

# IGCSE EQUILIBRIUM QUESTIONS I

1 State what is meant by the term *reversible reaction*. [1]

2 The equation below show a reversible reaction:



(a) Complete the equation by inserting state symbols. [1]

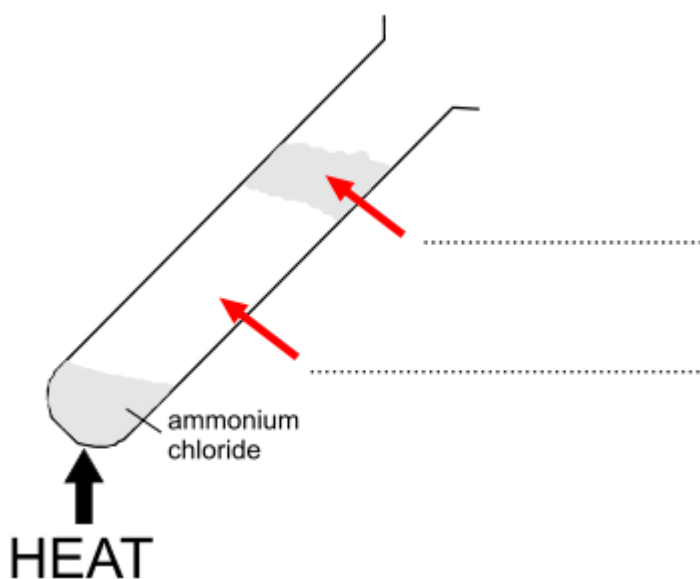
(b) State the full names and colours of: [4]

	NAME	COLOUR
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .....	.....	.....
$\text{CuSO}_4$ .....	.....	.....

3 When ammonium chloride is heated in a boiling tube a reversible reaction occurs.

(a) State the formula of ammonium chloride. [1]

(b) Complete the diagram by stating the names and physical states (solid/liquid/gas) of the species present in the places marked by the arrows. [4]



(c) Write an equation for the reversible reaction that occurs in the boiling tube. [2]

(d) The reactions that occur in the boiling tube can be described as *thermal decomposition* and *neutralisation*. Explain each of these terms **with reference to the reactions occurring**. [2]

*Thermal decomposition*.....

*Neutralisation*.....

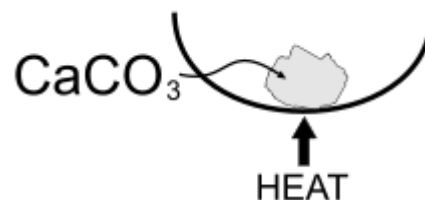
4 A reversible reaction will eventually come to a state of *dynamic equilibrium*. Explain what is meant by *dynamic equilibrium*. [2]

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- 5 The decomposition of calcium carbonate is a reversible reaction:



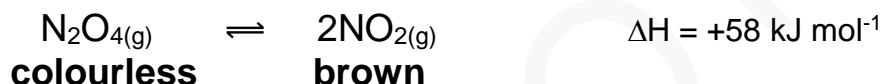
Some calcium carbonate is heated in an evaporating basin. Explain why it does not reach a state of equilibrium. [2]



- 6 For each of the following reactions state whether the position of equilibrium shifts to the left or to the right when the pressure is increased:



- 7 The decomposition of dinitrogen tetroxide ( $\text{N}_2\text{O}_4$ ) is reversible.  $\text{N}_2\text{O}_4$  is a colourless gas and  $\text{NO}_2$  is a brown gas.



Some  $\text{N}_2\text{O}_4$  is placed in a closed container at 25 °C and allowed to come to equilibrium. Deduce how the **appearance** of the mixture will change if:

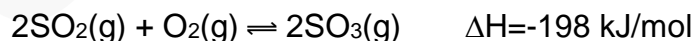
- (a) the volume of the container is increased at constant temperature and the mixture is allowed to come to equilibrium again [1]

The reaction mixture becomes **browner / less brown**  
(delete as appropriate)

- (b) the temperature is increased at constant pressure and the mixture is allowed to come to equilibrium again [1]

The reaction mixture becomes **browner / less brown**  
(delete as appropriate)

- 8 When sulfur dioxide and oxygen are placed in a closed container with a catalyst at a pressure of 200 kPa and a temperature of 450 °C a reversible reaction occurs:



Explain how the time taken to reach equilibrium and the amount of  $\text{SO}_3$  present at equilibrium would be affected by removing the catalyst. [3]