Sampe paper 3

Question 1

What is the percentage composition of sodium and sulphur and oxygen in sodium sulphate?

a) 30.4, 22, 45
b) 31, 24, 46
c) 31.4, 22.8, 45.7
d) 30.1, 22.8, 46.7
e) 30, 21.8, 46.7

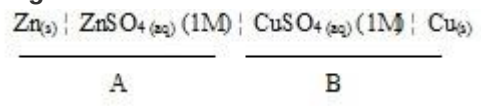
Correct Answer: c) 31.4, 22.8 & 45.7

Explanation:

Method is as follows:
Molecular formula for sodium sulphate is Na_2SO_4
Molar mass of sodium sulphate is 44+32+64 = 140
Mass percent of sodium is (2*22) / (140) * 100 = 31.4
Mass percent of sulphur is (1*32) / (140) * 100 = 22.8
Mass percent of oxygen is (4*16) / (140) * 100 = 45.7

Question 2

Identify the anode, cathode, oxidation half-cell and reduction half-cell in the following cell diagram.



a) A-anode, reduction half-cell; B- cathode, oxidation half-cell
b) A-cathode, reduction half-cell; B- anode, oxidation half-cell
c) A-anode, oxidation half-cell; B- cathode, reduction half-cell
d) A-cathode, oxidation half-cell; B- anode, reduction half-cell
e) A- anode, reduction half-cell; B- cathode, reduction half-cell

Correct Answer: c) A-anode, oxidation half-cell; B- cathode, reduction half-cell

Explanation:

Explanation: The anodic reaction is always to be written on the left hand of the cell diagram and the cathodic reaction is to be written on the right hand side. An oxidation reaction always takes place at the anode and the reduction reaction always takes place at the cathode.

Question 3

Which of the following is an example for an isolated system?

a) A pot of boiling water
b) Boiling a soup in an open sauce pan in a stove
c) Cooking rice in a pressure cooker
d) An open tank of water
e) Hot water in a thermos flask

Correct Answer: e) Hot water in a thermos flask

Explanation:

Hot water in a thermos flask is an example for an isolated system where neither energy nor matter can enter or exit. Boiling a soup in an open sauce pan in a stove is an example for open system in which, it can freely exchange its energy and matter with its surroundings. Cooking rice in a pressure cooker is an example for a closed system where it can exchange only energy with its surroundings. A pot of boiling water and an open tank of water is an example for an open system as the matter gets exchanged with its surroundings.

Question 4

The bond order for helium molecule is

a) 1
b) 2
c) 2.5
d) 3
e) 0

Correct Answer: e) 0

Explanation:

The electronic configuration of helium in the ground state is represented as $(\sigma_{1s})^2$ and in the excited state, it is represented as $(\sigma^*_{1s})^2$.
So, number of electrons in bonding molecular orbital (N_b) is 2 and number of electrons in antibonding molecular orbital (N_a) is 2.

$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{2-2}{2} = 0$$

The bond order for He_2 is 0, so the molecule does not exist.

Question 5

The order of ionisation energy is

a) s< p < d < f
b) s> p > d > f
c) s> p > d < f
d) s< d < p < f
e) s< p < f < d

Correct Answer: b) s > p > d > f

Explanation:

The ionisation energy depends upon the atomic radius. As the s-orbital electrons remain closer to the nucleus, the ionisation energy will be greater for s- orbital than for p-, d- and f- orbitals.

Question 6

Which of the following alkyl halides will undergo faster S_N^2 reactions?

a) $CH_3 – X$
b) 1^0 alkyl halide
c) 2^0 alkyl halide
d) 3^0 alkyl halide
e) All of these

Correct Answer: a) $CH_3 – X$

Explanation:

When the number of R groups in the carbon atoms gets increased, the reactivity of S_N^2 reactions will be decreased. So, methyl halide will undergo faster S_N^2 reaction than primary, secondary and tertiary alkyl halides. Tertiary alkyl halide does not undergo S_N^2 reaction because of steric hindrance.

Question 7

Which apparatus is used for mixing of organic chemicals?

a) Erlenmeyer flask
b) Florence flask
c) Beaker
d) Measuring jar
e) Buckner funnel

Correct Answer: b) Florence flask

Explanation:

Florence flask is used for mixing of organic chemicals. It is commonly called as round-bottom flask or boiling flask. Its narrow neck prevents the splash exposure.
Erlenmeyer flask is used for volumetric titration. It is also called as conical flask.
Buckner funnel is used for vacuum filtration.

Question 8

The relative intensity of signals in proton NMR is related to

a) Chemical shift and magnetic environment of proton
b) Different number of protons
c) Number of adjacent atoms containing number of protons
d) Total number of protons present in the molecule
e) Coupling constant

Correct Answer: d) Total number of protons present in the molecule

Explanation:

The relative intensity of signals in proton NMR is proportional to total number of protons present in the molecule. Number of signals indicates how many different kinds of protons are present in the molecule. Position of signals indicates the chemical shift and magnetic environment of proton. Splitting of signals indicates the number of adjacent atoms containing different number of protons.

Question 9

For acid-base equilibrium, the reaction always favours theformation of the

a) Strongest acid and the Strongest base
b) Weakest acid and the strongest base
c) Weakest acid and the weakest base
d) Strongest acid and the weakest base
e) Either a or c

Correct Answer: c) Weakest acid and weakest base

Explanation:

In an acid-base equilibrium, the reaction always favours the formation of the weakest acid and the weakest base due to their stability. The weakest acid and the weakest base must always be on the same side of the reaction.

Question 10

The oxidation state of oxygen in OF_2 is

a) -2
b) +1
c) -1
d) +2
e) 0

Correct Answer: d) +2

Explanation:

It's an unusual compound, in which oxygen takes the positive oxidation number +2. Because F is more electronegative than O, therefore F gets the -1 oxidation state and O gets the positive oxidation state.

Question 11

Calculate the angle at which second order reflection will occur in an X-ray spectrometer when X-rays of wavelength 1.54λ are diffracted by atoms of a crystal, with interplanar distance of 4.04 A^0.

a) 10^0 59'
b) 22^0 24'
c) 24^0 22'
d) 59^0 10'
e) 12^0 50'

Correct Answer: b) 22^0 24'

Explanation:

Given data: λ = 1.55, d = 4.04 A^0
For second order reflection n=2,
Bragg equation is 2d sin Θ = 2λ
Θ = $\sin^{-1}$ (λ/d) = $\sin^{-1}$(0.381) = 22^0 24'

Question 12

The unit of surface tension is

a) erg cm^{-2}
b) N
c) dyne cm^{-1}
d) N m^{-1}
e) Both c and d

Correct Answer: e) Both c and d

Explanation:

Surface tension is generally expressed in terms of dyne cm^{-1}. In SI unit, surface tension is expressed in terms of N m^{-1}.

Question 13

Pick out the correct statement related to Boyle's law

a) When pressure increases, volume also gets increased
b) Graph of pressure Vs. volume gives straight line
c) $P_1 * P_2 = V_1 * V_2$
d) P a 1/V
e) None of these

Correct Answer: d) P a 1/V

Explanation:

When pressure increases, volume gets decreased. Graph of pressure Vs volume gives curve. $P_1 * V_1 = P_2 * V_2$.

Question 14

The defect which is generally found in compounds of transition metals having variable valency is

a) Schottky defect
b) Frenkel defect
c) Metal excess defect
d) Metal deficiency defect
e) Line defect

Correct Answer: d) Metal deficiency defect

Explanation:

Metal deficiency defect is due to cation vacancy. Schottky defect is commonly found in ionic crystals in which cations and anions are of similar size. Frenkel defect is shown by ionic crystals of different size. Metal excess defect is due to anion vacancy and interstitial cation. In line defect, groups of atoms are arranged in an irregular position.

Question 15

When a decomposition reaction involves redox reactions, it is called

a) Single displacement reactions
b) Internal redox reaction
c) Simple redox reaction
d) Disproportionation reaction
e) None of these

Correct Answer: b) Internal redox reaction.

Explanation:

When a decomposition reaction involves redox reactions; it is called asinternal redox reaction, because the oxidized and reduced elements originate in the same compound. N in NH_4^+ is oxidized from -3 to 0 and N in NO_2^- is reduced from +3 to 0. Both redox reactions occur in the same NH_4NO_2 molecule.
Ex: $NH_4NO_{2(s)} \rightarrow N_{2(g)} + 2\ H_2O_{(g)}$
In single displacement reactions, atom of one reactant replaces the atom of the other reactant.
Ex: $a\ A + b\ BC \rightarrow c\ AC + d\ B$
In simple redox reaction,oxidation numbers of ionic reactants are changed by the direct transfer of electrons from one ion to the other.
Ex: $2\ Fe^{3+}_{(aq)} + Sn^{2+}_{(aq)} \rightarrow 2\ Fe^{2+}_{(aq)} + Sn^{4+}_{(aq)}$
In a disproportionation reaction, the same species will simultaneously get oxidised and reduced to form two different products.