Sample paper 8

Question 1

In an isobaric process

a) Temperature remains constant
b) Supplied heat energy remains constant
c) Pressure remains constant
d) Volume remains constant
e) Enthalpy remains constant

Correct Answer: c) Pressure remains constant

Explanation:

In an isobaric process, the pressure remains constant. Temperature remains constant in an isothermal process. In an isochoric process, volume remains constant. Enthalpy remains constant in an isoenthalpic process.

Question 2

The oxidation number of nitrogen in NO^-_2 is

a) +4
b) +3
c) +2
d) +1
e) -4

Correct Answer: b) +3

Explanation:

Oxygen atom in nitrate ion has the oxidation number of -2. Nitrate ion also has a charge -1. Thus the oxidation number of nitrogen in the nitrate ion can be calculated using the formula.
X+ 2(2) = -1
Therefore, X = +3

Question 3

Which of the following statements is TRUE for an E1 reaction?

a) E1 reaction requires a strong base to take place
b) Primary and secondary alkyl halides are good substrate for the E1 reaction.
c) E1 reactions occur during the solvolysis of tertiary alkyl halide
d) The rate of E1 vs S_N1 reaction increases at lower temperature
e) None of these

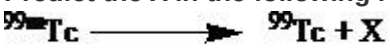
Correct Answer: c) E1 reactions occur during the solvolysis of tertiary alkyl halide

Explanation:

E1 reaction does not require base to take place. E1 reaction does not occur in primary alkyl halide. The reaction occurs during the solvolysis of tertiary alkyl halide.

Question 4

Predict the X in the following reaction



a) X is an alpha particle
b) X is a beta particle
c) X is a gamma ray
d) X is a positron
e) None of the above

Correct Answer: c) X is a gamma ray

Explanation:

In the above reaction, technetium is in excited state. It is converted to the ground state by the emission of a gamma ray without change in the atomic number as well as in the mass number. Emission of an alpha particle or beta particle or positron will bring a change in atomic number or in the mass number. But the gamma ray emission will not bring any change in the atomic number or in the mass number.

Question 5

The solution contains 10.0 mmol of acetic acid and its pK_a is 4.75. How many millimoles of sodium acetate are required to produce a buffer solution of pH 5.7?

a) 3.31 mmol
b) 33.1 mmol
c) 23.1 mmol
d) 35.1 mmol
e) 31.1 mmol

Correct Answer: b) 33.1 mmol

Explanation:

Given data: pH = 5.7, pK_a = 4.75, Molar concentration of acetic acid is 10.0 mmol.
$pH = pK_a + \log ([A^-] / [HA])$
$5.7 = 4.75 + \log (x / 10)$
$\log (x / 10) = 0.52$
$x/10 = 3.313$
$x = 33.1$ mmol.

Question 6

A galvanic cell converts

a) Electrical energy to chemical energy
b) Chemical energy to thermal energy
c) Chemical energy to electrical energy
d) Kinetic to potential energy
e) None of these

Correct Answer: c) Chemical energy to electrical energy

Explanation:

A galvanic cell converts chemical energy to electrical energy. Its redox reaction is spontaneous and responsible for the production of electrical energy. Electrolytic energy converts electrical energy to chemical energy, its redox reaction is non-spontaneous so, electrical energy has to be supplied to initiate the reaction.

Question 7

How many mL of 4M NaOH should be needed to neutralize 20 mL of 8M HCl?

a) 20 mL
b) 60 mL
c) 15 mL
d) 40 mL
e) None of the above

Correct Answer: d) 40 mL

Explanation:

For the neutralization reaction $M_aV_a = M_bV_b$
M_a = acid molarity, V_a = acid volume
M_b = base molarity, V_b = base volume
20 mL × 8 M = x mL × 4M
x = 40 mL

Question 8

Which of the following conditions is suitable for an alkaline solution?

a) $[H^+] > [OH^-]$
b) $[H^+] = [OH^-]$
c) $[H^+] < [OH^-]$
d) $[H^+] < 10^{-7} mol\ L^{-1}$
e) All the above

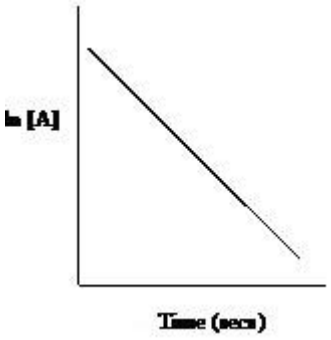
Correct Answer: c) $[H^+] < [OH^-]$

Explanation:

Generally in an alkaline solution the concentration of OH- will be higher than the concentration of H+. Therefore, the condition for the alkaline solution is $[H^+] < [OH^-]$.

Question 9

The following graph corresponds to



a) Third order kinetics
b) Zero order kinetics
c) Second order kinetics
d) First order kinetics
e) None of the above

Correct Answer: d) First order kinetics

Explanation:

The graph plotted between the logarithm of concentration of the reactant [A] and time is linear. It shows that the rate is directly proportional to the concentration of the reactant and it follows the first order kinetics.

Question 10

The relationship between free energy change and emf of a cell is

a) $\Delta H = -nFE$
b) $\Delta G = -nFE$
c) $\Delta F = nEG$
d) $\Delta G = nFE$
e) $\Delta H = nFE$

Correct Answer: b) $\Delta G = -nFE$

Explanation:

The relationship between free energy change and emf of a cell is $\Delta G = -nFE$, where n is the number of moles of electrons transferred, F stands for Faraday and is equal to 96495 coulombs and E is the emf of the cell.

Question 11

The number of lone pairs present in a water molecule is

a) 1
b) 2
c) 3
d) 4
e) 0

Correct Answer: b) 2

Explanation:

The number of lone pairs present in a water molecule is 2. This can be calculated from the hybridization of water. Water molecule is in bent shape due to the presence of these two lone pairs.

Question 12

Choose the correct phrase(s) that apply to an a- particle emission.
I) Atomic number reduces by two units
II) Mass number reduces by four units
III) The position of the product shifts towards left side by two groups relative to the parent position in the periodic table.

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

Correct Answer: e) I, II and III

Explanation:

An alpha particle is also known as a helium atom. During the emission of an alpha particle, the atomic number decreases by two units and the mass number decreases by two units. Due to this the position of the product shifts towards left side by two groups relative to the parent position in the periodic table.

Question 13

Identify the polar protic solvent from the following.

a) Acetone
b) Benzene
c) Hexane
d) Formic acid
e) Acetonitrile

Correct Answer: d) Formic acid

Explanation:

A protic solvent contains a hydrogen that is bonded to an oxygen or a nitrogen. It's a hydrogen bond donor. In the above set of solvents, formic acid is a protic solvent and the other solvents are aprotic solvents.

Question 14

Which of the following functional groups shows characteristic peak around 2200cm-1 in IR spectroscopy?

a) Ketone
b) Alcohol
c) Alkyne
d) Alkene
e) Aldehyde

Correct Answer: c. Alkyne

Explanation:

Alkynes show the characteristic peak around 2200cm^{-1} in IR spectroscopy. Carbonyl compounds 'characteristic peak appears at 1680-1750 cm^{-1}. Alcohol shows the characteristic peak at 3200-3500 cm^{-1}. Alkenes show the characteristic peak at 1680-1600 cm^{-1}.

Question 15

Choose the correct expression of the Raoult's law. Consider P_A as partial pressure of liquid component A, χ_A as mole fraction of liquid A and P^O_A as vapour pressure of pure liquid A.

a) $P_A = \chi_A P^O_B$
b) $P_A = \chi_A + \chi_B$
c) $P_A = \chi_A P^O_A$
d) $P_A = \chi_A / \chi_B$
e) None of the above

Correct Answer: c) $P_A = \chi_A P^O_A$

Explanation:

According to Raoult's law, the partial pressure (P_A) of any volatile component of a solution at any temperature is equal to vapour pressure of a pure liquid (P^O_A) multiplied by the mole fraction (χ_A) of that component in the solution.