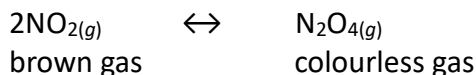


Chemistry 2.6 AS 91166 Demonstrate understanding of chemical reactivity

Writing Excellence answers to **Equilibrium – Temperature** questions

Equilibrium – Temperature QUESTION

Question: In a reaction, the brown gas nitrogen dioxide, $\text{NO}_{2(g)}$, exists in equilibrium with the colourless gas dinitrogen tetroxide, $\text{N}_2\text{O}_{4(g)}$. The equation for this reaction is represented by:



The table below shows the observations when changes were made to the system. Analyse these experimental observations.

In your answer you should:

- link all of the observations to equilibrium principles
- justify whether the formation of dinitrogen tetroxide from nitrogen dioxide is endothermic or exothermic.

Change		Observations
Pressure	increased (by decreasing the volume of the container)	Colour faded
	decreased (by increasing the volume of the container)	Colour darkened
Temperature	container with reaction mixture put into hot water	Colour darkened
	container with reaction mixture put into ice water	Colour faded

ANSWER

1. State the equilibrium principle	When a change is made to a system that is at equilibrium, the system responds to reduce the effect of that change.
2. Describe the factor in your question AND Link the principle to how the system responds to cooling or heating	The factor in the question above is temperature . If there is an increase in temperature, the system responds by absorbing more (heat) energy. If there is a decrease in temperature, the system responds by releasing more (heat) energy.
3. Generally , explain which side of the equation is favoured (relate to endothermic or exothermic)	With Heating (increasing temperature) this occurs by favouring the reaction , either forward or reverse direction, that is endothermic . With cooling (decreasing temperature) this occurs by favouring the reaction , either forward or reverse direction, that is exothermic .
4. Specifically , for your reaction with <u>heating</u> , link the observation to which direction of reaction would be favoured (endothermic or exothermic)	With heating In this case, the colour darkened, indicating that this favoured the reverse reaction , which must be the endothermic direction.
5. Describe how the system shift in <u>heating</u> would affect which products are made AND final observation.	So more $2\text{NO}_{2(g)}$, nitrogen dioxide, which is a brown gas, would be formed and there would be less $\text{N}_2\text{O}_{4(g)}$ dinitrogen tetroxide, which is a colourless gas
6. Specifically , for your reaction with <u>cooling</u> , link the observation to which direction of reaction would be favoured (endothermic or exothermic)	With cooling In this case, the colour lightened, indicating that this favoured the forward reaction , which must be the exothermic direction.
7. Describe how the system shift in <u>cooling</u> would affect which products are made AND final observation.	So more $\text{N}_2\text{O}_{4(g)}$ dinitrogen tetroxide, which is a colourless gas would be formed and there would be less $2\text{NO}_{2(g)}$, nitrogen dioxide, which is a brown gas,

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.