Nitrogen and fertilisers

Question Paper 1

Level	IGCSE
Subject	Chemistry (0620/0971)
Exam Board	Cambridge International Examinations (CIE)
Topic	Air and Water
Sub-Topic	Nitrogen and fertilisers
Booklet	Question Paper 1

Time Allowed: **47 minutes**

Score: **/39**

Percentage: **/100**

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	53%	48%	40%	33%	<25%

1. Fertilisers are used to provide three of the elements needed for plant growth.

   Which two compounds would give a fertiliser containing all three of these elements?

   A $Ca(NO_3)_2$ and $(NH_4)_2SO_4$

   B $Ca(NO_3)_2$ and $(NH_4)_3PO_4$

   C KNO_3 and $(NH_4)_2SO_4$

   D KNO_3 and $(NH_4)_3PO_4$

2 Which element is **not** added to a fertiliser?

   A aluminium

   B nitrogen

   C phosphorus

   D potassium

3. A bag of fertiliser 'Watch it grow' contains ammonium sulfate and potassium sulfate.

   Which of the three elements N, P and K does 'Watch it grow' contain?

	N	P	K
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

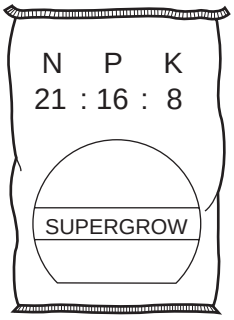
4. To grow roses, a fertiliser containing nitrogen, phosphorus and potassium is needed.

For the best flowers, the fertiliser should contain a high proportion of potassium.

Which fertiliser is best for roses?

fertiliser	proportion by mass		
	N	P	K
A	9	0	25
B	13	13	20
C	29	5	0
D	29	15	5

5. Which combination of chemical compounds could be used to produce the fertiliser shown?



A NH_4NO_3, $Ca_3(PO_4)_2$

B NH_4NO_3, $CO(NH_2)_2$

C NH_4NO_3, K_2SO_4, $(NH_4)_2SO_4$

D $(NH_4)_3PO_4$, KCl

6. Which two substances, when reacted together, would form a salt that contains two of the essential elements provided by fertilisers?

A potassium hydroxide and nitric acid

B potassium hydroxide and sulfuric acid

C sodium hydroxide and nitric acid

D sodium hydroxide and sulfuric acid

7. What are X and Y in the reaction shown?

ammonium chloride + solution X → alkaline gas Y

	X	Y
A	hydrochloric acid	ammonia
B	hydrochloric acid	chlorine
C	sodium hydroxide	ammonia
D	sodium hydroxide	chlorine

8. Fertilisers need to supply crops with three main elements.

Which compound contains all three of these elements?

A H_3PO_4 **B** KNO_3 **C** $NH_4K_2PO_4$ **D** NH_4NO_3

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

Which two compounds, when used together, 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

10. Farmers add calcium oxide (lime) and ammonium salts to their fields.

The compounds are not added at the same time because they react with each other.

Which gas is produced in this reaction?

A ammonia

B carbon dioxide

C hydrogen

D nitrogen

11. Nitrogen, phosphorus and potassium are essential elements for plant growth.

Which mixture provides all three essential elements?

	mixture	formula
A	ammonium phosphate + potassium chloride	$(NH_4)_3PO_4$ + KCl
B	ammonium phosphate + ammonium nitrate	$(NH_4)_3PO_4$ + NH_4NO_3
C	ammonium phosphate + ammonium chloride	$(NH_4)_3PO_4$ + NH_4Cl
D	ammonium nitrate + potassium chloride	NH_4NO_3 + KCl

12. Which substance would make the best general fertiliser?

	relative amount			solubility in water
	P	K	N	
A	5	0	5	soluble
B	5	5	20	insoluble
C	5	10	15	soluble
D	10	5	10	insoluble

13. Which method can be used to obtain ammonia from ammonium sulfate?

A Heat it with an acid.

B Heat it with an alkali.

C Heat it with an oxidising agent.

D Heat it with a reducing agent.

14. Which pair of compounds would make a N, P, K 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.

15. Which compound contains two of the three essential elements needed for a complete fertiliser?

A ammonium chloride

B ammonium nitrate

C ammonium phosphate

D ammonium sulfate

16. Which compound would **not** be an effective fertiliser?

A ammonium nitrate, NH_4NO_3

B calcium oxide, CaO

C calcium phosphate, $Ca_3(PO_4)_2$

D potassium nitrate, KNO_3

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

Which pair of substances contains 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

18. Which elements are present in NPK fertilisers?

A nitrogen, phosphorus, potassium

B nitrogen, potassium, calcium

C sodium, phosphorus, potassium

D sodium, potassium, calcium

19. Which compound is **not** a fertiliser?

A ammonium sulfate, $(NH_4)_2SO_4$

B calcium hydroxide, $Ca(OH)_2$

C potassium chloride, KCl

D urea, $CO(NH_2)_2$

20. Carbon dioxide and methane are 'greenhouse gases' which contribute to global warming.

Which process does **not** increase global warming?

A burning fossil fuels

B decay of organic waste

C farming cattle for beef

D growing crops such as sugar cane

21. A zinc compound forms carbon dioxide in two different reactions.

1 It is heated strongly.

2 It is added to hydrochloric acid.

Which type of reaction occurs in 1 and 2?

	1	2
A	combustion	neutralisation
B	combustion	oxidation
C	thermal decomposition	neutralisation
D	thermal decomposition	oxidation

22. 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)
A	11	11	27
B	12	37	10
C	28	10	10
D	31	29	9

23 The formulae of four compounds, W, X Y and Z, are given.

compound	formula
W	$FeSO_4$
X	$(NH_4)_3PO_4$
Y	KNO_3
Z	$NaCl$

Which mixture of compounds makes a complete fertiliser?

A W and X **B** W and Z **C** X and Y **D** Y and Z

24. Ammonia is formed by a reversible reaction.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

Which changes in conditions would increase the yield of ammonia?

	increase in pressure	increase in temperature
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

25. Ammonia is produced by the Haber process.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g).$$

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.

26. 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

27 To grow rose plants, a fertiliser containing nitrogen, phosphorus and potassium is often used.

For the best rose flowers, the fertiliser should contain a high proportion of potassium.

Which fertiliser is best for producing rose flowers?

fertiliser	proportion by mass		
	N	P	K
A	9	0	25
B	13	13	20
C	29	5	0
D	29	15	5

28 Ammonia is made by the Haber process.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

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

	nitrogen	hydrogen
A	fertilisers	reacting methane with steam
B	fertilisers	the air
C	the air	reacting methane with steam
D	the air	the air

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

A iron

B nickel

C platinum

D vanadium

30 A solid fertiliser contains ammonium sulfate.

A sample of the fertiliser is shaken with water.

To show the presence of ammonium ions in the solution, ...1..... is added and the gas produced is tested with damp .....2..... litmus paper.

Which words complete gaps 1 and 2?

	1	2
A	aqueous sodium hydroxide	blue
B	aqueous sodium hydroxide	red
C	dilute hydrochloric acid	blue
D	dilute hydrochloric acid	red

31 Which row gives the conditions for the Haber process?

	temperature / °C	pressure / atm	catalyst
A	200	2	V_2O_5
B	200	450	Fe
C	450	200	Fe
D	500	250	V_2O_5

32 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.

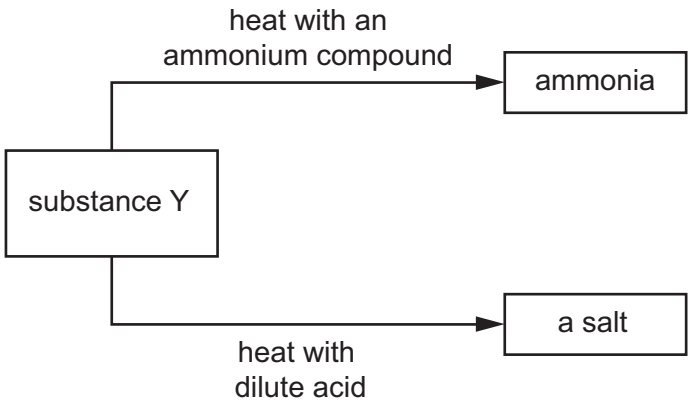
C An iron catalyst is used to increase the rate of the forward reaction.

D The unreacted hydrogen and nitrogen are recycled to increase the amount of ammonia produced.

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

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

34 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

35 Ammonia is manufactured by a reversible reaction.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

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
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

36 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.

37 The reaction used to manufacture ammonia from nitrogen and hydrogen is reversible.

An equilibrium can be established between ammonia, nitrogen and hydrogen.

Which statement describes the equilibrium?

A Both the forward reaction and the backward reaction have the same rate.

B The rate of the backward reaction is greater than the rate of the forward reaction.

C The rate of the forward reaction is greater than the rate of the backward reaction.

D The forward and backward reactions have both stopped.

38 Ammonia is produced when a mixture of ammonium chloride and substance X is heated.

What is substance X?

A ammonium sulfate

B barium chloride

C calcium hydroxide

D silver nitrate

39 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
A	ammonium	ammonia	Contact	iron
B	ammonium	ammonia	Haber	vanadium(V) oxide
C	sulfate	sulfuric acid	Contact	vanadium(V) oxide
D	sulfate	sulfuric acid	Haber	iron