P. P. SAVANI UNIVERSITY

Third Semester of B.Sc. Examination
December-2021
SSCH2150–Concepts in Physical Chemistry-II
13.12.2021, Monday Time: 09:00 a.m. to 11:30 a.m.. Maximum Marks: 60

Instructions:
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

Section-I (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a By what type of decay process Pb-214 converts into Bi-214?
- **A Beta decay**
- **B Alpha decay**
- **C Electron capture**
- **D Gamma decay**

1.1b An alpha particle is
- **A An electron**
- **B Two electrons and two neutrons**
- **C Two protons and two neutrons**
- **D Two electrons and one neutron**

1.1c The beta particle consists of
- **A Two electrons**
- **B One electron**
- **C One proton**
- **D Two protons**

1.1d When an alpha particle is released in nuclear decay, the mass number of the nucleus undergoing decay
- **A decreases by 2**
- **B decreases by 4**
- **C decreases by 8**
- **D decreases by 4**

1.1e One Isotope is produced by
- **A One alpha emission followed by two beta emissions**
- **B Two alpha emissions followed by one beta emission**
- **C Two alpha emissions followed by two beta emissions**
- **D One alpha emission followed by one beta emission**

1.1f Critical mass of U-235 fission reaction is
- **A 10 kg**
- **B 20 kg**
- **C 30 kg**
- **D 40 kg**

1.1g In a Geiger-Müller counter, one "count" is directly due to
- A One electron
- B Many electrons and ions
- C One ion
- D Two electrons and one ion

1.1h Which of the following statements about the biological effects of radiation is false?
- A Radiation can cause leukemia
- B Radon is absorbed through the skin
- C Radon is harmful because it decays to polonium
- D Radon is harmful because it decays to protium

1.1i The energy produced by the Sun involves which of the following nuclei.
- A H
- B B
- C Li
- D Be

1.1j Radiation is used in cancer treatment to
- A To get images of cancer cells
- B relieve pain
- C destroy cancer cells
- D destroy cancer causing substances

1.2 Answer the Following: (MCQ/Short Question/Fill in the Blanks) **[05]**

1.2a What is the main importance of a film badge?

1.2b Name the starting and ending elements of Actinium Series.

1.2c Define Nuclear Isomerism.

1.2d Define Radioactivity.

1.2e $^{238}_{92}U + ? \text{----} \rightarrow {}^{239}_{92}U$

Q.2 Short Notes (Attempt any two) **[06]**

A Explain *half-life period* of a radioactive substance.

B Write notes on Cloud Chamber.

C Write notes on Group Displacement Law.

Q.3 Explain in detail (Attempt any two) **[14]**

A (i) Explain Nuclear Fission and Fusion Reaction with an example of each.
(ii) The amount of carbon-14 in a piece of wood is found to be one-sixth of its amount in a fresh piece of wood. Calculate the age of old piece of wood.

B (i) Write note on: Solar Energy
(ii) A radioactive isotope has half-life period of 20 days. What is the amount of the isotope left over after 40 days if the initial concentration is 5 g?

C Explain FUSION AS A SOURCE OF ENERGY IN 21st CENTURY with equations.

Section-II (Total Marks - 30)

Q.1 Short Questions [10]

1.1 Objectives [05]

1.1a Equilibrium reactions are characterised by

A being non-spontaneous
B being spontaneous
C the presence of both reactants and products in a definite proportion
D All the above

1.1b Which of the following will change the equilibrium constant for a reaction mixture

A Changing temperature
B Changing pressure
C Changing concentration
D All the above

1.1c In writing equilibrium constant expressions, which of the following quantities can be used to represent the amount of reactants and products?

A Concentration
B Partial pressure
C Mole fractions
D (A) and (B) only

1.1d The promoter during Haber Process is

A Mo
B Pt
C V
D Fe

1.1e Which statement is true for a liquid/gas mixture in equilibrium?

A the equilibrium constant is dependent on temperature
B the equilibrium constant is dependent on pressure
C the equilibrium constant is dependent on catalyst
D the equilibrium constant is dependent on concentration

1.1f A mixture of three gases O_2, N_2 and CO_2 is

A 1-phase system
B 2-phase system
C 3-phase system
D 4-phase system

1.1g Phase Rule was discovered by

A Gibbs
B Boyle
C Charles
D Le Chatelier

1.1h If the equilibrium constant for a reaction is large, what can be said about the reaction?

A very little product is formed
B very little reactant remains at equilibrium

C the reaction goes to completion

D large quantities of reactants will remain at equilibrium

1.1i Water system has three phases - ice, water and vapours. The number of components in the system is

A 1

B 2

C 3

D 4

1.1j The number of phases for mixture of ethanol and water is

A 1

B 2

C 3

D 4

1.2 **Answer the Following: (MCQ/Short Question/Fill in the Blanks)** **[05]**

1.2a Define reversible reaction.

1.2b Write Law of mass action.

1.2c Define Triple point.

1.2d What is Polymorphism?

1.2e What is Degree of Freedom?

Q.2 **Short Notes (Attempt any two)** **[06]**

A Derive relationship between P, F and C.

B At a certain temperature, K for the reaction $3C_2H_2\ (g) \rightleftharpoons C_6H_6(g)$ is 4. If the equilibrium concentration of C_2H_2 is 0.5 mole/litre, what is the concentration of C_6H_6?

C Derive the unit of K_p for Haber's process.

Q.3 **Explain in detail (Attempt any two)** **[14]**

A Define Le Chatelier's Principle. With the help of this principle how can we optimize the Process to get the maximum yield of Nitric acid.

B Draw the phase diagram of sulphur system and explain it in detail.

C (i) Define heterogeneous equilibria. Give an example for the same.
(ii) At 25°C one mole of acetic acid was allowed to react with one mole of ethyl alcohol until equilibrium was established. The equilibrium mixture was found to contain 0.333 mole of unused acid. Calculate the equilibrium constant of the reaction at the same temperature.