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Class: XI
Subject: Chemistry
Topic: ASK15M11SA01
No. of Questions: 30

Q1. One part of an element A combines with two parts of B (another element). Six parts of element C combine with four parts of element B. If A and C combines together, the ratio of their masses will be governed by:

(a) law of definite proportions
(b) law of multiple proportions
(c) law of reciprocal proportions
(d) law of conservation of mass

Sol. (c)

$\frac{B}{A}=\frac{2}{1};\frac{B}{C}=\frac{4}{6}=\frac{2}{3}$ from this when A combined with C the ratio is A/C = 1/3

Hence (C) is correct.

Q2. In the reaction, $N_2+3H_2\longrightarrow 2NH_3$, the ratio of volumes of nitrogen, hydrogen and ammonia is 1 : 3 : 2. These figures illustrate the law of:

(a) Constant proportions
(b) Gay-Lussac
(c) Multiple proportions
(d) Reciprocal proportions

Sol. (b)

The above ratio of 1 : 3 : 2 illustrates the Gay-Lussac law of combining volume.

Hence (B) is correct.

Q3. The specific heat of a metal of atomic mass 32 is likely to be:

(a) 0.25
(b) 0.24
(c) 0.20
(d) 0.15

Sol. (c)

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Specific heat $= \frac{6.4}{\text{atomic mass}} = \frac{6.4}{32} = 0.2$

Hence (C) is correct.

Q4. The ion that is isoelectronic with CO is

(a) CN^-
(b) O_2^+
(c) O_2^-
(d) N_2^+

Sol. (a)

Both CO and CN^- have 14 electrons. Hence (A) is correct

Q5. The velocity of electron in the second orbit of He^+ will be

(a) 2.18×10^6 *m/s*
(b) 1.09×10^6 *m/s*
(c) 4.36×10^6 *m/s*
(d) None of these

Sol. (a)

$v_n = \frac{v_0 Z}{n}$. Hence (A) is correct.

Q6. The radii of two of the first four Bohr orbits of the hydrogen atom are in the ratio 1 : 4. The energy difference between them may be

(a) 0.85 eV
(b) 2.55 eV
(c) 3.40 eV
(d) 8.20 eV

Sol. (b)

$r_n = \frac{r_0 n^2}{Z}$ and $E_n = \frac{E_0 Z^2}{n^2}$. Hence **(B)** is correct.

Q7. Which of the following iso electronic ions has the lowest ionization enthalpy?

(a) K^+
(b) Ca^{2+}
(c) Cl^-

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(d) S^{2-}

Sol. (d)

S^{2-} has the largest size and hence the lowest I.E.

Hence (D) is correct.

Q8. The order of which the following oxides are arranged according to decreasing basic nature

(a) Na_2O, MgO, Al_2O_3, CuO
(b) CuO, Al_2O_3, MgO, Na_2O
(c) Al_2O_3, CuO, MgO, Na_2O
(d) CuO, MgO, Na_2O, Al_2O_3

Sol. (a)

As we move from left to right in a period, the basic character of the oxides of s- and p- block elements decreases while their acidic character increase. The basic character of oxides of transition elements is however lower than alkali and alkaline earth metal. Thus Na_2O is most basic followed by MgO and Al_2O_3 while CuO is least basic.

Hence (A) is correct

Q9. The heaviest element amongst the following is

(a) U
(b) Ra
(c) Pb
(d) Hg

Sol. (a)

Uranium is the heaviest element among the following.

Hence (A) is correct.

Q10. The ionization of hydrogen atom would give rise to

(a) hydride ion
(b) hydronium ion
(c) proton
(d) hydroxyl ion

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Sol. (c)

$$H_{(g)} \longrightarrow H^{+}_{(g)} + e^{-}$$

Whereas (A) is H^-, (B) H_3O^+ and (D) is OH^-.

Hence (C) is correct

Q11. Which is true about the electronegativity order of the following elements?

(a) P > Si
(b) C > N
(c) Br > Cl
(d) Sr > Ca

Sol. (a)

Electronegativity of P(2.1) is greater than Si (1.8).

Hence (A) is correct

Q12. Which of the following statement is/are not true for σ-bond.

1. It is formed by the overlapping of s – s or s – p orbitals
2. It is weaker than pi bond
3. It is formed when π–bond exists already.
4. It is resulted from partial overlapping of or

(a) 1, 2, 3, 4
(b) 2, 3 and 4
(c) 2 and 4
(d) 1, 2 and 4

Sol. (b)

Q13. Which of the following molecule has trigonal planer geometry?

(a) CO_2
(b) PCl_5
(c) BF_3
(d) H_2O

Sol. (a)

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BF_3 has trigonal planer geometry (sp^2 - hybridized Boron).

Hence (A) is correct.

Q14. Out of the three molecules XeF_4, SF_4 and SiF_4 one which has tetrahedral structures is

(a) All of three
(b) Only SiF_4
(c) Both SF_4 and XeF_4
(d) Only SF_4 and XeF_4

Sol. (b)

Hybridization of $XeF_4 = sp^3d^2$, $SF_4 = sp^3d$, $SiF_4 = sp^3$

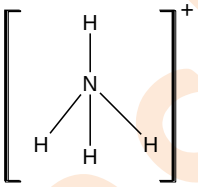
Hence (B) is correct.

Q15. When NH_3 is treated with HCl, state of hybridisation on central nitrogen

(a) Changes from sp^3 to sp^2
(b) Remains unchanged
(c) Changes from sp^3 to sp^3d
(d) Changes from sp^3 to sp

Sol. (b)

On NH_4^+ state of hybridisation on central nitrogen atom is sp^3 as in NH_3.



Hence **(B)** is the correct answer.

Q16. At which of the four conditions, the density of nitrogen will be the largest?

(a) STP
(b) 273 K and 2 atm
(c)) 546 K and 1 atm
(d) 546 K and 2 atm

Sol. (b)

Density of a gas is given $\rho = \frac{PM}{RT}$. Obviously the choice that has greater $\frac{P}{T}$ would have greater density.

Hence, **(B)** is correct.

Q17. A certain gas diffuses from two different vessels A and B. The vessel A has a circular orifice while vessel B has a square orifice of length equal to the radius of the orifice of vessel A. The ratio of the rates of diffusion of the gas from vessel A to vessel B, assuming same temperature and pressure is;

(a) π
(b) $1/\pi$
(c) 1 : 1
(d) 2 : 1

Sol. (a)

The rate of diffusion is directly proportional to the area of orifice.

$\therefore \quad d_A \propto \pi r^2$

$d_B \propto r^2$

$\therefore \quad \frac{d_A}{d_B} = \pi$

Q18. The behaviour of a real gas is usually depicted by plotting compressibility factor Z versus P at a constant temperature. At high temperature and high pressure, Z is usually more than one. This fact can be explained by van der Waal's equation when

(a) the constant 'a' is negligible and not 'b'
(b) the constant 'b' is negligible and not 'a'
(c) both constants 'a' and 'b' are negligible
(d) both the constants 'a' and 'b' are not negligible.

Sol. (a)

$$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$$

At low pressures, 'b' can be ignored as the volume of the gas is very high. At high temperatures 'a' can be ignored as the pressure of the gas is high.

$\therefore \quad P(V-b) = RT$

$PV - Pb = RT \Rightarrow PV = RT + Pb$

$$\frac{PV}{RT} = Z = 1 + \frac{Pb}{RT}$$

Hence, **(A)** is correct.

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Q19 Given that $2H_2(g) + O_2(g) \longrightarrow H_2O(g)$, $\Delta H = -115.4$ kcal the bond energy of H–H and O = O bond respectively is 104 kcal and 119 kcal, then the O–H bond energy in water vapour is

(a) 110.6 kcal / mol
(b) –110.6 kcal
(c) 105 kcal / mol
(d) None

Sol (a)

We know that heat of reaction

$\Delta H = \Sigma$B.E. (reactant) – ΣB.E (product)

For the reaction,

$2H–H(g) + O = O(g) \longrightarrow 2H – O–H(g)$

$\Delta H = -115.4$ kcal, B.E. of H–H = 104 kcal

B.E. of O=O = 119 kcal

Since one H_2O molecule contains two O–H bonds

$-115.4 = (2 \times 104) + 119 - 4$ (O–H) bond energy

$\therefore 4$ (O–H) bond energy = $(2\times 104) +119+115.4$

i.e., O–H bond energy = $\frac{(2\times104)+119+115.4}{4}$ = 110.6 kcal mol^{-1}

Hence, **(A)** is correct.

Q20. In a reversible adiabatic change ΔS is

(a) Infinity
(b) zero
(c) equal to $C_v dT$
(d) equal to $nR\ln V_2/V_1$

Sol. (b)

Q21. At constant temperature and pressure which one of the following statements is correct for the reaction? $CO(g) + 1/2O_2(g) \longrightarrow CO_2(g)$

(a) $\Delta H = \Delta E$
(b) $\Delta H < \Delta E$
(c) $\Delta H > \Delta E$
(d) ΔH is independent physical state of reactant

Sol. (b)

Q22. The velocity of electron in the ground state hydrogen atom is 2.18 ' $10^6 ms^{-1}$. Its. Velocity in the second orbit would be

(a) $1.09 \,'\, 10^6\, ms^{-1}$
(b) $4.38'10^6\, ms^{-1}$
(c) $5.5'10^5\, ms^{-1}$
(d) $8.76'10^6\, ms^{-1}$

Sol. (a)

We know that velocity of electron in nth Bohr's orbit is given by

N = $2.18'10^6$ m/s

For H, Z = 1

$Qv_1 = m/s$

$Qv_2 = \frac{m}{s} = 1.09'10^6\, m/s$

Q23. For the reaction, $C_7H_8(l) + 9O_2(g) \rightarrow 7CO_2(g) + 4H_2O(l)$, the calculated heat of reaction is 232 kJ/mol and observed heat of reaction is 50.4 kJ/mol, then the resonance energy is

(a) – 182.2 kJ / mol
(b) + 182.2 kJ / mol
(c) 172 kJ/ mol
(d)) None

Sol. (a)

As we know that,

Resonance energy = $\Delta H°$ (observed) – $\Delta H°$ (calculated)

= (50.4 – 232.6) kJ / mol

= – 182.2 kJ mol^{-1}

Q24. Which of the following is the strongest acid?

(a) $HClO_4$

(b) $HBrO_4$
(c) HIO_4
(d) HNO_3

Sol. (a)

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The acidic character of oxy acids decreases down the group and increases along the period. Also acidity increases with increase in oxidation number of central atom.

Hence, **(A)** is correct.

Q25. Reaction between iron and steam is reversible if it is carried out $3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

(a) at constant T
(b) at constant P
(c) in an open vessel
(d) in a closed vessel

Sol. (d)

In open vessel H_2 gas will escape.

Q26. Which salt undergoes hydrolysis?
(a) CH_3COONa
(b) KNO_3
(c) NaCl
(d) K_2SO_4

Sol. (a)

Salt of strong acid and strong base does not undergo hydrolysis.

Hence, **(A)** is correct.

Q27. For the reaction $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$ The value of K_c at 250°C is 26. The value of K_p at this temperature will be

(a) 0.61
(b) 0.57
(c) 0.83
(d) 0.46

Sol. (a)

$$K_p = K_c(RT)^{\Delta n} = 26 \times (0.082 \times 523)^{-1} = 0.61$$

Q28. If the degree of ionization of water be 1.8×10^{-9} at 298K. Its ionization constant will be

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(a) 1.8×10^{-16}
(b) 1×10^{-14}
(c) 1×10^{-16}
(d) 1.67×10^{-14}

Sol. (a)

Q29. When a solution of benzoic acid was titrated with NaOH the pH of the solution when half the acid neutralized was 4.2. Dissociation constant of the acid is

(a) 6.31×10^{-5}
(b) $3.2 \times 10^{-}$
(c) 8.7×10^{-8}
(d) 6.42×10^{-4}

Sol. (a)

$C_6H_5COOH + NaOH \rightleftharpoons C_6H_5COONa + H_2O$

After 0.5 0.5

neutralization

It is a buffer solution of weak acid and its salt

$pH = pK_a + \log \frac{[salt]}{[acid]}$

$pK_a = 4.2$

$K_a = 6.31 \times 10^{-5}$

Q30. The equilibrium constant for the reaction, $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO$ is 4×10^{-4} at 2000K In presence of a catalyst, equilibrium is attained ten times faster. Therefore, the equilibrium constant, in presence of the catalyst at 2000K is

(a) 40×10^{-4}
(b) 4×10^{-4}
(c) 4×10^{-5}
(d) difficulty to compute

Sol. (b)

Equilibrium is constant at constant temperature for a reaction