

[Effect of changing conditions (temperature, concentration, pressure) on equilibrium (Le Chatelier-style reasoning)]

Q1.a).(2018)

equilibrium moves to the right ✓ to remove added oxygen ✓	2	2 x 2.1	ALLOW more product/SO ₃ made or favours forward reaction or increases yield/ ORA
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Q1.b).(2018)

equilibrium moves to the right ✓ 3 molecules/moles go to 2 molecules/moles (so reducing the pressure) ✓ OR ALLOW if discuss rate of attainment of equilibrium instead of position of equilibrium reaction attains equilibrium faster✓ as increasing pressure increases frequency/success of collisions✓	2	2 x 2.1	ALLOW more product/SO ₃ made or favours forward reaction or increases yield/ ORA ALLOW fewer molecules/moles on right hand side/ ORA
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Q1.c).(2018)

equilibrium moves to the left ✓ to favour the endothermic reaction/ forward reaction is exothermic ✓ OR ALLOW if discuss rate of attainment of equilibrium instead of position of equilibrium reaction attains equilibrium faster✓ as increasing temperature increases frequency/success of collisions✓	2	2 x 2.1	ALLOW less product/SO ₃ made or favours backward reaction or decreases yield or more SO ₂ and/or O ₂ made
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Q2.(2020)

<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Describes the relationship between pressure and percentage of ammonia made and temperature and percentage of ammonia made. AND Explains how BOTH the pressure and temperature affects the percentage of ammonia made.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Describes the relationship between pressure and percentage of ammonia made and temperature and percentage of ammonia made. AND Gives an explanation of how either pressure or temperature affects the percentage of ammonia made.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p>	6	2 x 2.1 4 x 3.1a	<p>AO3.1a Analyse information and ideas to interpret. Describes how the percentage of ammonia made changes with temperature and pressure e.g.</p> <ul style="list-style-type: none"> increasing pressure from 2.5 to 40.0 Mpa increases percentage of ammonia e.g. from 92 to 99% at 100 °C increasing temperature from 100 to 500 °C decreases percentage of ammonia e.g. from 92 to 3% at 2.5 Mpa <p>AO2.1 Apply knowledge and understanding of scientific ideas Explains using Le Chatelier's principle the changes in the percentage of ammonia made</p> <ul style="list-style-type: none"> increasing the pressure increases the amount of ammonia made as equilibrium moves to favour the side with fewest moles increasing temperature decreases amount of ammonia made because equilibrium moves to favour the backward endothermic reaction
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Q3.a).(2021)

B O R D ✓

Q3.b).(2021)

A O R C ✓

Q3.c).(2021)

E ✓

Q4.a).(2022)

idea that...

when a change is made (to a reaction at equilibrium) ✓

the position (of equilibrium) moves to oppose the change ✓

2

1.1

To gain any mark equilibrium has to be mentioned at least once.

ALLOW the position of equilibrium moves to oppose the change for two marks.

ALLOW 1 mark for an example using one of pressure/concentration/temperature if no other mark awarded.

Q4.b).i).(2022)

decreases ✓

Q4.b).ii).(2022)

equilibrium moves to decrease the temperature ✓

2

2.1

ALLOW equilibrium moves to absorb (extra) energy

moves to endothermic/backward reaction ✓

ALLOW moves to left hand side

Q4.c).i).(2022)

increase ✓

Q4.c).ii).(2022)

equilibrium moves to decrease the pressure ✓

2

2.1

moves to side with least moles/molecules/forward reaction

ALLOW moves to right hand side/exothermic side

✓

Q5.(2024)

B