AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XI

ANNUAL EXAMINATIONS (THEORY) 2025

Chemistry Paper II

Time: 1 hour 30 minutes Marks: 35

INSTRUCTIONS

Please read the following instructions carefully.

1. Check your name and school information. Sign if it is accurate.

I agree that this is my name and school. **Candidate's Signature**

RUBRIC

2. There are EIGHT questions. Answer ALL questions. Questions 7 & 8 each offer TWO choices. Attempt any ONE choice from each.

3. When answering the questions:

   Read each question carefully.
   Use a black pointer to write your answers. DO NOT write your answers in pencil.
   Use a black pencil for diagrams. DO NOT use coloured pencils.
   DO NOT use staples, paper clips, glue, correcting fluid or ink erasers.
   Complete your answer in the allocated space only. DO NOT write outside the answer box.

4. The marks for the questions are shown in brackets ( ).

5. You may use a scientific calculator if you wish.

Q.1. (Total 4 Marks)

Describe the construction and working of a discharge tube with reference to the production of cathode rays.

Construction: (2 Marks)

Working: (2 Marks)

Q.2. (Total 3 Marks)

a. Identify ONE aspect of a molecular structure that the dipole moment indicates. (1 Mark)

b. Sketch the molecule of SO_3 and justify whether it is polar or non-polar. (2 Marks)

Space for diagram

Q.3. (Total 2 Marks)

Identify geometry and hybridisation state of the central atom of OF_2 using VSEPR model.

Geometry: _____

_____

Hybridisation: _____

_____

Q.4. (Total 4 Marks)

a. A mixture of iron and steam is allowed to come to equilibrium at 600°C. The equation for the chemical reaction is:

$$3Fe_{(s)} + 4H_2O_{(g)} \leftrightharpoons 4H_{2(g)} + Fe_3O_{4(s)}$$

If the equilibrium pressures of hydrogen and steam are 2.2 kPa and 1.4 kPa respectively, then write the equilibrium constant expression (K_p) and determine its value for the given reaction. (2 Marks)

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b. Given below is a reversible reaction at equilibrium.

$$2SO_{2(g)} + O_{2(g)} \leftrightharpoons 2SO_{3(g)} \qquad \Delta H = -194\ \text{kJ mol}^{-1}$$

In which direction will the equilibrium shift when the temperature is increased? Provide a suitable reason to support your answer. (2 Marks)

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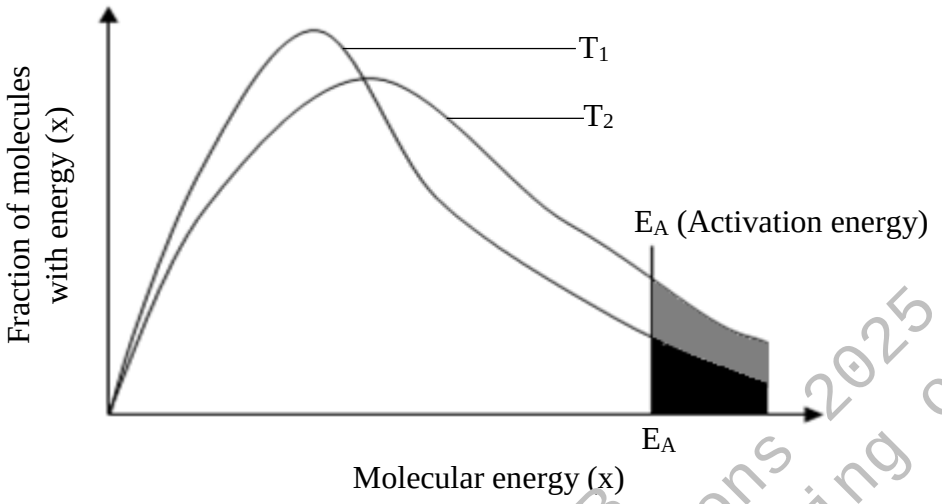
Q.5. (Total 4 Marks)

Consider the given graph with reference to the distribution of molecular energies at two different temperatures.



a. Which is the higher temperature, T_1 or T_2? (1 Mark)

_____

_____

b. What does the shaded area under the curves represent? (1 Mark)

_____

_____

c. Mention the TWO factors that increase the rate of a chemical reaction with the rise in temperature. (2 Marks)

_____

_____

_____

_____

Q.6. (Total 4 Marks)

a. Which pair of elements, one from Group IA and the other from Group VIIA, results in a compound exhibiting the most negative value of lattice enthalpy? (2 Marks)

b. Calculate the lattice enthalpy of potassium chloride using the given values (all in kJ mol^{-1}).

$\Delta H_{at}(K) = +90$; $\Delta H_{at}(Cl) = +122$; 1^{st} IE(K) = +418; 1^{st} EA(Cl) = –349; $\Delta H_f(KCl) = -437$

(2 Marks)

Q.7. (Total 7 Marks)

EITHER

a. 1.12 dm^3 of N_2 gas and 3.36 dm^3 of H_2 gas can combine to make 2.24 dm^3 of NH_3.

Write a balanced chemical equation with simple whole numbers by calculating the number of moles from volumes for the given reaction. (7 Marks)

OR

b. In 1833, Michael Faraday proposed the first law of electrolysis.

i. Provide the statement of the law and derive corresponding mathematical expression. (5 Marks)

ii. Determine the mass of sodium produced when a current of 5 amperes is passed through molten sodium chloride for a duration of 3 hours. (2 Marks)

Q.8. (Total 7 Marks)

EITHER

a. Explain the acid-base reactions involved in the following situations:

i. Regulation of gastric acidity in the human stomach (4 Marks)

ii. Curdling of milk to yield dairy products (3 Marks)

Support your answer with a suitable example and/ or an equation where required.

OR

b. Elaborate upon the concept of boiling-point elevation by:

i. defining it as a colligative property. (1 Mark)

ii. writing its equation that articulates the concept with respect to solution concentration. (1 Mark)

iii. calculating the molar mass of glucose when 18 g of it are dissolved in 150 g of water, resulting in a boiling point of 100.34°C under 1 atmosphere. The molal boiling point elevation constant for water is 0.51°C kg/mol. It's important to note that glucose, as a molecular solid, exists as discrete molecules within the solution. (5 Marks)

END OF PAPER

Please use this page for rough work

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