Sample paper 10

Question 1

Among the following, which element will have the least negative electron gain enthalpy?

a) F
b) Cl
c) P
d) S
e) I

Correct Answer: c) P

Explanation:

Electron gain enthalpy or electron affinity generally becomes more negative across a period. Within a group, electron gain enthalpy becomes less negative on going down the group. So, the element with least negative electron gain enthalpy is phosphorus.

Question 2

UV-V is spectroscopy of organic compounds is usually concerned with which electronic transition?

a) $\sigma \rightarrow \sigma^*$
b) $\pi \rightarrow \pi^*$
c) $n \rightarrow \pi^*$
d) $n \rightarrow \sigma^*$
e) $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$

Correct Answer: e) $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$

Explanation:

The electronic transition of organic compounds are i) n rarr; π* in which the electron of an unshared pair goes to an unstable (anti-bonding) π*-orbital, ii) π rarr; π*, in which an electron goes from a stable (bonding) π orbital to an unstable (anti-bonding) π* orbital.

Question 3

Find the volume of 0.25 moles of gas at 200 kPa and 300 K temperature.

a) 3 L
b) 2.5 L
c) 3.02 L
d) 3.117 L
e) 3.5 L

Correct Answer: d) 3.117 L

Explanation:

Given data:
P =200 kPa, n=0.25 moles, T=300 K, R=8.314 J K^{-1} mol^{-1}.
Ideal gas equation is PV=nRT
V = nRT/P

= (0.25 * 8.314* 300) / 200.
V = 3.117 L

Question 4

Identify the stable carbocation from the following.

a) $CH_3CH_2^+$
b) $FCH_2CH_2^+$
c) $ClCH_2CH_2^+$
d) $BrCH_2CH_2^+$
e) $ICH_2CH_2^+$

Correct Answer: a) $CH_3CH_2^+$

Explanation:

Ethyl carbocation is more stable than the rest of the cations. The carbocation with more alkyl group is more stable, because the alkyl in carbocation decreases the positive charge on the carbon and increases the stability. If an electronegative atom is present in the carbocation the stability of carbocation decreases, because an electronegative atom increases the positive charge on the carbocation, which decreases the stability of the carbocation.

Question 5

Find the oxidation number for $\underline{Fe}_2O_3$, $K\underline{Br}O_4$ and $\underline{P}O_4^{3-}$

a) +6, +8, -6
b) +3, -7, -5
c) +3, +7, +5
d) -3, -7, -5
e) +6, +7, +5

Correct Answer: c) +3, +7, +5

Explanation:

For $\underline{Fe}_2O_3$, each O atom has an oxidation state of -2. So, 3*-2 = -6. To nullify +6 electrons in Fe, each Fe atom will have +3 electrons.
For $K\underline{Br}O_4$, each O atom has an oxidation state of -2. So, 4*-2 = -8. K atom has 1 electron so Br will have +7 electrons to nullify 4 O-atoms.
For $\underline{P}O_4^{3-}$, each O atom has an oxidation state of -2. Oxygen atom has a charge of -3. So, (-2) + (-3) = -5. So, phosphorus atom will have +5 electrons.

Question 6

400 mL of solution is created by dissolving 116 g of NaCl in water. What is the molarity of the NaCl solution?

a) 5 M
b) 10 M
c) 20 M
d) 185M
e) 370 M

Correct Answer: a) 5 M

Explanation:

Molecular mass of NaCl = 58 g/mol
Moles of NaCl = 116g/58 g mol^{-1} = 2 moles
Molarity = moles of solute/ litres of solution = 2 moles/0.4 L = 5M.

Question 7

Calculate the pH of the 0.05 M HCl solution.

a) pH = 1.3
b) pH = 1.5
c) pH = 2
d) pH = 2.3
e) pH = 2.5

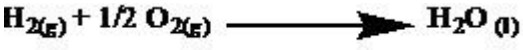
Correct Answer: a) pH = 1.3

Explanation:

For HCl, normality = molarity = 0.05 = 5× 10^{-2}
pH = -log [H^+]
Therefore, pH = -log [5× 10^{-2}] = 2-log 5 = 2- 0.6990 = 1.3010.

Question 8

In the following reaction the negative change in the enthalpy indicates



ΔH = -68.5 k cal/mol

a) System absorbs energy from its surrounding
b) System becomes exothermic
c) Reactants have less energy than the products
d) System becomes endothermic
e) Can't be predicted

Correct Answer: b) System becomes exothermic

Explanation:

The negative change in the enthalpy indicates that the system gives off energy to its surroundings and the system becomes exothermic.

Question 9

Arrhenius equation is

a) $k = A\ e^{-Ea/RT}$
b) $k = A\ e^{Ea/RT}$
c) $k = A\ e^{-Ea/T}$
d) $k = A\ e^{-RT/Ea}$
e) $k = A\ e^{-1/RT}$

Correct Answer: a) $k = A\ e^{-Ea/RT}$

Explanation:

Arrhenius equation is generally given as $k = A\ e^{-Ea/RT}$ k- rate constant, E_a- activation energy, A- frequency factor, R- universal gas constant and T- temperature in Kelvin.

Question 10

Calculate the standard EMF of the cell: Cd, Cd^{2+} || Cu^{2+}, Cu. The standard reduction potentials of Cu^{2+}, Cu and Cd^{2+}, Cd are 0.34 and -0.40 volts respectively.

a) +0.06
b) +0.74
c) -0.06
d) -0.74
e) -1.2

Correct Answer: b) +0.74

Explanation:

Standard EMF of the cell $E^o_{cell} = E^o_{right} - E^o_{left}$
Therefore, $E^o_{cell} = E^o_{Cu^{2+}}, Cu - E^o_{Cd^{2+}}, Cd$
E^o_{cell} = 0.34 V - (-0.4 V) = + 0.76 V.

Question 11

The exponential form of radioactivity or decay rate is (consider N_0 – initial concentration. t- time and N- concentration of the nuclei at time t)

a) $N_0 = N\ e^{\lambda t}$
b) $N = N_0 e^{\lambda t}$
c) $N_0 = N\ e^{-\lambda t}$
d) $N = N_0\ e^{-\lambda t}$
e) $N = N_0 e^{t}$

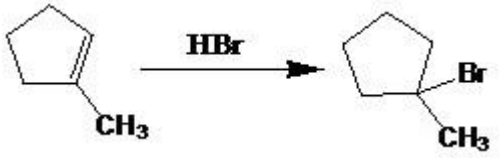
Correct Answer: d) $N = N_0\ e^{-\lambda t}$

Explanation:

Radioactivity or decay rate is directly proportional to the concentration of the radioactive nuclei. This can be calculated using the formula $N = N_0\ e^{-\lambda t}$

Question 12

Choose the correct phrase(s) that can apply to the reaction.



I) It's a regioselective reaction
II) In this reaction electrophile adds to the sp^2 carbon with more number of hydrogen
III) This reaction follows the Anti-Markovnikov's rule.

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

Correct Answer: d) I and II

Explanation:

Addition of a hydrogen halide to an unsymmetrical alkene is a regioselective reaction, in which the electrophile is added to sp^2 carbon with more number of hydrogen, because it follows the Markonikov's rule.

Question 13

Red shift in UV-Vis spectroscopy is also known as

a) Hyperchromic shift
b) Hypochromic shift
c) Hypsochromic shift
d) Bathochromic shift
e) None of the above

Correct Answer: d) Bathochromic shift

Explanation:

Bathochromic shift is also known as red shift in which, the chromophore shifts the absorption maximum from shorter wavelength to longer wavelength (low energy).

Question 14

What is the maximum number of electrons that can accommodate in its orbitals, when n=3?

a) 8
b) 6
c) 18
d) 30
e) 12

Correct Answer: c) 18

Explanation:

For n=3, there are three sub shells, $3s^2$ $3p^6$ $3d^{10}$. s-orbital can accommodate a maximum of 2 electrons, three sub shells of p-orbital can have a maximum of 6 electrons and five sub shells of d-orbital can have a maximum of 10 electrons. So, it can accommodate 18 electrons in all the three orbitals.

Question 15

When the stationary phase is solid, then the compounds can be separated on the basis of

a) Partition
b) Adsorption
c) Paper chromatography
d) Both a and b
e) Either a or b

Correct Answer: b) Adsorption

Explanation:

The stationary phase can be a solid or a liquid supported on a solid. When the stationary phase is a solid, the basis of separation is adsorption, when it is a liquid, the basis is partition. The stationary phase is liquid in paper chromatography.