($\mu = 1.85D$).

5. Which of the hydrogen halides has the highest percentage of ionic character?

(a) HCI *(b)* HBr *(c)* HF *(d)* HI

Explanatory Answer: **(C)**

Percentage ionic character depends upon (i) ΔEN and (ii) μ of the molecule. HF molecule has greatest value of ΔEN = 1.9 and highest value of μ = 1.90 D. Hence its percentage ionic character is highest amongst HF, HCl, HBr and HI.

HFΔEN = 4.0 – 2.1 = 1.9
HCL ΔEN = 3.0 – 2.1 = 0.9
HBr ΔEN = 2.8 – 2.1 = 0.7
HI ΔEN = 2.5 – 2.1 = 0.4

Hence, order of percentage ionic character is:
HF > CHl > HBr > HI

6. Which of the following species has unpaired electrons in anti-bonding molecular orbitals?

(a) O_2^{+2} *(b)* N_2^{-2}
(c) B_2 *(d)* F_2

Explanatory Answer: **(B)**

According to molecular orbital diagram of O_2, there are two unpaired electrons in antibonding molecular orbital. When O_2^{+2} is formed, two unpaired electrons from antibonding molecular orbitals are removed. No unpaired electron is left. The molecular orbital diagram of N_2 shows that it has no unpaired electrons in antibonding molecular orbitlas. When N_2^{-2} is formed, it gains two unpaired electrons in its antibonding molecular orbitals. The molecular orbital diagram of B_2 is same as that for N_2. It also have tow unpaired electrons but in bonding molecular orbital (π-$2p_y$ and π-$2p_z$). But F_2 has paired electrons in antibonding molecular orbitals.

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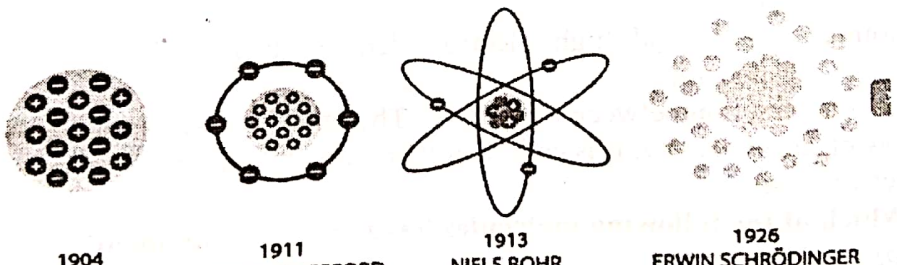
ATOMIC MODELS



TEST NO.5

1. **If an endothermic reaction is allowed to take place very rapidly in the air, the temperature of the surrounding air:**

(a) remains constant (b) increases
(c) decreases (d) remain unchanged

Explanatory Answer: **(C)**

During endothermic reaction heat is absorbed by the system from surrounding and temperature of surrounding air is decreased.

2. **In endothermic reactions, the heat content of the:**

(a) products is more than that of reactants
(b) reactants is more than that of products
(c) both (a) and (b)
(d) reactants and products are equal

Explanatory Answer: **(A)**

In endothermic reaction, the products are formed with the absorption of heat. So heat contents of products will be greater than reactants.

3. **Calorie is equivalent to:**

(a) 0.4184 J (b) 41.84 J
(c) 4.184 J (d) 418.4 J

Explanatory Answer: **(C)**

1 J = 0.239 cals
Calorie is bigger unit of energy than joule.

4. **The change in heat energy of a chemical reaction at constant temperature and pressure is called:**

(a) enthalpy change (b) heat of sublimation
(c) bond energy (d) internal energy change

Explanatory Answer: **(A)**

The change in heat energy of a chemical reaction at constant temperature and pressure is called enthalpy change.

5. **Which of the following statements is contrary to the first law of thermodynamics?**

(a) Energy can neither be created nor destroyed.
(b) One form of energy can be transferred into an equivalent amount of other kinds of energy.
(c) In an adiabatic process, the work done is independent of its path.
(d) Continuous production of mechanical work without supplying an equivalent amount of heat is possible.

Explanatory Answer: **(D)**

It is not possible to get continuous mechanical work without supplying of heat because according to first law of thermodynamics the amount of work done is equal to the amount of supplied heat.

6. **For a given process, the heat changes at constant pressure (q_p) and at constant volume (q_v) are related to each other as:**

(a) $q_p = q_v$ (b) $q_p < q_v$
(c) $q_p > q_v$ (d) $q_p = q_{v/2}$

Explanatory Answer: **(C)**

At constant pressure, heat supplied (q_p) is used is expansion (work done) as well as in increasing internal energy of the system. But at constant volume, heat supplied (q_v) only increases the internal energy. Hence value of q_p is greater than q_v.

7. For the reaction: $NaOH + HCl \longrightarrow NaCl + H_2O$ the change in enthalpy is called:

(a) heat of reaction *(b)* heat of formation
(c) heat of neutralization *(d)* heat of combustion

Explanatory Answer: (C)

When acid base reaction takes place, it leads to formation of neutral compounds (water and salt). That's why this reaction is called as neutralization reaction and heat evolved during this reaction is called heat of neutralization.

8. The net heat change in a chemical reaction is same, whether it is brought about in two or more different ways in one or several steps. It is known as:

(a) Henry's law *(b)* Joule's principle
(c) Hess's law *(d)* **Law of conservation of energy**

Explanatory Answer: (B)

The statement is the definition of Hess's law.

9. Enthalpy of neutralization of all the strong acids and strong bases has the same value because:

(a) neutralization leads to the formation of salt and water.
(b) strong acids and bases are ionic substances.
(c) acids always give rise to H^+ ions and bases always furnish OH^- ions.
(d) the net chemical change involve the combination of H^+ and OH^- ions to form water.

Explanatory Answer: (B)

Strong acids and bases are completely dissociated in water and during neutralization H^+ and OH^- combine to form H_2O, which is an exothermic process and 57.4 kJ/mol of energy is evolved. This value is always same for strong acids and bases.

10. Molarity of pure water is:

(a) 1 (b) 18 (c) 55.5 (d) 6

Explanatory Answer: (C)

Molarity is he number of moles per litre (1 dm^3). And density of water is g/cm3

1 g = 1 cm3

1000 g = 1000 cm3 = 1 dm3

The mass of 1 dm3 is 1000 g. We can calculate the no. of moles in 1000 g (1dm3) of pure water

$$n = \frac{m}{M} = \frac{1000}{18} = 55.5 \text{ moles}$$

11. 18g glucose is dissolved in 90g of water. The relative lowering vapour pressure is equal to:

(a) $\frac{1}{5}$ (b) 5.1

(c) $\frac{1}{51}$ (d) 6

Explanatory Answer: (B)

The relative lowering of vapour pressure is equal to mole fraction of solute

$$\frac{\Delta P}{P^o} = x_2$$

Mole fraction of solute (x_2) can be calculated by knowing the no. of moles of solute and solvent. No. of moles of glucose in 18 g = $\frac{18}{180} = \frac{1}{10} = 0.1$ moles.

No. of moles of water in 90 g = $\frac{90}{18} = 5$ moles. Hence, mole fraction of solute (x_2) is the ratio of no. of moles of solute to the total no. of moles.

$x_2 = \frac{0.1}{0.1+5} = \frac{0.1}{5.1} = \frac{1}{51}$

and $\frac{\Delta P}{P^\circ} = \frac{1}{51}$

12. A solution of glucose is 10%. The volume in which 1g mole of it is dissolved will be:

(a) $1dm^3$ (b) $1.8dm^3$
(c) $200cm^3$ (d) $900cm^3$

Explanatory Answer: **(B)**

10% w/v glucose solution means
10 g of glucose = 100 cm^3 of solution

1 g of glucose = $\frac{100}{10}$ cm^3 of solution

and 180 g (1 g mole) of glucose = $\frac{100}{10} \times 180$ cm^3 of solution

= 1800 cm^3
= 1.8 dm^3 of solution
(1 dm^3 = 1000 cm^3)

Hence, the volume of solution in which 1 g mole (180 g) of glucose is present is 1800 cm^3 (1.8 dm^3)

13. An aqueous solution of methanol in water has vapour pressure:

(a) Equal that of water (b) Equal to that of methanol
(c) More than that of water (d) Less than that of water

Explanatory Answer: **(C)**

The solution ethanol in water shows positive deviation from Raoult's Law. It means that vapour pressure of solution is greater and boiling point is lesser than either of the two component.

Boiling point of water = 100°C
Boiling point of ethanol = 78.5°C
Boiling point of solution = 78.1°C

14. An azeotropic mixture of two liquids boils at a lower temperature than either of them when:

(a) It is saturated.
(b) It shows positive deviation from Raoult's law.
(c) It shows negative deviation from Raoult's law.
(d) It is metastable.

Explanatory Answer: **(B)**

An azeotropic mixture of two liquids that boils at lower temperature than either of them, then its vapour pressure is higher than either of them. And a solution whose vapour pressure is greater than either of two components.

15. In azeotropic mixture showing positive deviation from Raoult's law, the volume of the

mixture is:

(a) Slightly more than the total volume of the components.
(b) Slightly less than the total volume of the components.
(c) Equal to the total volume of the components.
(d) None of these.

Explanatory Answer: **(A)**

When azeotropic mixture shows positive deviation from Raoult's law, then its vapour pressure I greater than either of the two components. Increase of vapour pressure is only possible when there is decrease of intermolecular force between solute and solvent molecules. The decrease of force leads to increase of volume of two components.

16. Which of the following solutions has the highest boiling point?

(a) 5.85% solution of sodium chloride
(b) 18.0% solution of glucose
(c) 6.0% solution of urea
(d) All have the same boiling point

Explanatory Answer: **(A)**

5.85% NaCl solution means 5.85 g (0.1 mole) of NaCl in 100 g of solution.
18.0% glucose solution means 1.8 g (0.1 mole) of glucose in 100 g of solution.
6.0% urea solution means 6 g (0.1 mole) of urea 100 g of solution.
All the solutions contains 0.1 moles of respective species per 100 g of solution. 0.1 moles of both glucose and urea produces 6.02×10^{23} particles in solution because NaCl ionizes and produces twice the no. of ions than formula. Unit 5.85% NaCl solution will have highest boiling point than
other two species because it contain twice no. of particles than other two

17. Two solutions of NaCl and KCl are prepared separately by dissolving same amount of the solute in water. Which of the following statements is true for these solutions?

(a) KCl solution will have higher boiling point than NaCl solution .
(b) Both the solutions have same boiling points
(c) KCl and NaCl solutions possess same vapour pressure
(d) KCl solution possesses lower freezing point than NaCl solution

Explanatory Answer: **(B)**

The molar mass of NaCl is 5.85 g/mole and that of KCl is 74.5 g/mole. 1 formula unit of both the species produces two ions in the solution. If we consider the same amount (mass) i.e., 58.5g of both the species, then 58.5 g of NaCl (equal to its 1 mole) produces twice the Avogadro's number of particles (ions). Whereas 58.5 g KCl (less than its one mole) produce less than twice the N_A of ions. Hence, the 58.5 g of NaCl solution containing greater number of particles (ions) have higher
boiling point than KCl solution. In order words, both have different boiling point.

Note: (For this case only)

1. The boiling point of NaCl solution is higher and its freezing point is lesser than KCl solution.
2. The vapour pressure of NaCl solution is lower than KCl solution.

TEST NO.6

1. Molarity of pure water is:

(a) 1 (b) 18

(c) 55.5 (d) 6

Explanatory Answer: (C)

Molarity is he number of moles per litre (1 dm^3). And density of water is g/cm3

1 g = 1 cm3

1000 g = 1000 cm3 = 1 dm3

The mass of 1 dm3 is 1000 g. We can calculate the no. of moles in 1000 g (1dm3) of pure water

$$n = \frac{m}{M} = \frac{1000}{18} = 55.5 \text{ moles}$$

2. 18g glucose is dissolved in 90g of water. The relative lowering vapour pressure is equal to:

(a) $\frac{1}{5}$ (b) 5.1

(c) $\frac{1}{51}$ (d) 6

Explanatory Answer: (B)

The relative lowering of vapour pressure is equal to mole fraction of solute

$$\frac{\Delta P}{P^o} = x_2$$

Mole fraction of solute (x_2) can be calculated by knowing the no. of moles of solute and solvent.

No. of moles of glucose in 18 g $= \frac{18}{180} = \frac{1}{10} = 0.1$ moles.

No. of moles of water in 90 g $= \frac{90}{18} = 5$ moles. Hence, mole fraction of solute (x_2) is the ratio of no. of moles of solute to the total no. of moles.

$$x_2 = \frac{0.1}{0.1+5} = \frac{0.1}{5.1} = \frac{1}{51}$$

and $$\frac{\Delta P}{P^o} = \frac{1}{51}$$

3. A solution of glucose is 10%. The volume in which 1g mole of it is dissolved will be:

(a) 1dm^3 (b) 1.8dm^3

(c) 200cm^3 (d) 900cm^3

Explanatory Answer: (B)

10% w/v glucose solution means

10 g of glucose = 100 cm^3 of solution

1 g of glucose $= \frac{100}{10}$ cm^3 of solution

and 180 g (1 g mole) of glucose $= \frac{100}{10} \times 180$ cm^3 of solution

$= 1800$ cm^3

$= 1.8$ dm^3 of solution

(1 dm^3 = 1000 cm^3)

Hence, the volume of solution in which 1 g mole (180 g) of glucose is present is 1800 cm^3 (1.8 dm^3)

4. **An aqueous solution of methanol in water has vapour pressure:**

(a) Equal that of water (b) Equal to that of methanol

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Explanatory Answer: (C)

The solution ethanol in water shows positive deviation from Raoult's Law. It means that vapour pressure of solution is greater and boiling point is lesser than either of the two component.

Boiling point of water = 100°C

Boiling point of ethanol = 78.5°C

Boiling point of solution = 78.1°C

5. **An azeotropic mixture of two liquids boils at a lower temperature than either of them when:**

(a) It is saturated.

(b) It shows positive deviation from Raoult's law.

(c) It shows negative deviation from Raoult's law.

(d) It is metastable.

Explanatory Answer: (B)

An azeotropic mixture of two liquids that boils at lower temperature than either of them, then its vapour pressure is higher than either of them. And a solution whose vapour pressure is greater than either of two components.

6. **In azeotropic mixture showing positive deviation from Raoult's law, the volume of the mixture is:**

(a) Slightly more than the total volume of the components.

(b) Slightly less than the total volume of the components.

(c) Equal to the total volume of the components.

(d) None of these.

Explanatory Answer: (A)

When azeotropic mixture shows positive deviation from Raoult's law, then its vapour pressure I greater than either of the two components. Increase of vapour pressure is only possible when there is decrease of intermolecular force between solute and solvent molecules. The decrease of force leads to increase of volume of two components.

7. **Which of the following solutions has the highest boiling point?**

(a) 5.85% solution of sodium chloride

(b) 18.0% solution of glucose

(c) 6.0% solution of urea

(d) All have the same boiling point

Explanatory Answer: (A)

5.85% NaCl solution means 5.85 g (0.1 mole) of NaCl in 100 g of solution.

18.0% glucose solution means 1.8 g (0.1 mole) of glucose in 100 g of solution.

6.0% urea solution means 6 g (0.1 mole) of urea 100 g of solution.

All the solutions contains 0.1 moles of respective species per 100 g of solution. 0.1 moles of both glucose and urea produces 6.02×10^{23} particles in solution because NaCl ionizes and produces twice the no. of ions than formula. Unit 5.85% NaCl solution will have highest boiling point than other two species because it contain twice no. of particles than other two

8. **Two solutions of NaCl and KCl are prepared separately by dissolving same amount of the solute in water. Which of the following statements is true for these solutions?**

(a) KCl solution will have higher boiling point than NaCl solution
(b) Both the solutions have same boiling points
(c) KCl and NaCl solutions possess same vapour pressure
(d) KCl solution possesses lower freezing point than NaCl solution

Explanatory Answer: **(B)**

The molar mass of NaCl is 5.85 g/mole and that of KCl is 74.5 g/mole. 1 formula unit of both the species produces two ions in the solution. If we consider the same amount (mass) i.e., 58.5g of both the species, then 58.5 g of NaCl (equal to its 1 mole) produces twice the Avogadro's number of particles (ions). Whereas 58.5 g KCl (less than its one mole) produce less than twice the N_A of ions. Hence, the 58.5 g of NaCl solution containing greater number of particles (ions) have higher boiling point than KCl solution. In order words, both have different boiling point.

Note: (For this case only)

1. The boiling point of NaCl solution is higher and its freezing point is lesser than KCl solution.
2. The vapour pressure of NaCl solution is lower than KCl solution.

9. The molal boiling point constant is the ratio of the elevation in boiling point to:

(a) Molarity (b) Molality
(c) Mole fraction of solvent (d) Mole fraction of solute

Explanatory Answer: **(B)**

The boiling point elevation of a solution is directly proportional to molality of the solution.

$$\Delta T_b \propto m$$

$$\Delta T_b = K_b m$$

$$K_b = \frac{\Delta T_b}{m}$$

Hence, molal boiling point constant is the ratio of boiling point elevation to molality of the solution.

10. Colligative properties are the properties of:

(a) Dilute solutions which behave as nearly ideal solutions
(b) Concentrated solutions which behave as nearly non-ideal solutions
(c) Both (i) and (ii)
(d) Neither (i) nor (ii)

Explanatory Answer: **(A)**

Dilute solutions are usually ideal. Colligative properties are the properties of dilute solutions. For concentrated solutions, there are large numbers of solute particles very close to each other. Due to which attraction starts and particles associate. As a result, no. of particles reduces and effect on the property is also less. Hence concentrated solution do not behave ideally.

TEST NO.7

1. The cathodic reaction in the electrolysis of dil. H_2SO_4 with Pt electrodes is:

(a) Reduction (b) Oxidation
(c) Both oxidation and reduction (d) Neither oxidation or reduction

Explanatory Answer: (A)

When electrolysis of dil. H2SO4 is done with Pt-electrodes, H+ ions are reduced to H2 at cathode.

$$2H^+ + 2e^- \rightarrow H_2$$

2. Which of the following statements is correct about galvanic cell?

(a) Anode is negatively charged (b) Reduction occurs at anode
(c) Cathode is positively charged (d) Reduction occurs at cathode

Explanatory Answer: (B)

Reduction always takes place at cathode and oxidation at anode. In galvanic cell, anode is negatively charged because loss of electrons takes place here whereas cathode is positively charged because electrons enter into the cell through it and reduction takes place here.

3. Stronger the oxidizing agent, greater is the:

(a) oxidation potential (b) reduction potential
(c) redox potential (d) E.M.F. of cell

Explanatory Answer: (B)

Reduction potential is the tendency of an element to gain electrons and to act as oxidizing agent. Greater the reduction potential. Stronger the oxidizing agent.

4. If the salt bridge is not used between two half cells, then the voltage:

(a) Decrease rapidly (b) Decrease slowly
(c) Does not change (d) Drops to zero

Explanatory Answer: (D)

In the absence of salt bridge, there is net charge accumulation in the two half cells. As a result of that, the two half cell reaction stops and cell voltage drops to zero.

5. If a strip of Cu metal is placed in a solution of $FeSO_4$:

(a) Cu will be precipitated out (b) Fe is precipitated out
(c) Cu and Fe both dissolve (d) No reaction take place

Explanatory Answer: (D)

Cu being below Fe in electrochemical series, cannot displace it from $FeSO_4$. And hence, no reaction occurs.

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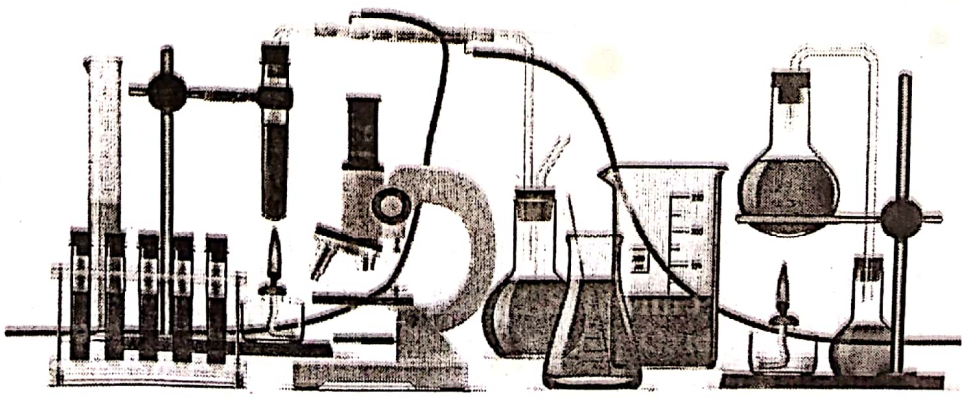

TEST NO.8

1. For which system does the equilibrium constant, K_c has units of (concentration)$^{-1}$?

(a) $N_2+3H_2 \rightleftharpoons 2NH_3$
(b) $H_2 + I_2 \rightleftharpoons 2HI$
(c) $2NO_2 \rightleftharpoons N_2O_4$
(d) $2HF \rightleftharpoons H_2+F_2$

Explanatory Answer: (C)

$2NO_2 \rightleftharpoons N_2O_4$

$$Ke = \frac{[N_2O_4]}{[NO_2]^2} = \frac{[Conc.]^1}{[Conc.]^2} = [Conc.]^{-1}$$

For reaction in option 'b' and 'd'. K_c has no units since number of moles of products and reactants are equal. For reaction in option 'a' number of moles of reactants are greater than products by 2. Hence, K_c for this reaction has units $[Conc.]^{-2}$.

2. Which statement about the following equilibrium is correct?

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -188.3 \text{ kJ mol}^{-1}$$

(a) The value of K_p falls with a rise in temperature
(b) The value of K_p falls with increasing pressure
(c) Adding V_2O_5 catalyst increase the equilibrium yield of sulphur trioxide
(d) The value of K_p is equal to K_c

Explanatory Answer: (A)

Negative enthalpy of this reaction shows that reaction is endothermic in backward reaction. Rise of temperature will speed up the backward reaction, with the increasing concentration of reactants, their partial pressures increase in the denominator of equilibrium expression. Hence value of K_p will fall.

$$K_p = \frac{[Pso_3]^2}{[Pso_2]^2[Po_2]}$$

3. The pH of 10^{-3} mol dm^{-3} of an aqueous solution of H_2SO_4 is:

(a) 3.0 (b) 2.7
(c) 2.0 (d) 1.5

Explanatory Answer: (B)

$H_2SO_4 \rightarrow 2H^+ + SO^{-2}$

10^{-3} moles 2×10^{-3} 10^{-3} moles

From the above ionization, it is clear that H^+ ion concentration is 2×10^{-3}.

$[H^+] = 2 \times 10^{-3}$

Hence, $pH = -\log [H^+]$

$pH = -\log 2 \times 10^{-3}$

$pH = 2.7$

4. The solubility product of AgCl is 2.0×10^{-10} mol^2 dm^{-6}. The maximum concentration of Ag^+ ions in the solution is:

(a) 2.0×10^{-10} mol dm^{-3}
(b) 1.41×10^{-5} mol dm^{-3}
(c) 1.0×10^{-10} mol dm^{-3}
(d) 4.0×10^{-20} mol dm^{-3}

Explanatory Answer: **(B)**

Ionization of AgCl is $AgCl \rightleftharpoons Ag^{+}_{(s)} + Cl^{-}_{(s)}$

If 'S' moles of AgCl are soluble, it produce 'S' moles of Ag^{+1} ions and 'S' moles of Cl– ions and $K_{sp} = [Ag^{+}][Cl–]$.

$K_{sp} = S \times S = S^2$

S2 = Ksp

S2 = 2 × 10–10

$\sqrt{S^2} = \sqrt{2 \times 10^{-2}}$

$S = 1.41 \times 10^{-5}$ moles/dm^3

The maximum concentration of Ag^{+} ion will be 1.41×10^{-5} moles/dm^3.

5. An excess of aqueous silver nitrate is added to aqueous barium chloride and precipitate is removed by filtration. What are the main ions in filtrate?

(a) Ag^{+} and NO_3^{-} only

(b) Ag^{+} and Ba^{2+} and NO_3^{-}

(c) Ba^{2+} and NO_3^{-} only

(d) Ba^{2+} and NO_3^{-} and Cl^{-}

Explanatory Answer: **(B)**

When $AgNO_3$ reacts with $BaCl_2$, $Ba(NO_3)_2$ and AgCl is formed. AgCl is precipitated. $Ba(NO_3)_2$ is soluble as Ba^{+2} and NO_3^{-1}. As $AgNO_3$ is used in excess, Ag^{+} ion and NO_3^{-1} ions will also be present. Hence, filtrate will have soluble Ba^{+2}, NO_3^{-1} and excess Ag^{+} ion.