

The Questions number from 1 to 10 below carries 3 marks each:

Q1.

- Which undergo nitration easily m-dinitrobenzene or toluene? Give reason.
- What is the number of σ and π bonds in $N \equiv C-CH = CH-C \equiv N$?
- Indicate the number of σ and π bonds in $HCONHCH_3$.

Q2. If successive ionization energies of a certain element are $I_1 = 589.5$ kJ/mol, $I_2 = 1145$ kJ/mol, $I_3 = 4900$ kJ/mol, $I_4 = 6500$ kJ/mol, $I_5 = 8100$ kJ/mol, then identify the unknown element as K, Si, Ca or As from the pattern of ionization energies.

Q3. Give reasons:

- LiCl is more covalent than KCl.
- In aqueous solution Li^+ has lowest mobility.

Q4. Professor of Delhi University found that some scraps emit high energy radiations which harmed large number of people. There are certain elements like Co-60 which emit radiations at their own and this phenomenon is called radioactivity. There are three kinds of rays.

- Name the ray which is used to treat cancer.
- Give the source of γ -rays used for treating cancer.
- Discuss the values not possessed by people disposing off radioactive waste materials.

Q5.

- Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2 ns and the number of photons emitted during the pulse source is 2.5×10^{15} , then calculate the energy of the source.
- Calculate the wave number for the longest wavelength transition in the

Balmer series of atomic hydrogen.

Q6. These people are not concerned with the health of other people. The first element in every group of representative elements shows properties different from the characteristic properties of the group.

- a) Name three such elements.
- b) Give two abnormal properties of each one of them.

Q7. When we eat sweets, they form acid in our mouth which reacts with calcium phosphate of the enamel and tooth starts to decay. In order to avoid tooth decay, we should brush our teeth after every meal.

- a) Comment: "Calcium phosphate is a basic salt".
- b) Give reason: "Toothpaste is basic in nature".
- c) Give the expression for K_{sp} of calcium phosphate.

Q8. How would you classify the state of chemical equilibrium in a chemical reaction based on the extent to which the reactions proceed?

Q9. BARC at Trombay in Mumbai has five nuclear reactors which produce electricity. Boron rods are used as control rods to absorb neutrons in nuclear reactors, used for the production of electricity. Boron steel containers are used to dispose nuclear waste materials safely. Metal borides are used as protective shield.

- a) Give reason for the absorption of neutrons by boron.
- b) Give methods to dispose-off nuclear wastes safely.
- c) Give harmful effects of nuclear radiations.

Q10. Explain the physical significance of van der Waals parameters.

The Questions number from 11 to 17 below carries 5 marks each:

Q11. i) Give the chemical reactions when borax solution is acidified.
ii) Explain why BF_3 exists whereas BH_3 does not?
iii) SiO_2 is solid but CO_2 is a gas at room temperature.

Q12.

- a) Explain the rule for the formation of 1-bromopropane by adding HBr to propene in presence of benzoyl peroxide.

b) What is the cause of extra ordinary stability of benzene inspite of presence of three double bonds in it?

c) Alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reactions. Why?

d) Why moist ethene be dried by passing it through concentrated sulphuric acid?

Q13. What are the uses of dihydrogen?

Q14.

a) Out of n-hexane and ethyne which will be more acidic. Also give reason for this behaviour.

b) Explain with an example:

i) Wurtz reaction ii) Acidic Dehydration

c) Convert propyne to propanone

Q15. Write the balanced ionic equation for the reaction of permanganate ion with bromide ion in basic medium to give manganese dioxide and bromate ion.

Q16. Explain the rules for calculating oxidation number.

Q17. Prasad did not paint his iron gate and so it got corroded. Iron gets rusted in presence of oxygen and moisture and large amount of iron gets wasted due to corrosion. Corrosion is a process in which metals react with compounds present in atmosphere to form surface compounds.

a) Justify: "Corrosion is an electrochemical phenomenon".

b) How rusting of iron be prevented?

c) What happens to the metal which undergoes corrosion?