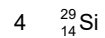
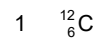


4 The symbols of four atoms are listed.



Which atoms have more neutrons than protons?

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

1 Atoms and ions are made from particles called electrons, neutrons and protons.

(a) Complete Table 1.1.

Table 1.1

particle	relative charge	relative mass
electron	−1	$\frac{1}{1840}$
neutron		
proton		

[2]

(b) Table 1.2 shows information about some atoms or ions.

Complete Table 1.2.

Table 1.2

atom or ion	number of electrons	number of neutrons	number of protons
$^{40}_{20}\text{Ca}^{2+}$		20	20
$^{19}_9\text{F}$	9		9
	10	9	8

[5]

(c) (i) The relative atomic mass, A_r , of an element is the average mass of its isotopes compared to one atom of isotope **X**.

Identify isotope **X**.

..... [1]

(ii) A sample of magnesium consists of two isotopes with mass numbers 24 and 26.
[A_r : Mg, 24.3]

Calculate the percentage abundance of the isotope of magnesium with mass number 24.

percentage abundance = [1]

1 A list of substances is shown.

aluminium oxide calcium oxide chlorine ethanol graphite
nitrogen oxygen propane propene silicon(IV) oxide

Answer the questions using the list of substances.

Each substance may be used once, more than once, or not at all.

State which of the substances:

(a) is a compound with a giant covalent structure

..... [1]

(b) is an unsaturated hydrocarbon

..... [1]

(c) is an amphoteric oxide

..... [1]

(d) is a good conductor of electricity when solid

..... [1]

(e) contains simple molecules with 9 atoms

..... [1]

(f) react together to form slag in the blast furnace

..... and [2]

(g) belongs to a homologous series whose general formula is C_nH_{2n+2}

..... [1]

(h) is manufactured by the catalytic addition of steam to ethene

..... [1]

(i) is a gas that is approximately 78% of clean, dry air.

..... [1]

[Total: 10]

4 This question is about compounds of sulfur.

(a) Sulfuric acid is manufactured in a four-stage process.

stage 1 Sulfur dioxide is produced from ores containing sulfur.

stage 2 Sulfur dioxide reacts with oxygen to form sulfur trioxide.

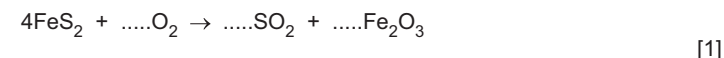
stage 3 Sulfur trioxide reacts with concentrated sulfuric acid to form oleum, $H_2S_2O_7$.

stage 4 Oleum reacts with water to form concentrated sulfuric acid.

(i) Iron pyrite is an ore containing sulfur. The ore contains a compound with the formula FeS_2 .

FeS_2 reacts with oxygen in the air to produce sulfur dioxide.

Balance the symbol equation for this reaction.



(ii) Complete the dot-and-cross diagram in Fig. 4.1 to show the electronic configuration in an oxygen molecule, O_2 . Show outer-shell electrons only.

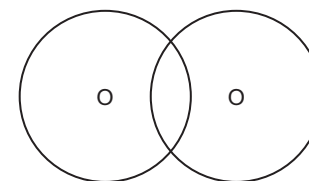


Fig. 4.1

[2]

(b) (i) State **three** typical conditions for the reaction between sulfur dioxide and oxygen in **stage 2**.

1

2

3

[3]

(ii) Write a symbol equation for the reaction that occurs in **stage 2**.

..... [1]

(iii) Write the symbol equation for the reaction in **stage 3**.

..... [1]

(c) Sulfuric acid reacts with carbon. The equation for the reaction is shown.



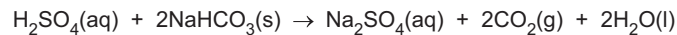
Give the oxidation number of carbon in:

• C

• CO_2

[2]

(d) Dilute sulfuric acid reacts with sodium hydrogencarbonate, NaHCO_3 , to produce carbon dioxide gas, CO_2 .



4.20 g of NaHCO_3 is added to excess dilute sulfuric acid.

Calculate the volume of $\text{CO}_2(\text{g})$, measured at r.t.p., produced using the following steps.

- Calculate the number of moles of NaHCO_3 in 4.20 g.

The M_r of NaHCO_3 is 84.

..... mol

- Deduce the number of moles of $\text{CO}_2(\text{g})$ that are produced.

..... mol

- Calculate the volume of $\text{CO}_2(\text{g})$ produced in cm^3 .

One mole of any gas occupies $24\,000\text{ cm}^3$ at r.t.p.

..... cm^3

[3]