Sample paper 7

Question 1

According to Trouton's rule, the ratio between the enthalpy of vaporization and boiling point is equal to

a) 88 $JK^{-1}mole^{-1}$
b) 10.5 $JK^{-1}mole^{-1}$
c) 55 $JK^{-1}mole^{-1}$
d) 27$JK^{-1}mole^{-1}$
e) 85 $JK^{-1}mole^{-1}$

Correct Answer: a) 88 $JK^{-1}mole^{-1}$

Explanation:

According to Trouton's rule, the ratio between the enthalpy of vaporization and boiling point is equal to 88 $JK^{-1}mole^{-1}$.

Question 2

Doping of IV A group element Ge with the V A group element Ar produces

a) Insulator
b) Conductor
c) p-type semiconductor
d) n-type semiconductor
e) Can't be predicted

Correct Answer: d) n-type semiconductor

Explanation:

Doping of Ge with Ar produces n-type semiconductor, which can conduct electricity through electrons.

Question 3

Choose the correct statement from the following. Consider T^o_b- Boiling point of pure solvent, T_b – Boiling point of the solution.

a) $T^o_b > T_b$
b) $T^o_b = T_b$
c) $T^o_b < T_b$
d) $T^o_b = T_b = 0$
e) None of the above

Correct Answer: c) $T^o_b < T_b$

Explanation:

Boiling point of the solution is always greater than that of the pure solvent, because there is an elevation in the boiling point by the addition of solute to the solvent.

Question 4

Predict the conjugate base of the following acids.
I) H_2SO_4 II) N_3H

a) I-H^+, II-H^+
b) I-SO_3, II-N_2
c) I-$(SO_4)^{2-}$, II-$(N_3)^-$
d) I-HSO_4-, II-$(N_3)^-$
e) I-H^+, II-N_2

Correct Answer: d) I-HSO_4-, II-$(N_3)^-$

Explanation:

An acid-base pair, which is differed by only one proton is called as conjugate acid-base pair. In the above case, conjugate base of sulphuric acid is HSO_4- and for N_3H the conjugate base is N_3-.

Question 5

In which of the following processes will entropy decrease?

a) Boiling of water
b) Freezing of liquid
c) Melting of ice
d) Expansion of a gas
e) Dissolving solute in a solvent

Correct Answer: b) Freezing of liquid

Explanation:

Entropy will decrease while freezing the liquid, because in freezing, a liquid changes to a solid. Generally a solid will have less entropy than a liquid.

Question 6

All radioactive transformations follow

a) Zero order kinetics
b) First order kinetics
c) Second order kinetics
d) Third order kinetics
e) These are complex reactions. Can't predict the rate order.

Correct Answer: b) First order kinetics

Explanation:

All the radioactive kinetics follow first order kinetics. The rate of the reaction depends only on the concentration of one of the reactants.

Question 7

Choose the correct statement from the following.
I) In an electrochemical cell reaction, the half-cell in the left side corresponds to the anode, and the half-cell in the right side corresponds to the cathode.
II) Oxidation reaction occurs at anode and reduction reaction occurs at cathode.
III) Current flows from the cathode to the anode.

a) I only
b) II and III
c) I and III
d) I, II and III
e) I and II

Correct Answer: e) I and II

Explanation:

Statements I and II are correct with respect to electrochemical cell reactions, whereas the III statement is not correct. In an electrochemical cell current flows from the anode to the cathode.

Question 8

When the 4s orbital is complete, the new electron will enter the

a) 4p orbital
b) 4d orbital
c) 4f orbital
d) 3d orbital
e) 5s orbital

Correct Answer: d) 3d orbital

Explanation:

Based on Aufbau principle, in the ground state the electrons occupy the low energy orbital first then they will occupy the higher energy orbitals. The energy order of orbitals is 4s< 3d< 4p< 5s< 4d.

Question 9

Which of the given pair(s) is an example for isobars?

a) ${}_{6}C^{14}$, ${}_{7}N^{14}$
b) ${}_{1}H^{1}$, ${}_{1}H^{2}$
c) ${}_{7}N^{15}$, ${}_{8}O^{16}$
d) ${}_{6}C^{12}$, ${}_{6}C^{13}$
e) None of the above

Correct Answer: a) ${}_{6}C^{14}$, ${}_{7}N^{14}$

Explanation:

Isobars are different chemical elements that have the same number of nucleons. In other words, isobars differ in proton number but have the same mass number. Here, the first pair alone has different proton number but the same mass number.

Question 10

10) Which one of the given alkyl halides is more reactive in S_N2 reaction?

a) CH_3I
b) CH_3Br
c) CH_3Cl
d) CH_3Cl
e) All the alkyl halides have the same reactivity

Correct Answer: a) CH_3I

Explanation:

Generally, carbon halogen bond is more polar due to the electronegativity of the halides. In halides iodine has the largest size. Therefore, it polarizes easily than the rest of the halides and leaves the carbon more easily than other halides do. Because iodine is a weaker base, so it leaves quickly.

Question 11

Which of the following has the highest boiling point?

a) n-octane
b) Isooctane
c) n-pentane
d) Isopentane
e) Neopentane

Correct Answer: a) n-octane

Explanation:

Generally, there is a regular increase in the boiling point as the carbon number increases. So, a molecule with more number of carbon atoms has higher boiling point. Therefore, octane and isooctane will have the highest boiling point. Between octane and isooctane, octane will have the highest boiling point, because the branched alkanes have lesser boiling point than the linear chain alkanes.

Question 12

The freezing point of a 0.01 m aqueous solution of NaCl will be

a) 0^oC
b) Below 0^oC
c) 1^oC
d) 2^oC
e) 2.5^oC

Correct Answer: b) Below 0^oC

Explanation:

There is always change (depression) in the freezing point by the addition of solute to a solvent. Therefore, the freezing point of NaCl solution will be lower than that of water. Water's freezing point is zero degree.

Question 13

The acid dissociation constant K_a is equal to

a) $[HA]/[H^+][A^+]$
b) $[H^+][A^-]/[HA]$
c) $[H^+]/[HA]$
d) $[A^+]/[HA]$

None of the above

Correct Answer: b) $[H^+][A^-]/[HA]$

Explanation:

The acid dissociation constant K_a is defined as the ratio between the concentrations of the ions present in that acid to that of the concentration of the undissociated acid.
$K_a = [H^+][A^-]/[HA]$

Question 14

For a reaction ΔS = 170 J/mol.kand ΔH = 170 KJ/mol. At what temperature would the reaction be spontaneous?

a) 298 k
b) 500 k
c) 700 k
d) 999 k
e) 1100 k

Correct Answer: e) 1100 k

Explanation:

$\Delta G = \Delta H - T\Delta S$
Consider the reaction is in equilibrium,
$0 = \Delta H – T\Delta S$
$T = \Delta H/\Delta S$ = (170 KJ/mol) / (170 J/mol.k) = (170 × 103J/mol) / (170 J/mol.k) = 1000k
For a spontaneous reaction $\Delta G < 0$, to be $\Delta G < 0$, T should be above 1000 k.
Therefore, at T = 1100 k the reaction would be spontaneous.

Question 15

The sum of the powers of the concentration terms that occur in the rate equation is called

a) Rate
b) Rate constant
c) Order
d) Half life
e) Mole fraction

Correct Answer: c) Order

Explanation:

The sum of the powers of the concentration terms that occur in the rate equation is called order of the reaction.