

# Chapter 12

## Sulfur

### 12.1 Sulfur

01. 0620\_m21\_qp\_22 Q: 32

Which substance is used as a bleach in the manufacture of paper?

- A carbon dioxide
  - B nitrogen dioxide
  - C silicon dioxide
  - D sulfur dioxide
- 

02. 0620\_s21\_qp\_21 Q: 31

Which catalyst is used in the Contact process?

- A calcium oxide
  - B iron
  - C manganese(II) oxide
  - D vanadium(V) oxide
-

03. 0620\_s21\_qp\_23 Q: 30

Which substance is used as a catalyst in the manufacture of sulfuric acid by the Contact process?

- A iron
- B nickel
- C phosphoric acid
- D vanadium(V) oxide

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04. 0620\_w21\_qp\_21 Q: 31

Which raw material is used in the Contact process?

- A air
- B ammonia
- C carbon
- D nitrogen

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05. 0620\_w21\_qp\_22 Q: 31

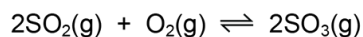
Which reaction involving sulfur dioxide is correct?

- A It is produced during the extraction of zinc from zinc blende.
- B It reacts with concentrated sulfuric acid to form oleum.
- C It reacts with sulfur to form sulfur trioxide.
- D It turns an acidified solution of potassium manganate(VII) purple.

### 12.1. SULFUR

06. 0620\_w21\_qp\_23 Q: 31

One of the steps in manufacturing sulfuric acid in the Contact process is shown.



Which catalyst is used to increase the rate of this reaction?

- A aluminium oxide
  - B iron
  - C phosphoric acid
  - D vanadium(V) oxide
- 

07. 0620\_m20\_qp\_22 Q: 34

Which row describes the conditions used in the manufacture of sulfuric acid by the Contact process?

|   | catalyst          | pressure | temperature |
|---|-------------------|----------|-------------|
| A | iron              | high     | high        |
| B | iron              | low      | low         |
| C | vanadium(V) oxide | high     | low         |
| D | vanadium(V) oxide | low      | high        |

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08. 0620\_p20\_qp\_20 Q: 34

Which row shows the conditions for the manufacture of sulfuric acid?

|   | pressure/atm | temperature/°C | catalyst          |
|---|--------------|----------------|-------------------|
| A | 2            | 450            | vanadium(V) oxide |
| B | 2            | 250            | iron              |
| C | 200          | 450            | iron              |
| D | 200          | 250            | vanadium(V) oxide |

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09. 0620\_s20\_qp\_21 Q: 34

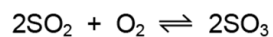
The Contact process is used to manufacture concentrated sulfuric acid and consists of four steps.

Which step involves a catalyst?

- A production of sulfur dioxide gas
  - B production of sulfur trioxide gas
  - C production of oleum
  - D production of concentrated sulfuric acid
-

10. 0620\_s20\_qp\_22 Q: 34

One of the reactions used in the manufacture of sulfuric acid is shown.



Which catalyst is used to increase the rate of this reaction?

- A iron
  - B manganese(IV) oxide
  - C vanadium(V) oxide
  - D nickel
- 

11. 0620\_s20\_qp\_23 Q: 34

Which reaction in the Contact process is catalysed by vanadium(V) oxide?

- A  $\text{S(s)} + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g})$
  - B  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$
  - C  $\text{SO}_3(\text{g}) + \text{H}_2\text{SO}_4(\text{l}) \rightarrow \text{H}_2\text{S}_2\text{O}_7(\text{l})$
  - D  $\text{H}_2\text{S}_2\text{O}_7(\text{l}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2\text{SO}_4(\text{l})$
- 



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12.1. SULFUR

12. 0620\_w20\_qp\_21 Q: 33

Which row describes two uses of sulfur dioxide?

|          | use 1                         | use 2                                |
|----------|-------------------------------|--------------------------------------|
| <b>A</b> | bleaching paper pulp          | neutralising acidic industrial waste |
| <b>B</b> | bleaching paper pulp          | preserving food and drink            |
| <b>C</b> | extracting iron from hematite | neutralising acidic industrial waste |
| <b>D</b> | extracting iron from hematite | preserving food and drink            |



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13. 0620\_w20\_qp\_22 Q: 34

The element sulfur is found in a number of different minerals.

Which mineral contains the greatest percentage by mass of sulfur?

- A** barite,  $\text{BaSO}_4$
  - B** galena,  $\text{PbS}$
  - C** gypsum,  $\text{CaSO}_4$
  - D** pyrite,  $\text{FeS}_2$
-

14. 0620\_w20\_qp\_23 Q: 34

Which row shows the conditions used for the manufacture of sulfuric acid in the Contact process?

|          | pressure / atm | temperature / °C | catalyst          |
|----------|----------------|------------------|-------------------|
| <b>A</b> | 250            | 200              | vanadium(V) oxide |
| <b>B</b> | 2              | 450              | vanadium(V) oxide |
| <b>C</b> | 250            | 200              | iron              |
| <b>D</b> | 2              | 450              | iron              |

15. 0620\_m19\_qp\_22 Q: 35

The Contact process is used to make sulfuric acid.

The steps in the process are listed.

- 1 Dissolve sulfur trioxide in 98% concentrated sulfuric acid.
- 2 Heat sulfur strongly in air.
- 3 Add oleum to water.
- 4 Pass sulfur dioxide over a vanadium(V) oxide catalyst.

Which sequence of steps is correct?

- A** 4 → 1 → 2 → 3
- B** 4 → 2 → 3 → 1
- C** 2 → 1 → 4 → 3
- D** 2 → 4 → 1 → 3

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16. 0620\_s19\_qp\_21 Q: 33

Which row shows the conditions used in the Contact process?

|          | temperature / °C | pressure / atm | catalyst          |
|----------|------------------|----------------|-------------------|
| <b>A</b> | 25               | 2              | iron              |
| <b>B</b> | 25               | 200            | iron              |
| <b>C</b> | 450              | 2              | vanadium(V) oxide |
| <b>D</b> | 450              | 200            | vanadium(V) oxide |

## 12.1. SULFUR

17. 0620\_w19\_qp\_21 Q: 34

Ammonium sulfate is used as a fertiliser.

It is made from ammonia and sulfuric acid.

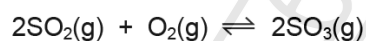
Which words complete gaps 1, 2 and 3?

The .....1..... is made by the .....2..... process in which .....3..... is used as a catalyst.

|          | 1             | 2       | 3                 |
|----------|---------------|---------|-------------------|
| <b>A</b> | ammonia       | Contact | iron              |
| <b>B</b> | ammonia       | Haber   | vanadium(V) oxide |
| <b>C</b> | sulfuric acid | Contact | vanadium(V) oxide |
| <b>D</b> | sulfuric acid | Haber   | iron              |

18. 0620\_m18\_qp\_22 Q: 33

The equation for the formation of sulfur trioxide from sulfur dioxide is shown.



The forward reaction is exothermic.

Which combination of pressure and temperature gives the highest equilibrium yield of sulfur trioxide?

|          | pressure | temperature |
|----------|----------|-------------|
| <b>A</b> | high     | high        |
| <b>B</b> | high     | low         |
| <b>C</b> | low      | high        |
| <b>D</b> | low      | low         |

19. 0620\_s18\_qp\_21 Q: 33

Which statement about sulfur and its compounds is **not** correct?

- A** Sulfur dioxide is used as a food preservative.
- B** Sulfur dioxide turns acidified aqueous potassium manganate(VII) from purple to colourless.
- C** Sulfur forms a basic oxide.
- D** Sulfur is used in the manufacture of sulfuric acid.

20. 0620\_s18\_qp\_22 Q: 33

Which row describes the uses of sulfur and sulfur dioxide?

|          | sulfur                       | sulfur dioxide    |
|----------|------------------------------|-------------------|
| <b>A</b> | extraction of aluminium      | food preservative |
| <b>B</b> | extraction of aluminium      | water treatment   |
| <b>C</b> | manufacture of sulfuric acid | food preservative |
| <b>D</b> | manufacture of sulfuric acid | water treatment   |

21. 0620\_s18\_qp\_23 Q: 33

Element Z forms an oxide,  $ZO_2$ . Three uses of  $ZO_2$  are listed.

- bleaching agent
- killing bacteria
- manufacturing an important acid

What is Z?

- A** carbon
- B** lead
- C** nitrogen
- D** sulfur

22. 0620\_w18\_qp\_21 Q: 33

Which statement about sulfur or one of its compounds is correct?

- A** Sulfur occurs naturally as the element sulfur.
- B** Sulfur dioxide is used to kill bacteria in drinking water.
- C** Sulfuric acid is a weak acid.
- D** Dilute sulfuric acid is a dehydrating agent.

### 12.1. SULFUR

23. 0620\_m17\_qp\_22 Q: 33

The ions present in ammonium sulfate are formed from the products of the Contact and Haber processes.

Both of these processes involve the use of a catalyst.

Which row is correct?

|          | ion      | formed from   | process | catalyst          |
|----------|----------|---------------|---------|-------------------|
| <b>A</b> | ammonium | ammonia       | Contact | iron              |
| <b>B</b> | ammonium | ammonia       | Haber   | vanadium(V) oxide |
| <b>C</b> | sulfate  | sulfuric acid | Contact | vanadium(V) oxide |
| <b>D</b> | sulfate  | sulfuric acid | Haber   | iron              |

24. 0620\_s17\_qp\_21 Q: 33

Which statement about sulfuric acid is correct?

- A** It is made by the Haber process.
- B** It is made in the atmosphere by the action of lightning.
- C** It reacts with ammonia to produce a fertiliser.
- D** It reacts with copper metal to produce hydrogen gas.

25. 0620\_w17\_qp\_21 Q: 33

Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

|          | temperature /°C | pressure /atm | catalyst                      |
|----------|-----------------|---------------|-------------------------------|
| <b>A</b> | 40              | 200           | Fe                            |
| <b>B</b> | 40              | 200           | V <sub>2</sub> O <sub>5</sub> |
| <b>C</b> | 400             | 2             | Fe                            |
| <b>D</b> | 400             | 2             | V <sub>2</sub> O <sub>5</sub> |

26. 0620\_m16\_qp\_22 Q: 33

What is a property of concentrated sulfuric acid but **not** of dilute sulfuric acid?

- A** It is a dehydrating agent.
- B** It neutralises alkalis.
- C** It produces a white precipitate with barium nitrate.
- D** It reacts with metals to give a salt and hydrogen.

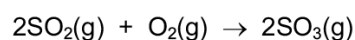
27. 0620\_p16\_qp\_20 Q: 34

Which row shows the conditions for the manufacture of sulfuric acid?

|          | pressure/atm | temperature/°C | catalyst          |
|----------|--------------|----------------|-------------------|
| <b>A</b> | 2            | 450            | vanadium(V) oxide |
| <b>B</b> | 2            | 250            | iron              |
| <b>C</b> | 200          | 450            | iron              |
| <b>D</b> | 200          | 250            | vanadium(V) oxide |

28. 0620\_s16\_qp\_21 Q: 33

The equation for an exothermic reaction in the Contact process is shown.

Which effects do increasing the temperature and using a catalyst have on the rate of formation of sulfur trioxide,  $\text{SO}_3$ ?

|          | increasing the temperature | using a catalyst |
|----------|----------------------------|------------------|
| <b>A</b> | rate decreases             | rate decreases   |
| <b>B</b> | rate decreases             | rate increases   |
| <b>C</b> | rate increases             | rate decreases   |
| <b>D</b> | rate increases             | rate increases   |

29. 0620\_s16\_qp\_22 Q: 33

The Contact process is used for the manufacture of sulfuric acid.

Which statement about this process is **not** correct?

- A** A catalyst of iron is used.
- B** Oxygen from the air is used to react with sulfur dioxide.
- C** Sulfur trioxide dissolves in sulfuric acid to form oleum.
- D** The temperature used is around 450°C.

### 12.1. SULFUR

30. 0620\_s16\_qp\_23 Q: 33

One step in the manufacture of sulfuric acid is the oxidation of sulfur dioxide to sulfur trioxide.

Which conditions are used for this step?

|          | temperature / °C | pressure / atmospheres | catalyst          |
|----------|------------------|------------------------|-------------------|
| <b>A</b> | 450              | 1.5                    | iron              |
| <b>B</b> | 450              | 1.5                    | vanadium(V) oxide |
| <b>C</b> | 450              | 200                    | iron              |
| <b>D</b> | 450              | 200                    | vanadium(V) oxide |

31. 0620\_w16\_qp\_21 Q: 33

Sulfuric acid is manufactured by the Contact process.

The most important reaction takes place in the presence of a catalyst.

What are the reactants and the catalyst for this reaction?

|          | reactants                 | catalyst          |
|----------|---------------------------|-------------------|
| <b>A</b> | sulfur and oxygen         | vanadium(V) oxide |
| <b>B</b> | sulfur dioxide and oxygen | vanadium(V) oxide |
| <b>C</b> | sulfur dioxide and steam  | iron              |
| <b>D</b> | sulfur trioxide and water | platinum          |

32. 0620\_w16\_qp\_22 Q: 33

Sulfuric acid is manufactured by a series of chemical reactions, one of which is catalysed by vanadium(V) oxide.

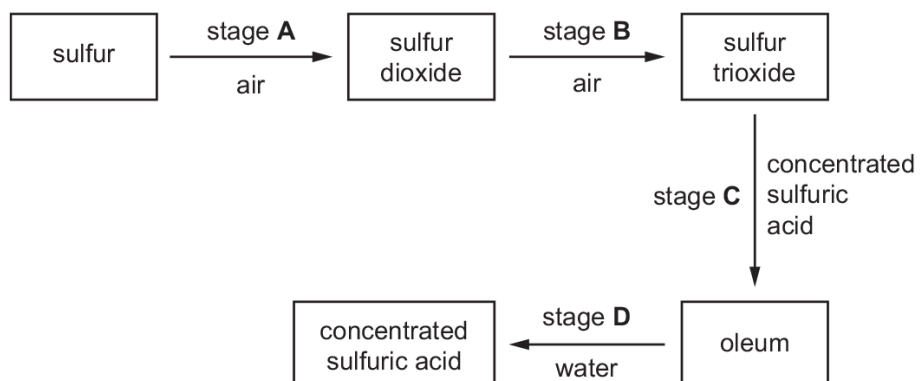
What is the equation for the reaction catalysed by vanadium(V) oxide?

- A**  $S + O_2 \rightarrow SO_2$
- B**  $2S + 3O_2 \rightarrow 2SO_3$
- C**  $2SO_2 + O_2 \rightarrow 2SO_3$
- D**  $SO_3 + H_2O \rightarrow H_2SO_4$

33. 0620\_w16\_qp\_23 Q: 33

The following scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



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| SN | Paper          | Q. No. | Answer |
|----|----------------|--------|--------|
| 01 | 0620_m21_qp_22 | 32     | D      |
| 02 | 0620_s21_qp_21 | 31     | D      |
| 03 | 0620_s21_qp_23 | 30     | D      |
| 04 | 0620_w21_qp_21 | 31     | A      |
| 05 | 0620_w21_qp_22 | 31     | A      |
| 06 | 0620_w21_qp_23 | 31     | D      |
| 07 | 0620_m20_qp_22 | 34     | D      |
| 08 | 0620_p20_qp_20 | 34     | A      |
| 09 | 0620_s20_qp_21 | 34     | B      |
| 10 | 0620_s20_qp_22 | 34     | C      |
| 11 | 0620_s20_qp_23 | 34     | B      |
| 12 | 0620_w20_qp_21 | 33     | B      |
| 13 | 0620_w20_qp_22 | 34     | D      |
| 14 | 0620_w20_qp_23 | 34     | B      |
| 15 | 0620_m19_qp_22 | 35     | D      |
| 16 | 0620_s19_qp_21 | 33     | C      |
| 17 | 0620_w19_qp_21 | 34     | C      |
| 18 | 0620_m18_qp_22 | 33     | B      |
| 19 | 0620_s18_qp_21 | 33     | C      |
| 20 | 0620_s18_qp_22 | 33     | C      |
| 21 | 0620_s18_qp_23 | 33     | D      |
| 22 | 0620_w18_qp_21 | 33     | A      |
| 23 | 0620_m17_qp_22 | 33     | C      |
| 24 | 0620_s17_qp_21 | 33     | C      |
| 25 | 0620_w17_qp_21 | 33     | D      |
| 26 | 0620_m16_qp_22 | 33     | A      |
| 27 | 0620_p16_qp_20 | 34     | A      |
| 28 | 0620_s16_qp_21 | 33     | D      |
| 29 | 0620_s16_qp_22 | 33     | A      |
| 30 | 0620_s16_qp_23 | 33     | B      |
| 31 | 0620_w16_qp_21 | 33     | B      |
| 32 | 0620_w16_qp_22 | 33     | C      |
| 33 | 0620_w16_qp_23 | 33     | B      |