Particles, atomic structure, ionic bonding, the Periodic Table

CORE questions

Core 1

(b) Describe three things you would **see** when a small piece of sodium is added to a beaker of water.

1. .....

2. .....

3. .....

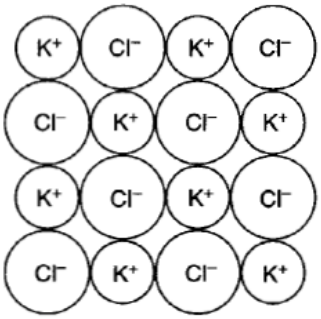
[3]

(c) Lithium (Li), sodium (Na), and potassium (K) are in the same group of the Periodic Table. The following table compares the properties and electronic structure of these elements. Suggest a value for the boiling point of sodium and complete the rest of the table.

element	*boiling point / °C*	*reaction with water*	*electronic structure*
lithium	1342	steady reaction	2.1
sodium		rapid reaction	
potassium	760		2.8.8.1

[3]

(d) When potassium burns in chlorine, potassium chloride is formed. Part of the structure of potassium chloride is shown below.



(i) Describe the type of bonding in potassium chloride.

.....[1]

(ii) State the simplest formula for potassium chloride.

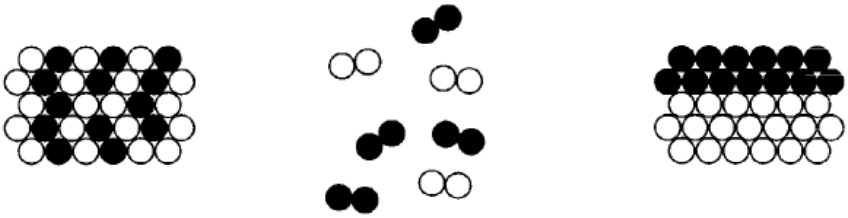
.....[1]

(iii) Explain why solid potassium chloride does not conduct electricity.

.....[1]

Core 2

(iii) Which one of the following, **A**, **B** or **C**, is a correct representation of an alloy?
Put a ring around the correct answer.



A **B** **C** [1]

(b) Zinc is a metal. State three physical properties that **all** metals have in common.

1. .....

2. .....

3. .....

[3]

Core 3

6 Carbon-14 is a radioactive isotope which is formed in the upper atmosphere.

(a) Explain the meaning of the terms

(i) *radioactive,* .....

.....[1]

(ii) *isotope.* .....

.....[2]

(b) State one medical use of radioactive isotopes.

.....[1]

(c) Carbon-14 has a nucleon (mass) number of 14.
Complete the table below to show the type of charge and number of particles present in one atom of carbon-14.

type of particle	*type of charge on the particle*	*number of particles present*
proton		
neutron		
electron		

[6]

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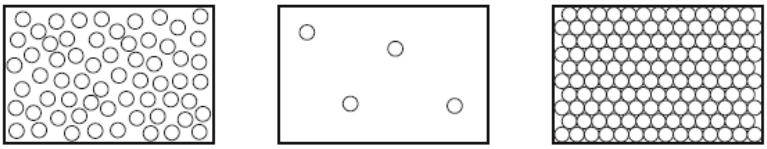
Paper 1 Question 1

1 The diagrams show the arrangement of particles in three different physical states of substance X.



state 1 state 2 state 3

Which statement about the physical states of substance X is correct?

A Particles in state 1 vibrate about fixed positions.

B State 1 changes to state 2 by diffusion.

C State 2 changes directly to state 3 by condensation.

D The substance in state 3 has a fixed volume.

Paper 1 Question 3

3 Element Y has a nucleon number of 19 and a proton number of 9.

Which group in the Periodic Table does it belong to?

A I **B** III **C** VII **D** VIII

Paper 1 Question 4

4 The nucleon number and proton number of the lithium atom are shown by the symbol $^{7}_{3}Li$.

What is the correct symbol for the lithium ion in lithium chloride?

A $^{6}_{2}Li^{-}$ **B** $^{6}_{3}Li^{+}$ **C** $^{7}_{3}Li^{+}$ **D** $^{7}_{3}Li^{-}$

Paper 1 Question 6

6 The table shows the structure of different atoms and ions.

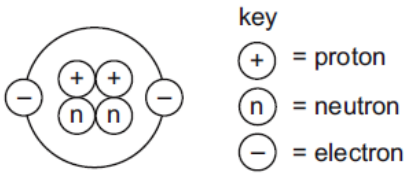
particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg^{2+}	X	24	12	12	10
F	9	19	9	Y	9
F^-	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

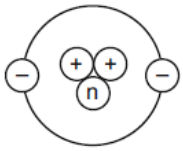
Paper 1 Question 7

7 The diagram shows the structure of an atom.

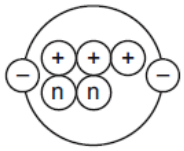


Which diagram shows the structure of an isotope of this atom?

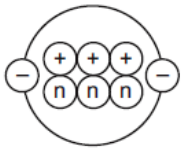
A



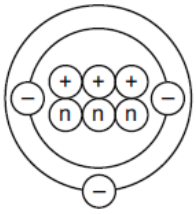
B



C



D



Paper 1 Question 8

8 Which two elements react together to form an ionic compound?

element	electronic structure
R	2,4
T	2,8
X	2,8,1
Z	2,8,7

A R and T **B** T and X **C** X and Z **D** Z and R

Paper 1 Question 11

11 The chemical formulae of two substances, W and X, are given.

W $NaAlSi_3O_8$

X $CaAl_2Si_2O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

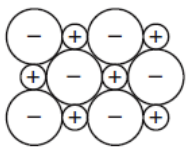
3 X contains twice as much aluminium as W.

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

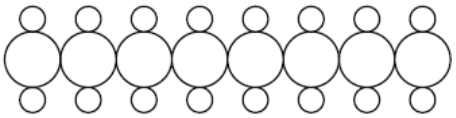
Paper 1 Question 28

28 Which diagram could represent the structure of an alloy?

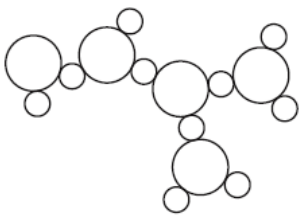
A



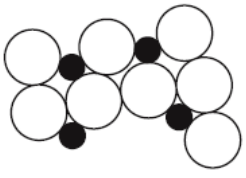
B



C

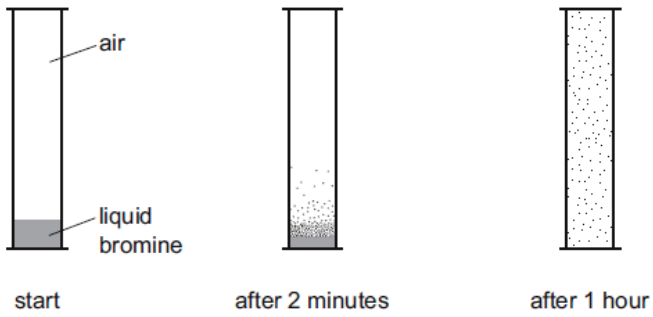


D



Paper 3 Question 2

(b) A teacher placed a small amount of liquid bromine in the bottom of a sealed gas jar of air. After two minutes red-brown fumes were seen just above the liquid surface. After one hour the red-brown colour had spread completely throughout the gas jar.



Use the kinetic particle model of matter to explain these observations.

.....

.....

..... [3]

EXTENSION question

Extension 1

The element scandium, proton (atomic) number, $Z = 21$, was discovered by L Nilson in Sweden in 1879.

(a) It forms only one ion which has the formula $^{45}_{21}Sc^{3+}$.

(i) How many electrons, protons and neutrons are there in this ion?

number of electrons .....

number of protons .....

number of neutrons .....

(ii) Predict the electron distribution of this ion.

.....

[4]

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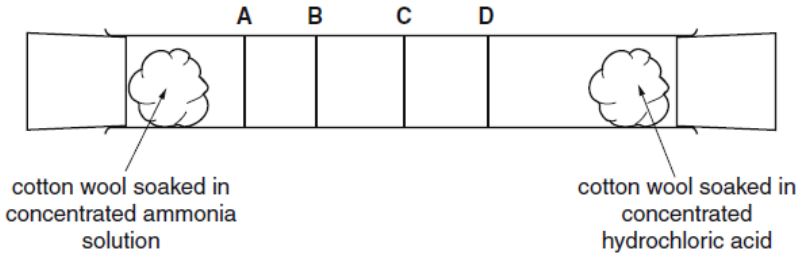
Paper 2 Question 2

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?



Paper 3 Question 5

(b) The symbols for two isotopes of iron are shown below.

$^{54}_{26}Fe$ $^{57}_{26}Fe$

(i) How do these two isotopes differ in their atomic structure?

.....[1]

(ii) Determine the number of neutrons present in one atom of the isotope $^{57}_{26}Fe$.

.....[1]

(iii) Determine the number of electrons in one Fe^{3+} ion?

.....[1]

Paper 4 Question 2

2 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	18	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....

..... [1]

(ii) **A**, **B** and **C** are all particles of the same element.

.....

..... [1]

(iii) Particles **A** and **C** are isotopes of the same element.

.....

..... [2]

(b) **(i)** What is the electronic structure of particle **A**?

..... [1]

(ii) Is element **A**, a metal or a non-metal? Give a reason for your choice.

.....

..... [1]

[Total: 6]

Paper 4 Question 3

(ii) Compare the movement and arrangement of the molecules in solid nitrogen to those in nitrogen gas.

.....

.....

.....

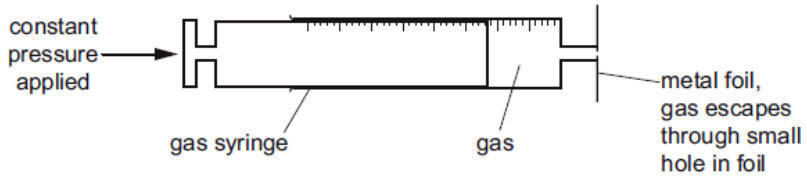
..... [3]

(b) A sealed container contains nitrogen gas. The pressure of the gas is due to the molecules of the gas hitting the walls of the container.
Use the kinetic theory to explain why the pressure inside the container increases when the temperature is increased.

.....

..... [2]

The following apparatus can be used to measure the rate of diffusion of a gas.



The following results were obtained.

gas	temperature /°C	rate of diffusion in cm^3/min
nitrogen	25	1.00
chlorine	25	0.63
nitrogen	50	1.05

(c) (i) Explain why nitrogen gas diffuses faster than chlorine gas.

.....

..... [2]

(ii) Explain why the nitrogen gas diffuses faster at the higher temperature.

..... [1]

Particles, atomic structure, ionic bonding, the Periodic Table – answers

Core 1

(b) any three observations such as:
floats on water
moves about
bursts into flame
fizzes
bubbles
dissolves
disappears
goes into a ball

(c)

boiling point	reaction with water	electronic structure
900 – 1100	very vigorous	

(d) **(i)** ionic / electrovalent

(ii) KC*l*

(iii) ions are not free to move

Core 2

(iii) A

(b) any three from:
conduct heat
conduct electricity
malleable
ductile
sonorous
shiny

Core 3

(a) **(i)** ionising particles given off or named radiation, α, β and γ

(ii) atoms with the same number of protons / same element / same atomic number different numbers of neutrons / different mass numbers

(b) any suitable such as:
finding out how well an organ is carrying out its function treating cancers
sterilising surgical instruments

(c) + 6

none 8
6

Specimen Paper 1

1 D

3 C

4 C

6 D

7 A

8 C

11 B

28 D

Specimen Paper 3

2 **(b)** Any three of:
bromine evaporates / liquid evaporates;
more energetic particles change from liquid to vapour or gas;
diffusion;
random movement of particles / particles move everywhere / air and bromine particles are moving;
(bromine and air) particles get mixed up / collision of bromine and air particles;

Extension 1

(a) **(i)** 18e
21p
24n

(ii) 2.8.8

Specimen Paper 2

2 D

Specimen Paper 3 Question 5

5 **(b)** **(i)** number of neutrons / different nucleon number

(ii) 31

(iii) 23

Specimen Paper 4 Question 2

2 **(a)** **(i)** same number of protons and electrons

(ii) all have the same number of protons / same proton number / same atomic number

(iii) same number of protons / same proton number / same atomic number;
different number of neutrons / different nucleon number / different mass number;

(b) **(i)** 2, 8, 5

(ii) non-metal because it accepts electrons / needs 3e to complete outer energy level / because it is in Group V or 5e in outer shell
note: need both non-metal and reason for one mark

Specimen Paper 4 Question 3

3 **(ii)**

	solid	gas
pattern:	regular / lattice	random / irregular / no pattern;
distance:	close	far apart / spread out;
movement:	vibrate / fixed position	moving;

note: comparison must be made

(b) particles have more energy / move faster;
collide harder / collide more frequently / more collisions / collide with more force;
allow: molecules instead of particles

(c) **(i)** nitrogen has smaller M_r;
nitrogen (molecules) move faster (than chlorine molecules) / ora;
note: comparison must be made

(ii) (at higher temperature) molecules move faster / have more energy