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 Of the following which one is most damaging when ingested?

- **A Alpha emitters**
- **B Beta emitters**
- **C Gamma emitters**
- **D All of the above**

1.1b The curie is a measure of the

- **A lethal threshold for radiation exposure**
- **B total energy absorbed by an object exposed to a radioactive source**
- **C number of disintegrations per second of a radioactive substance**
- **D number of alpha particles emitted by exactly 1 g of a radioactive substance**

1.1c When an alpha particle is released in nuclear decay, the mass number of the nucleus undergoing decay

- **A Decreased by 2**
- **B Increased by 2**
- **C Decreased by 4**
- **D Increased by 4**

1.1d The beta particle consists of

- **A One electron**
- **B Two electrons**
- **C Three electrons**
- **D Four electrons**

1.1e One alpha emission followed by two beta emission produces an

- **A Isotope**
- **B Isomer**
- **C Isobar**
- **D Isotone**

1.1f Usually, the largest dose of radiation that a person gets is from

- **A Normal radiation**
- **B nuclear power plants**
- **C nuclear background radiation**

D natural background radiation

1.1g A cyclotron is used to get
- A energetic ions
- B energetic protons
- C Energetic neutrons
- D energetic electrons

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

1.1i The purpose of a moderator in a nuclear reactor is
- A to fast the fission neutrons so that they can be captured to sustain the chain reaction
- B to slow the fission neutrons so that they can be captured to sustain the chain reaction
- C to slow the fission electrons so that they can be captured to sustain the chain reaction
- D to fast the fission electrons so that they can be captured to sustain the chain reaction

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

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

1.2a Define Radioactivity.

1.2b $^{236}_{88}Ra \longrightarrow {}^{232}_{86}Rn + ?$

1.2c The S I unit of radioactivity is _____.

1.2d Name the starting and ending elements of Thorium Series.

1.2e Define Nuclear Isomerism.

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

A Explain nuclear stability in terms of neutron-proton ratio.

B Write notes on Ionization Chamber

C Write notes on Artificial Radioactivity

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

A (i) Explain Nuclear Fission and Fusion Reaction with an example of each.
(ii) A bone taken from a garbage pile buried under a hill-side had 14C/12C ratio 0.477 times the ratio in a living plant or animal. What was the date when the animal was buried?

B (i) Write note on : Hydrogen bomb
(ii) A radioactive isotope has half-life period of 40 days. What is the amount of

the isotope left over after 80 days if the initial concentration is 5 g?

C Explain Half-life period and derive mathematically.

Section-II (Total Marks - 30)

Q.1 **Short Questions** [10]

1.1 **Objectives** [05]

1.1a **A chemical system is at equilibrium**

- **A when the rates of the forward reaction and the reverse reaction are equal**
- **B when the rates of the forward reaction and the reverse reaction are unequal**
- **C when the rates of the forward reaction is more than the reverse reaction**
- **D when the rates of the forward reaction is less than the reverse reaction**

1.1b **The catalyst during Haber Process is**

- **A Mo**
- **B Pt**
- **C V**
- **D Fe**

1.1c **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**

1.1d **A saturated solution of sodium chloride is**

- **A One phase system**
- **B Two phase system**
- **C Three phase system**
- **D Four phase system**

1.1e **For one phase and one component system, the degrees of freedom are equal to**

- **A 0**
- **B 1**
- **C 2**
- **D 3**

1.1f **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**

1.1g **Which one of the following statements is incorrect?**

- **A adding products shifts the equilibrium to the left**

B adding products shifts the equilibrium to the right
C exothermic reactions shift the equilibrium to the left with increasing temperature
D adding a catalyst shifts the equilibrium to the right

1.1h The temperature at which a polymorphic substance changes from one form to another is called
A Boyle's temperature
B Triple temperature
C Transition temperature
D Charles' temperature

1.1i At a triple point
A both the temperature and pressure are fixed
B Only temperature is fixed
C Only pressure is fixed
D None of the above

1.1j A saturated solution of sodium chloride in contact with solid solute has the phases and components equal to
A 2 and 2
B 2 and 3
C 3 and 4
D 3 and 3

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

1.2a What is the value of K_c for the production of HI from Hydrogen and Iodine?

1.2b Define phase rule.

1.2c What is Eutectic point?

1.2d What is Heterogeneous equilibrium?

1.2e What is the value of $\Delta G°$ at equilibrium?

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

A 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?

B NH_4Cl in equilibrium with its dissociation product is a one component system- Justify.

C Derive relationship between K_p and K_c.

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 Ammonia.

B Draw the phase diagram of water 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.