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Chapter 1

The particulate nature of matter

1.1 The particulate nature of matter

1. 0620_m20_qp_22 Q: 1

The formula of methane is CH_4 and the formula of ethane is C_2H_6 .

Which row describes diffusion and the relative rates of diffusion of methane and ethane?

	description of diffusion	relative rate of diffusion
A	particles move from a high concentration to a low concentration	ethane diffuses more quickly than methane
B	particles move from a high concentration to a low concentration	methane diffuses more quickly than ethane
C	particles move from a low concentration to a high concentration	ethane diffuses more quickly than methane
D	particles move from a low concentration to a high concentration	methane diffuses more quickly than ethane

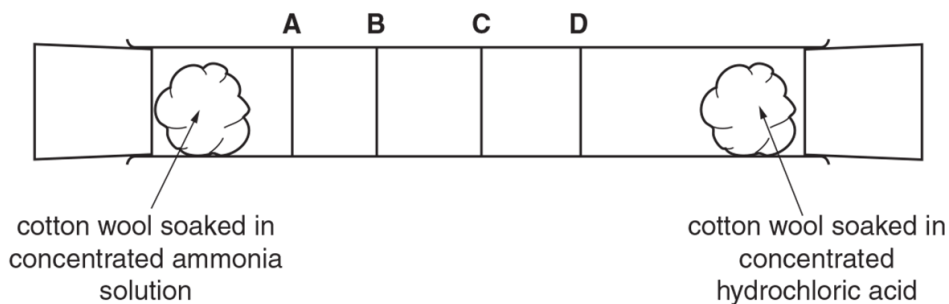
2. 0620_p20_qp_20 Q: 2

The diagram shows the diffusion of hydrogen chloride and ammonia in a glass tube.

The gases are given off by the solutions at each end of the tube.

When hydrogen chloride and ammonia mix they produce a white solid, ammonium chloride.

Which line shows where the white solid is formed?



3. 0620_s20_qp_21 Q: 1

A mixture of ice and water is left to stand and the ice melts.

Which row describes what happens as the ice is melting?

	temperature of mixture	energy changes
A	increases	average kinetic energy of particles increases
B	increases	energy is used to overcome attractive forces
C	stays the same	average kinetic energy of particles increases
D	stays the same	energy is used to overcome attractive forces

4. 0620_m19_qp_22 Q: 1

Pure water boils at 100°C.

What happens to the water particles when water boils?

- A** They gain energy and move further apart.
- B** They gain energy and stay close together.
- C** They lose energy and move further apart.
- D** They lose energy and stay close together.

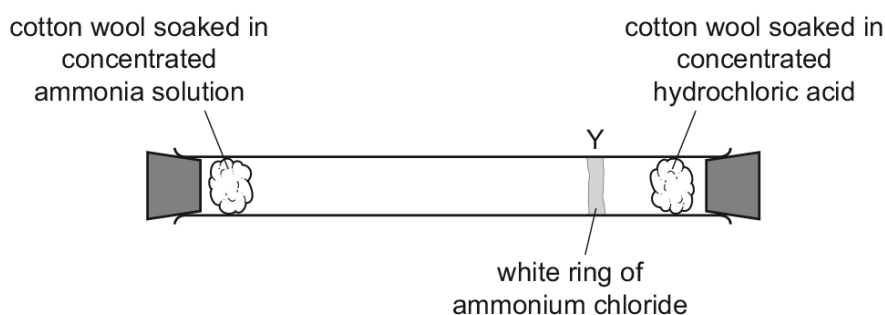
5. 0620_s19_qp_21 Q: 1

Which statement explains why ammonia gas, NH_3 , diffuses at a faster rate than hydrogen chloride gas, HCl ?

- A** Ammonia expands to occupy all of the space available.
- B** Ammonia has a smaller relative molecular mass than hydrogen chloride.
- C** Ammonia is an alkali and hydrogen chloride is an acid.
- D** Ammonia molecules diffuse in all directions at the same time.

6. 0620_s19_qp_22 Q: 1

The apparatus shown is set up. After 20 minutes a white ring of ammonium chloride is seen at position Y.



Which statement about the molecules of ammonia and hydrogen chloride is correct?

- A** Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more slowly.
 - B** Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more quickly.
 - C** Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more slowly.
 - D** Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more quickly.
-

7. 0620_s19_qp_23 Q: 1

Hydrogen chloride gas ($M_r = 36.5$) is released at P in the apparatus shown.

The Universal Indicator paper turns red after 38 s.



The experiment is repeated using sulfur dioxide ($M_r = 64$).

What is the result for sulfur dioxide?

	Universal Indicator turns	time for Universal Indicator to change colour / s
A	blue	26
B	blue	51
C	red	26
D	red	51

8. 0620_w19_qp_21 Q: 1

Samples of four gases are released in a room at the same time.

The gases are carbon dioxide, CO_2 , hydrogen chloride, HCl , hydrogen sulfide, H_2S , and nitrogen dioxide, NO_2 .

Which gas diffuses fastest?

- A** carbon dioxide
 - B** hydrogen chloride
 - C** hydrogen sulfide
 - D** nitrogen dioxide
-

9. 0620_w19_qp_22 Q: 1

The rate of diffusion of a gas depends on its molecular mass and the temperature.

Which combination of molecular mass and temperature gives the slowest rate of diffusion?

	molecular mass	temperature
A	high	high
B	high	low
C	low	high
D	low	low

10. 0620_w19_qp_23 Q: 1

Which two gases will diffuse at the same rate, at the same temperature?

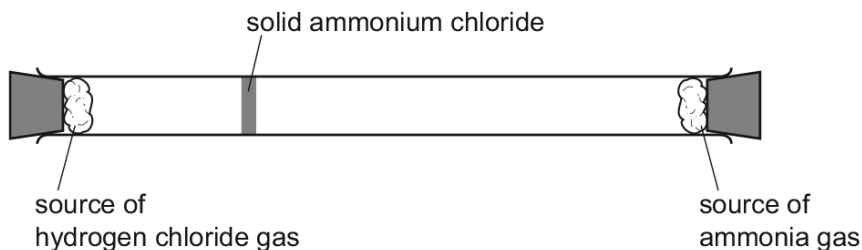
- A** carbon monoxide and carbon dioxide
 - B** carbon monoxide and nitrogen
 - C** chlorine and fluorine
 - D** nitrogen and oxygen
-

11. 0620_m18_qp_22 Q: 1

Hydrogen chloride gas, HCl , reacts with ammonia gas, NH_3 , to form solid ammonium chloride.

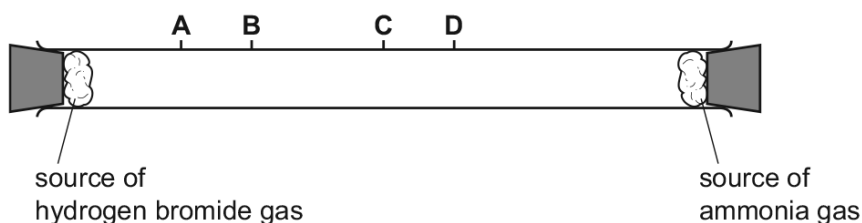
The apparatus is set up as shown.

After a few minutes, solid ammonium chloride forms where the two gases meet.



The experiment is repeated using hydrogen bromide, HBr , in place of hydrogen chloride.

How far along the tube does the solid ammonium bromide form?



12. 0620_m18_qp_22 Q: 2

Substance L melts at -7°C and is a brown liquid at room temperature.

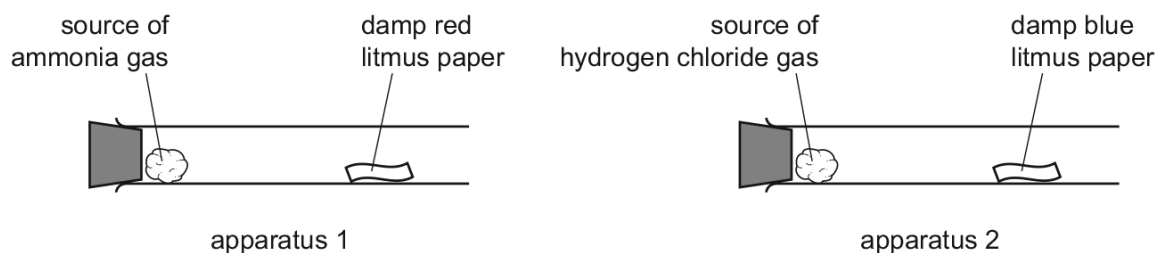
Which temperature is the boiling point of pure L?

- A -77°C
 - B -7°C to $+7^\circ\text{C}$
 - C 59°C
 - D 107°C to 117°C
-

13. 0620_s18_qp_21 Q: 1

A student investigated the diffusion of ammonia gas, NH_3 , and hydrogen chloride gas, HCl .

Two sets of apparatus were set up as shown at room temperature and pressure.



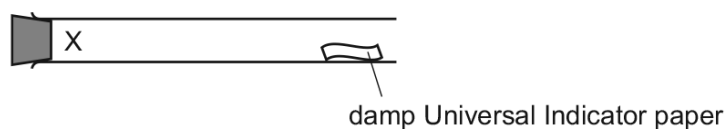
The damp red litmus paper in apparatus 1 changed colour after 30 seconds.

How long does it take for the damp blue litmus paper to change colour in apparatus 2?

- A 64 seconds
- B 30 seconds
- C 21 seconds
- D The blue litmus paper would not change colour.

14. 0620_s18_qp_22 Q: 1

A gas is released at point X in the apparatus shown.



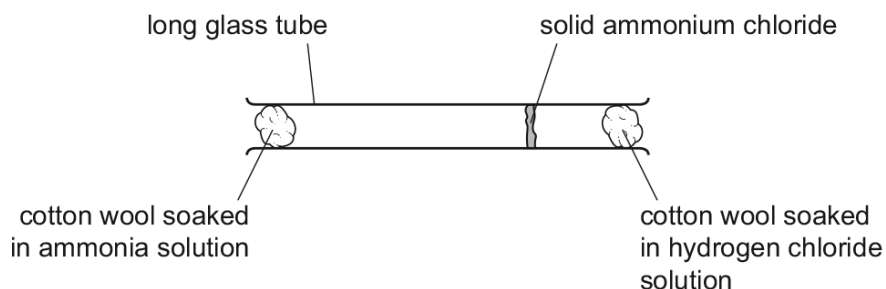
Which gas turns the damp Universal Indicator paper red most quickly?

- A ammonia, NH_3
- B chlorine, Cl_2
- C hydrogen chloride, HCl
- D sulfur dioxide, SO_2

15. 0620_s18_qp_23 Q: 1

Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.



Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

- A** Ammonia solution is a base and hydrogen chloride solution is an acid.
- B** Ammonia molecules diffuse more slowly than hydrogen chloride molecules.
- C** Hydrogen chloride has a greater molecular mass than ammonia.
- D** Hydrogen chloride moves by Brownian motion.

16. 0620_w18_qp_21 Q: 1

When smoke particles are observed with a microscope they are seen to move around randomly. This is called Brownian motion.

What causes Brownian motion?

- A** diffusion of the smoke particles
 - B** molecules in the air hitting the smoke particles
 - C** sublimation of the smoke particles
 - D** the smoke particles hitting the walls of the container
-

Chapter 2

Experimental techniques

2.1 Measurement

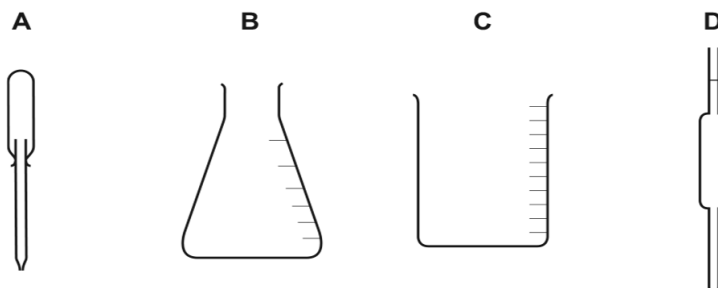
30. 0620_s20_qp_21 Q: 2

Which piece of apparatus should be used to measure exactly 21.4 cm^3 of water?

- A 25 cm^3 beaker
 - B 25 cm^3 pipette
 - C 50 cm^3 burette
 - D 50 cm^3 measuring cylinder
-

31. 0620_s20_qp_22 Q: 2

Which piece of apparatus is used to measure 25.0 cm^3 of aqueous sodium hydroxide?



32. 0620_s20_qp_23 Q: 2

Which piece of apparatus is used to measure 13.7 cm^3 of dilute hydrochloric acid?

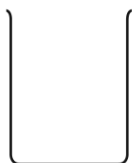
- A balance
 - B burette
 - C conical flask
 - D pipette
-

33. 0620_m19_qp_22 Q: 3

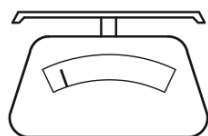
Lead(II) iodide is insoluble in water.

Lead(II) iodide is made by adding aqueous lead(II) nitrate to aqueous potassium iodide.

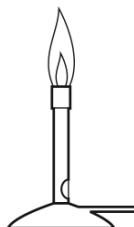
Which pieces of apparatus are needed to obtain solid lead(II) iodide from 20 cm^3 of aqueous lead(II) nitrate?



1



2



3



4



5

A 1, 2 and 4**B** 1, 3 and 5**C** 1, 4 and 5**D** 2, 4 and 5

34. 0620_s19_qp_21 Q: 2

2.00 g of powdered calcium carbonate is added to 50.0 cm^3 of hydrochloric acid.

Which apparatus is used to measure the calcium carbonate and the hydrochloric acid?

	calcium carbonate	hydrochloric acid
A	balance	burette
B	balance	thermometer
C	pipette	burette
D	pipette	thermometer

35. 0620_s19_qp_22 Q: 2

A student measures 25.00 cm^3 of dilute hydrochloric acid accurately.

Which apparatus is most suitable?

A beaker**B** measuring cylinder**C** burette**D** dropping pipette

36. 0620_s19_qp_23 Q: 2

Which piece of apparatus is used to measure 24.8 cm^3 of gas produced during a reaction?

- A beaker
 - B conical flask
 - C measuring cylinder
 - D pipette
-

37. 0620_w19_qp_21 Q: 2

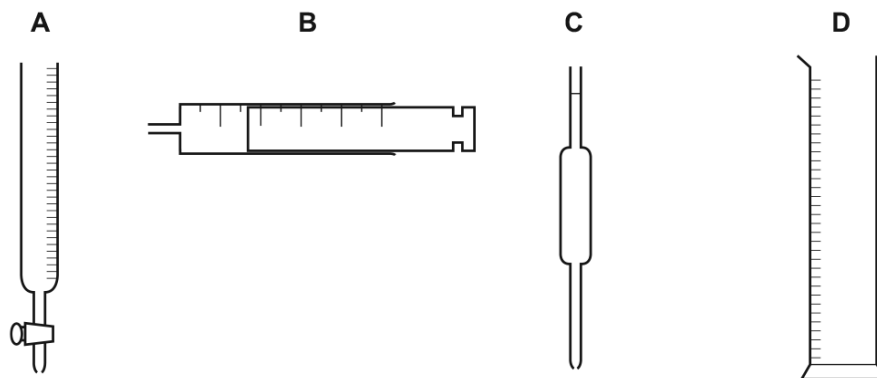
A student is asked to measure the time taken for 0.4 g of magnesium carbonate to react completely with 25.0 cm^3 of dilute hydrochloric acid.

Which pieces of apparatus does the student need?

- A balance, stop-clock, pipette
 - B balance, stop-clock, thermometer
 - C balance, pipette, thermometer
 - D stop-clock, pipette, thermometer
-

38. 0620_s18_qp_21 Q: 3

Which piece of apparatus is used to measure exactly 26.3 cm^3 of a liquid?



39. 0620_s18_qp_22 Q: 3

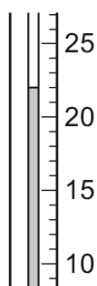
Which piece of apparatus **cannot** be used to collect and measure the volume of gas produced in an experiment?

- A burette
- B gas syringe
- C measuring cylinder
- D pipette

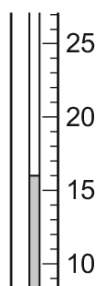
40. 0620_s18_qp_23 Q: 3

Solid R reacted with dilute sulfuric acid.

The initial temperature of the dilute sulfuric acid and the final temperature of the solution are shown.



initial temperature
of the dilute
sulfuric acid ($^{\circ}\text{C}$)



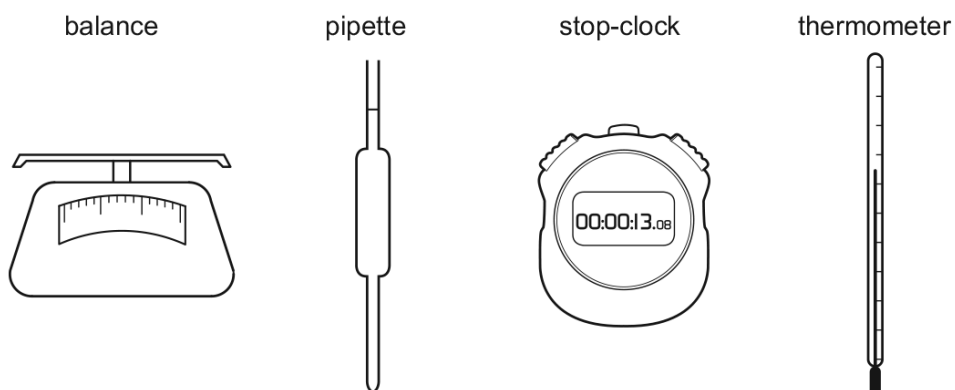
final temperature
of the solution ($^{\circ}\text{C}$)

What was the change in temperature in $^{\circ}\text{C}$?

- A -6
- B -4
- C 4
- D 6

41. 0620_w18_qp_21 Q: 2

The diagrams show four pieces of laboratory equipment.

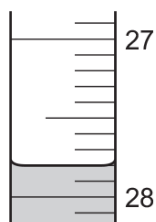


Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

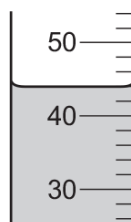
	balance	pipette	stop-clock	thermometer
A	x	x	x	✓
B	✓	x	x	✓
C	x	✓	x	✓
D	✓	x	✓	x

42. 0620_m17_qp_22 Q: 2

The diagrams show liquids in a burette and a measuring cylinder.



burette



measuring cylinder

Which row shows the correct readings for the burette and the measuring cylinder?

	burette	measuring cylinder
A	27.8	42
B	27.8	44
C	28.2	42
D	28.2	44

43. 0620_w17_qp_21 Q: 2

A student put 25.0 cm^3 of dilute hydrochloric acid into a conical flask.

The student added 2.5 g of solid sodium carbonate and measured the change in temperature of the mixture.

Which apparatus does the student need to use to obtain the most accurate results?

- A** balance, measuring cylinder, thermometer
- B** balance, pipette, stopwatch
- C** balance, pipette, thermometer
- D** burette, pipette, thermometer

44. 0620_w17_qp_22 Q: 2

During an experiment a measurement is recorded in cm^3 .

Which apparatus is used?

- A balance
 - B measuring cylinder
 - C stopclock
 - D thermometer
-

45. 0620_w17_qp_23 Q: 2

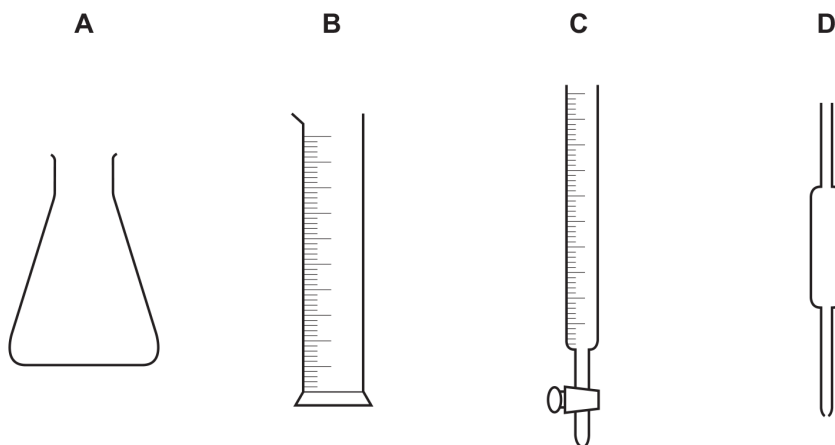
25 cm^3 of an alkali are added to 20 cm^3 of an acid. The temperature change is measured.

Which apparatus is **not** needed in the experiment?

- A 25 cm^3 measuring cylinder
 - B 100 cm^3 beaker
 - C balance
 - D thermometer
-

46. 0620_m16_qp_22 Q: 2

Which piece of apparatus is used to measure variable quantities of liquid in a titration?

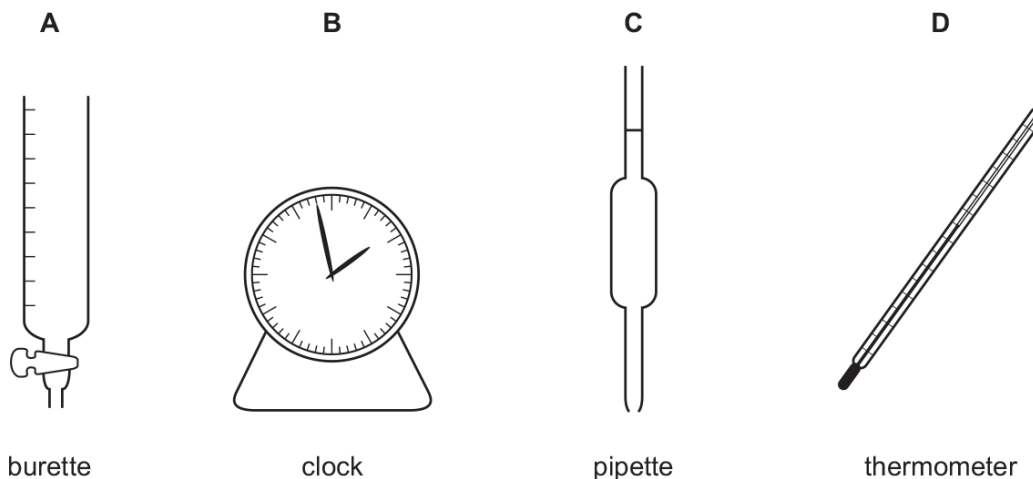


47. 0620_w16_qp_21 Q: 2

A student mixes 25cm^3 samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

In each case, the student measures the change in temperature to test if the reaction is exothermic.

Which piece of apparatus is **not** needed?



2.2 Purity

48. 0620_m20_qp_22 Q: 2

Which test is used to show that a sample of water is pure?

- A** Evaporate the water to see if any solids remain.
- B** Heat the water to check its boiling point.
- C** Test with anhydrous cobalt(II) chloride.
- D** Use universal indicator paper to check its pH.

49. 0620_m20_qp_22 Q: 3

Chromatography is used to separate and identify the components in both coloured and colourless mixtures.

For colourless mixtures the chromatogram has to be treated with another chemical.

What is the name of this type of chemical?

- A** colouring agent
 - B** display agent
 - C** finding agent
 - D** locating agent
-

Appendix A

Answers