Sample paper 5

Question 1

The boiling point of benzene is 80OC. Estimate its molar heat of vaporization. Assume that it obeys Trouton's rule.

  a) 25.64 kJ mol^{-1}
  b) 31.064 kJ mol^{-1}
  c) 29.96 kJ mol^{-1}
  d) 39.54 kJ mol^{-1}
  e) 40.67 kJ mol^{-1}

Correct Answer: b) 31.064 kJ mol^{-1}

Explanation:

From the Trouton's law $\Delta H/T_b = 88$ J mol^{-1} K^{-1}
The given data is $T_b = 80^O C = 80+273 = 353$ K
Therefore, $\Delta H = (88$J mol^{-1} K^{-1}) (353 K) = 31064 J mol^{-1} = 31.064 kJ mol^{-1}

Question 2

The force of attraction between gaseous particles is

  a) Strong
  b) Weak
  c) Very strong
  d) Very weak
  e) Negligible

Correct Answer: e) Negligible

Explanation:

Due to very high kinetic energy, gaseous particles easily escape from the attractions of other particles and tend to maintain very long distances from each other. So, the attraction between gaseous particles is negligible.

Question 3

The coordination number of hcp structure is

  a) 6
  b) 4
  c) 8
  d) 12
  e) 2

Correct Answer: d) 12

Explanation:

Each sphere in hcp structure is in contact with 12 neighbouring spheres. Six spheres are on its own layer, three on the above layer and remaining three on the below layer. So, the coordination number of hcp structure is 12. For BCC structure it is 8. For ZnO it is 4.

Question 4

Diamond is an example for

a) Ionic crystals
b) Metallic crystals
c) Covalent crystals
d) Molecular crystals
e) None of these

Correct Answer: c) Covalent crystals

Explanation:

In diamond, atoms are linked together by continuous system of covalent bonds. In ionic crystals, atoms are held together by ionic bonds. In metallic crystals, atoms are held together by metallic bonds. In molecular crystals, molecules are held together by weak Van der Waals forces.

Question 5

Select the incorrect phrase(s) about the significance of salt bridge
I. Connects the solutions of two half-cell reactions.
II. It keeps the solution of two half-cells electrically charged.
III. Prevents liquid-liquid junction potential.

a) I & II
b) I & III
c) II & III
d) II only
e) III only

Correct Answer: d) II only.

Explanation:

It keeps the solution of two half-cells electrically neutral. In anodic half-cell, positive ions will accumulate around the anode due to deposition of negative ions by oxidation. To neutralise these positive ions, sufficient number of negative ions are provided by salt bridge. Similarly for cathodic half-cell, it is vice-versa.

Question 6

Hess's law is related to _____ of the system.

a) Free energy change
b) Entropy change
c) Enthalpy change
d) Internal energy
e) None of these

Correct Answer: c) Enthalpy change

Explanation:

Hess's law states that the enthalpy or heat energy change accompanying a chemical reaction is independent of the pathway between the initial and final states. ΔH for a single reaction can be

calculated from the difference between the enthalpy (heat) of formation of the product and reactant.
ΔH^0reaction = $\Sigma \Delta H_f^0$ (products) $- \Sigma \Delta H_f^0$ (reactant)

Question 7

7) Which one of the following molecules is held together by dative bond?

    a) $AlBr_3$
    b) NaCl
    c) $Al_2 Cl_6$
    d) $C_2 H_6$
    e) $H_2 O2$

Correct Answer: c)$Al_2 Cl_6$

Explanation:

In $Al_2 Cl_6$ lone pairs of electron from chlorine are donated to electron deficient aluminium in such a way that it is held together by dative bond, where aluminium acts as an electron acceptor and chlorine acts as an electron donor.
$AlBr_3$ is a neutral ionic molecule. NaCl- ionic bond, $C_2 H_6$ - covalent bond,$H_2 O_2$– Hydrogen bond.

Question 8

Arrange the following atoms and ions in the increasing order of atomic size
Mg, Mg^{2+}, Al, Al^{3+}

    a) Al^{3+}> Al > Mg^{2+}> Mg
    b) Mg^{2+} Mg > Al^{3+}> Al
    c) Mg > Mg^{2+} > Al > Al^{3+}
    d) Mg > Al > Mg^{2+}> Al^{3+}
    e) Al^{3+}> Mg^{2+} > Al > Mg

Correct Answer: d) Mg > Al > Mg^{2+}> Al^{3+}

Explanation:

Atomic radii decrease across the period. Cations are smaller than their parent atoms. Among these isoelectronic ions, the one with larger positive nuclear charge will have the smaller radius. So, here the largest atom is Mg and the smallest one is Al^{3+}.

Question 9

Which of the following groups has –I effect?

    a) $-CH_3$
    b) $-C_2 H_5$
    c) $-C(CH_3)_3$
    d) $–C_6 H_5$
    e) Both a and c

Correct Answer: d) $–C_6 H_5$

Explanation:

The polarisation of the bond is due to electron withdrawing or electron donating effect of adjacent atoms or groups. Such a type of electron displacement along a carbon chain is called Inductive effect. Eg: C –>--- C –>--- C –>--- $C_6 H_5$ The electron withdrawing nature of groups or atoms is called negative inductive effect. C_6H_5 is the only group, which has –I effect. Since --$C_6 H_5$ is electron-withdrawing group, it pulls up the electrons towards itself. Thereby it creates a partial positive charge in adjacent carbon atoms and partial negative charge in phenyl group ($C_6 H_5$).

Question 10

An example for interpolation error is

   a) Incorrect identification of indicator's color change in titration
   b) Guessing the correct value between two calibrated marks on the metre scale
   c) Zero setting of the needle in analog display
   d) Calibration of measured instrument
   e) None of these

Correct Answer: b) Guessing the correct value between two calibrated marks on the metre scale

Explanation:

Guessing the correct value between two calibrated marks on the metre scale is an example for interpolation error. It is one of the two types of human or personal errors.
Incorrect identification of indicator's color change in titration – Operative error. Zero setting of the needle in analog display – static error. Calibration of measured instrument - Instrument error.

Question 11

The one which is most commonly used as a detection of developed colorless chromatogram spots in T.L.C plate is

   a) Iodine
   b) Phosphorus
   c) Water
   d) Copper salts
   e) Ammonia

Correct Answer: a) Iodine

Explanation:

The spots of colorless compounds can be detected by placing the T.L.C plate in a closed jar containing few crystals of iodine. Spots of compounds, which absorb iodine, will indicate as a brown color.

Question 12

The Henderson-Hasselbalch equation for acid is

   a) $pH = pK_a - \log ([A^-] / [HA])$
   b) $pH = pKa + \log ([HA] / [A^-])$

c) $pH = pKb + \log ([B] / [HB^+])$

d) $pH = pK_a + \log ([A^-] / [HA])$

e) $pH = pK_a + 2\log ([A^-] / [HA])$

Correct Answer: d) $pH = pK_a + \log ([A^-] / [HA])$

Explanation:

The Henderson-Hasselbalch equation explains whether a compound will exist in its acidic form or in its basic form at a particular pH. $[A^-]$ = Molar concentration of a conjugate base. $[HA]$ = Molar concentration of an undissociated weak acid (M).

Question 13

An azeotropic mixture is also called

a) Increased boiling mixture
b) Decreased boiling mixture
c) Constant boiling mixture
d) Either a or b
e) None of these

Correct Answer: c) Constant boiling mixture

Explanation:

A pure chemical compound boils at a constant temperature and distils over completely at the same temperature without any change in composition. It is also known as constant boiling mixture.

Question 14

A system is said to be in equilibrium at all the times. Such a process is called

a) Irreversible process
b) Equilibrium process
c) Static process
d) Quasi-static process
e) Reversible process

Correct Answer: d) Quasi-static process

Explanation:

A quasi-static process is the one in which the system may be considered to be in equilibrium at all times.

Question 15

Which one of the following is an intensive property?

a) Volume
b) Density
c) Mass
d) Energy
e) None of these.

Correct Answer: b) Density

Explanation:

Density is the only intensive property of the above-mentioned properties. All other properties are extensive properties. Intensive property of a system is that which is independent of the amount of the substance present in the system. Extensive property of a system depends upon the amount of substance or substances present in the system.