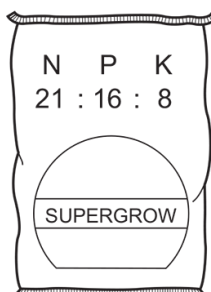


## 11.3 Nitrogen and fertilisers

01. 0620\_m21\_qp\_22 Q: 30

Which combination of chemical compounds can be used to produce the fertiliser shown?

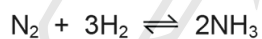


- A  $(\text{NH}_4)_3\text{PO}_4$ ,  $\text{KCl}$
  - B  $\text{NH}_4\text{NO}_3$ ,  $\text{Ca}_3(\text{PO}_4)_2$
  - C  $\text{NH}_4\text{NO}_3$ ,  $\text{CO}(\text{NH}_2)_2$
  - D  $\text{NH}_4\text{NO}_3$ ,  $\text{K}_2\text{SO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$
- 

02. 0620\_s21\_qp\_21 Q: 29

Ammonia is made by reacting nitrogen with hydrogen in the Haber process.

The equation for the process is shown.



Which changes in reaction conditions would produce a greater yield of ammonia?

- 1 adding more iron catalyst
  - 2 increasing the reaction pressure
  - 3 increasing the particle size of the iron catalyst
- A 1 only      B 2 only      C 1 and 2      D 2 and 3
-

03. 0620\_s21\_qp\_22 Q: 30

Which natural resource **cannot** provide a raw material for the manufacture of ammonia?

- A** air  
**B** limestone  
**C** petroleum  
**D** water
- 

04. 0620\_s21\_qp\_22 Q: 31

Ammonia is made in the Haber process.

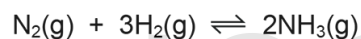
Which conditions are used in the Haber process?

	temperature /°C	pressure / atmospheres	catalyst used
<b>A</b>	450	200	iron
<b>B</b>	450	5	vanadium(V) oxide
<b>C</b>	200	450	iron
<b>D</b>	200	5	vanadium(V) oxide

---

05. 0620\_s21\_qp\_23 Q: 28

Ammonia is made from nitrogen and hydrogen. The equation for the reaction is shown.



The forward reaction is exothermic.

Which conditions give the greatest equilibrium yield of ammonia?

	temperature /°C	pressure / atm
<b>A</b>	200	15
<b>B</b>	200	150
<b>C</b>	500	15
<b>D</b>	500	150

---

### 11.3. NITROGEN AND FERTILISERS

06. 0620\_w21\_qp\_21 Q: 30

Which statements about the Haber process are correct?

- 1 One of the raw materials is extracted from liquid air by fractional distillation.
- 2 One of the raw materials is produced by the reaction of steam and methane.
- 3 The catalyst for the Haber process is vanadium(V) oxide.

**A** 1 only      **B** 1 and 2 only      **C** 2 and 3 only      **D** 1, 2 and 3

---

07. 0620\_w21\_qp\_22 Q: 29

Which conditions are used in the Haber process?

	temperature /°C	pressure /atmospheres
<b>A</b>	100	10
<b>B</b>	450	10
<b>C</b>	450	200
<b>D</b>	1000	500

---

08. 0620\_w21\_qp\_23 Q: 30

Which process is used to produce hydrogen for the Haber process?

- A** electrolysis of water
  - B** reacting aluminium with sodium hydroxide
  - C** reacting iron with sulfuric acid
  - D** reacting methane with steam
- 

09. 0620\_m20\_qp\_22 Q: 33

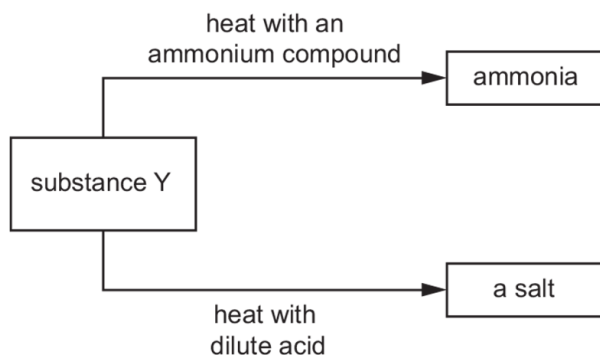
Fertilisers are mixtures of different compounds used to increase the growth of crops.

Which pair of substances contain the three essential elements for plant growth?

- A** ammonium nitrate and calcium phosphate
  - B** ammonium nitrate and potassium chloride
  - C** ammonium phosphate and potassium chloride
  - D** potassium nitrate and calcium carbonate
-

10. 0620\_p20\_qp\_20 Q: 33

The diagram shows some reactions of substance Y.

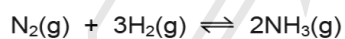


Which type of substance is Y?

- A an alcohol
- B a base
- C a catalyst
- D a metal

11. 0620\_s20\_qp\_21 Q: 31

Ammonia is manufactured by the Haber process.



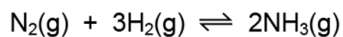
What are the conditions used in the Haber process?

	temperature /°C	pressure /atm
<b>A</b>	400	100
<b>B</b>	400	300
<b>C</b>	20	300
<b>D</b>	20	100

### 11.3. NITROGEN AND FERTILISERS

12. 0620\_s20\_qp\_22 Q: 31

In the Haber process, nitrogen and hydrogen are reacted to make ammonia.



The forward reaction is exothermic.

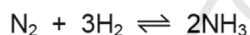
Which conditions produce the maximum yield of ammonia?

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

---

13. 0620\_s20\_qp\_23 Q: 31

Hydrogen and nitrogen react to form ammonia in the Haber process.



The forward reaction is exothermic.

Which statements about the process are correct?

- 1 Nitrogen is obtained from the air.
- 2 Increasing the temperature of the reaction increases the yield of ammonia.
- 3 Increasing the reaction pressure increases the yield of ammonia.
- 4 Vanadium(V) oxide is used as a catalyst.

**A** 1 and 2      **B** 1 and 3      **C** 2 and 3      **D** 3 and 4

---

14. 0620\_w20\_qp\_21 Q: 31

Ammonia is manufactured using the Haber process.

Which statement about this process is correct?

- A** The catalyst used for this reaction is vanadium pentoxide.
  - B** The hydrogen used is extracted from air.
  - C** Using a high pressure increases the yield of ammonia.
  - D** Using a high temperature increases the yield of ammonia.
-

15. 0620\_w20\_qp\_22 Q: 32

The results of tests on solid S and its aqueous solution are shown.

tests on solid S	tests on aqueous solution of S	
effect of heat	effect of aqueous sodium hydroxide	effect of aqueous ammonia
brown gas given off, together with a gas which relights a glowing splint	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

What is S?

- A aluminium nitrate
  - B aluminium sulfate
  - C zinc sulfate
  - D zinc nitrate
- 

16. 0620\_w20\_qp\_23 Q: 31

What is the catalyst in the Haber process?

- A Fe
  - B Ni
  - C Pt
  - D  $V_2O_5$
- 

17. 0620\_m19\_qp\_22 Q: 33

The raw materials for the Haber process are hydrogen and nitrogen.

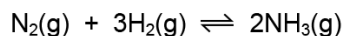
What are the sources of the hydrogen and nitrogen?

- A hydrogen from ethanol and nitrogen from NPK fertilisers
  - B hydrogen from methane and nitrogen from air
  - C hydrogen from sulfuric acid and nitrogen from air
  - D hydrogen from water and nitrogen from ammonium nitrate
-

### 11.3. NITROGEN AND FERTILISERS

18. 0620\_s19\_qp\_21 Q: 31

Ammonia is manufactured by the Haber Process.



The forward reaction is exothermic.

Which conditions maximise the yield of ammonia?

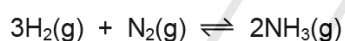
	pressure	temperature
<b>A</b>	high	high
<b>B</b>	high	low
<b>C</b>	low	high
<b>D</b>	low	low

---

19. 0620\_s19\_qp\_22 Q: 32

Ammonia is produced in the Haber process.

The equation for the reaction is shown.



The forward reaction is exothermic.

Which conditions of temperature and pressure produce the highest yield of ammonia?

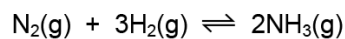
	temperature	pressure
<b>A</b>	high	high
<b>B</b>	high	low
<b>C</b>	low	high
<b>D</b>	low	low

---

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20. 0620\_s19\_qp\_23 Q: 32

Ammonia is manufactured in an exothermic reaction.



What is the effect of lowering the temperature on the rate of formation and equilibrium yield of ammonia?

	rate of formation	equilibrium yield
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

21. 0620\_m18\_qp\_22 Q: 31

Which pair of compounds would make an NPK fertiliser?

- A** ammonium sulfate and potassium phosphate
- B** calcium hydroxide and ammonium nitrate
- C** calcium phosphate and potassium chloride
- D** potassium nitrate and ammonium sulfate

22. 0620\_s18\_qp\_21 Q: 31

Ammonia is manufactured by reacting hydrogen with nitrogen in the Haber process.

Which row describes the sources of hydrogen and nitrogen and the conditions used in the manufacture of ammonia in the Haber process?

	source of hydrogen	source of nitrogen	temperature of reaction / °C	pressure of reaction / atm
<b>A</b>	air	natural gas	250	2
<b>B</b>	air	natural gas	250	200
<b>C</b>	natural gas	air	450	2
<b>D</b>	natural gas	air	450	200

### 11.3. NITROGEN AND FERTILISERS

23. 0620\_w18\_qp\_21 Q: 28

Which statement describes the role of iron in the Haber process?

- A It is used as a catalyst.
  - B It is used as a reducing agent.
  - C It is used to condense the ammonia gas into a liquid.
  - D It is used to increase the yield of ammonia.
- 

24. 0620\_w18\_qp\_22 Q: 28

Which statement about the Haber process is correct?

- A The hydrogen used is obtained from the air.
  - B The nitrogen used is obtained from nitrates in the soil.
  - C Nitrogen reacts with hydrogen to make ammonia.
  - D The reaction takes place at room temperature and pressure.
- 

25. 0620\_w18\_qp\_23 Q: 28

Ammonia is manufactured by the Haber process from nitrogen and hydrogen.

Which row gives the main sources of these two gases?

	hydrogen	nitrogen
A	air	air
B	air	natural gas
C	natural gas	air
D	natural gas	natural gas

---

26. 0620\_s17\_qp\_21 Q: 32

Which row gives the conditions for the Haber process?

	temperature / °C	pressure / atm	catalyst
A	200	2	V <sub>2</sub> O <sub>5</sub>
B	200	450	Fe
C	450	200	Fe
D	500	250	V <sub>2</sub> O <sub>5</sub>

---

27. 0620\_s17\_qp\_22 Q: 31

Which statement about the conditions used in the Haber process is **not** correct?

- A** A high temperature is used because the forward reaction is exothermic.
- B** A high pressure is used because there are fewer moles of gas in the products than in the reactants.
- C** An iron catalyst is used to increase the rate of the forward reaction.
- D** The unreacted hydrogen and nitrogen are recycled to increase the amount of ammonia produced.

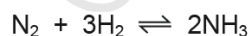
28. 0620\_s17\_qp\_23 Q: 31

Which row gives the catalyst for the Haber process and the sources of the raw materials?

	catalyst	source of hydrogen	source of nitrogen
<b>A</b>	iron	electrolysis	fertiliser
<b>B</b>	iron	methane	air
<b>C</b>	vanadium pentoxide	methane	air
<b>D</b>	vanadium pentoxide	methane	fertiliser

29. 0620\_w17\_qp\_21 Q: 31

Ammonia is made by the Haber process.



What are the sources of the nitrogen and hydrogen used in the Haber process?

	nitrogen	hydrogen
<b>A</b>	fertilisers	reacting methane with steam
<b>B</b>	fertilisers	the air
<b>C</b>	the air	reacting methane with steam
<b>D</b>	the air	the air

### 11.3. NITROGEN AND FERTILISERS

30. 0620\_w17\_qp\_22 Q: 31

Which metal is used as a catalyst in the Haber process for the manufacture of ammonia?

- A iron
  - B nickel
  - C platinum
  - D vanadium
- 

31. 0620\_w17\_qp\_23 Q: 31

The Haber process for making ammonia is carried out at a temperature of 450 °C and a pressure of 200 atmospheres in the presence of a catalyst.

Which statement is **not** correct?

- A Lowering the pressure increases the rate at which ammonia is produced.
  - B Lowering the temperature slows down the rate at which ammonia is produced.
  - C Maintaining a very high pressure is very difficult and needs expensive equipment.
  - D The reaction is a reversible reaction which can proceed forwards and backwards.
- 

32. 0620\_m16\_qp\_22 Q: 32

Fertilisers are used to provide three elements needed to increase the yield of crops.

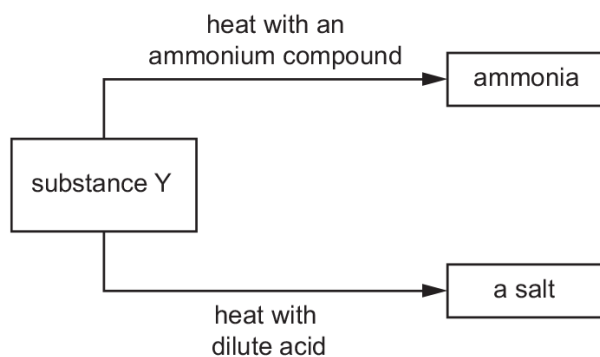
Which two compounds would provide all three of these elements?

- A ammonium nitrate and calcium phosphate
  - B ammonium nitrate and potassium sulfate
  - C potassium nitrate and calcium phosphate
  - D potassium nitrate and potassium sulfate
- 

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33. 0620\_p16\_qp\_20 Q: 33

The diagram shows some reactions of substance Y.

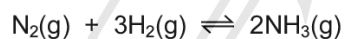


Which type of substance is Y?

- A an alcohol
- B a base
- C a catalyst
- D a metal

34. 0620\_s16\_qp\_21 Q: 32

Ammonia is formed by a reversible reaction.



The forward reaction is exothermic.

Which changes in conditions would increase the yield of ammonia?

	increase in pressure	increase in temperature
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

### 11.3. NITROGEN AND FERTILISERS

35. 0620\_s16\_qp\_21 Q: 34

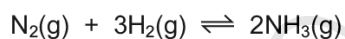
A farmer's soil is very low in both nitrogen (N) and phosphorus (P).

Which fertiliser would improve the quality of this soil most effectively?

	percentage		
	nitrogen (N)	phosphorus (P)	potassium (K)
<b>A</b>	11	11	27
<b>B</b>	12	37	10
<b>C</b>	28	10	10
<b>D</b>	31	29	9

36. 0620\_s16\_qp\_22 Q: 32

Ammonia is manufactured by a reversible reaction.



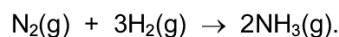
The forward reaction is exothermic.

What is the effect of increasing the pressure on the percentage yield and rate of formation of ammonia?

	percentage yield	rate of formation
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

37. 0620\_s16\_qp\_23 Q: 32

Ammonia is produced by the Haber process.

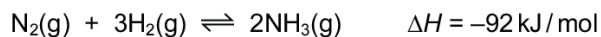


Which statement about the Haber process is **not** correct?

- A** An iron catalyst is used to increase the rate of reaction.
- B** The reaction is carried out at high temperature to increase the rate of reaction.
- C** The reaction is carried out at low pressure to increase the yield of ammonia.
- D** The reaction is reversible.

38. 0620\_w16\_qp\_21 Q: 32

Ammonia is manufactured by the Haber process. The reaction is exothermic.

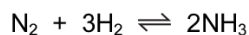


Which statement about the Haber process is correct?

- A The reaction is irreversible and produces only one product.
  - B The reaction is reversible and produces less ammonia at high pressure.
  - C The reaction is reversible and produces less ammonia at high temperature.
  - D The reaction is slow because a catalyst is not used in the Haber process.
- 

39. 0620\_w16\_qp\_22 Q: 32

Ammonia is manufactured by the Haber process, using an iron catalyst.



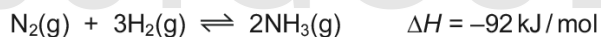
It is not possible to obtain 100% yield.

What is the reason for this?

- A A high pressure is used.
  - B Ammonia decomposes at high temperature.
  - C Some of the ammonia is recycled.
  - D The ammonia reacts with the catalyst.
- 

40. 0620\_w16\_qp\_23 Q: 32

The Haber process for the manufacture of ammonia occurs at 450°C and 250 atmospheres. The nitrogen and hydrogen are supplied in a 1:3 ratio by volume. The reaction is exothermic.



Which change causes an increase in the yield of ammonia?

- A decreasing the concentration of nitrogen
  - B decreasing the pressure
  - C decreasing the temperature
  - D using equal amounts of the two reactants
-

SN	Paper	Q. No.	Answer
01	0620_m21_qp_22	30	A
02	0620_s21_qp_21	29	B
03	0620_s21_qp_22	30	B
04	0620_s21_qp_22	31	A
05	0620_s21_qp_23	28	B
06	0620_w21_qp_21	30	B
07	0620_w21_qp_22	29	C
08	0620_w21_qp_23	30	D
09	0620_m20_qp_22	33	C
10	0620_p20_qp_20	33	B
11	0620_s20_qp_21	31	B
12	0620_s20_qp_22	31	B
13	0620_s20_qp_23	31	B
14	0620_w20_qp_21	31	C
15	0620_w20_qp_22	32	D
16	0620_w20_qp_23	31	A
17	0620_m19_qp_22	33	B
18	0620_s19_qp_21	31	B
19	0620_s19_qp_22	32	B
20	0620_s19_qp_23	32	B
21	0620_m18_qp_22	31	A
22	0620_s18_qp_21	31	D
23	0620_w18_qp_21	28	A
24	0620_w18_qp_22	28	C
25	0620_w18_qp_23	28	C
26	0620_s17_qp_21	32	C
27	0620_s17_qp_22	31	A
28	0620_s17_qp_23	31	B
29	0620_w17_qp_21	31	C
30	0620_w17_qp_22	31	A
31	0620_w17_qp_23	31	A
32	0620_m16_qp_22	32	C
33	0620_p16_qp_20	33	B
34	0620_s16_qp_21	32	B
35	0620_s16_qp_21	34	D
36	0620_s16_qp_22	32	D
37	0620_s16_qp_23	32	C
38	0620_w16_qp_21	32	C
39	0620_w16_qp_22	32	B
40	0620_w16_qp_23	32	C