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H 3 6 7 9 8 A 0 3 1 2

3

Turn over

1. Lithium and sodium are reactive metals in the same group of the periodic table.

(a) The lithium atom contains electrons, neutrons and protons.

(i) Describe the position of these particles in the lithium atom.

.....
.....
.....
.....

(2)

(ii) A lithium atom has an atomic number of 3 and a mass number of 7.
State the number of each type of particle in this lithium atom.

..... protons
..... electrons
..... neutrons

(2)

(b) When lithium is heated and put into a gas jar of oxygen, a vigorous reaction takes place.

(i) During the reaction, heat is given out.
What type of reaction is this?

.....

(1)

(ii) The product is lithium oxide.
The lithium oxide contains lithium ions, Li^+ , and oxide ions, O^{2-} .
Write the formula of lithium oxide.

.....

(1)



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(c) The electronic configuration of lithium is 2.1.
Sodium is below lithium in the periodic table and has the electronic configuration 2.8.1.

(i) Describe how the electronic configuration of an atom of an element shows the group and period in which the element appears in the periodic table.

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(2)

(ii) Sodium is more reactive than lithium.

Use the electronic configurations of their atoms to explain why.

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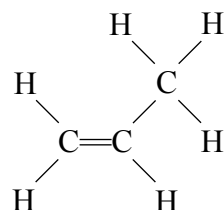
(1)

Q1

(Total 9 marks)



2. The diagram shows one molecule of propene.



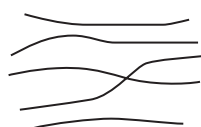
(a) What is the molecular formula of propene?

..... (1)

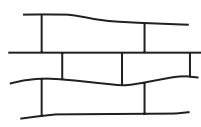
(b) Propene can form the polymer poly(propene).
Draw a diagram to show the part of a poly(propene) chain formed by two propene monomer units.

(2)

(c) The diagrams show the structures of polymer A and polymer B.
One of these is a thermosetting polymer and one is a thermoplastic polymer.



polymer A



polymer B

(i) Identify each polymer as thermosetting or thermoplastic.

Polymer A is

Polymer B is

(1)

(ii) State how the structure of a thermosetting polymer differs from that of a thermoplastic polymer.

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..... (1)



(d) State one problem caused by disposing of polymers by burning.

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(1)

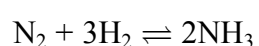
(Total 6 marks)

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Q2



3. Ammonia is manufactured by the Haber process.
The equation for the reaction is



- (a) Calculate the mass of ammonia that would be formed if 1.40 kg of nitrogen reacts completely with excess hydrogen.
(Relative molecular masses: $\text{N}_2 = 28.0$; $\text{H}_2 = 2.00$, $\text{NH}_3 = 17.0$)

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Answer = kg
(2)

- (b) 1.40 kg of nitrogen is left in a sealed container with excess hydrogen.
The container is maintained at a pressure of 200 atm and contains an iron catalyst at 450 °C.
The mixture is left until there is no further increase in the amount of ammonia.
The mass of ammonia formed is much less than the mass calculated in part (a).
Explain why.

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(2)

- (c) Draw a dot and cross diagram to show the arrangement of electrons in one molecule of ammonia.
Show outer electrons only.

(2)



(d) Ammonia is a simple molecular, covalent substance.
Explain why liquid ammonia has a low boiling point.

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(2)

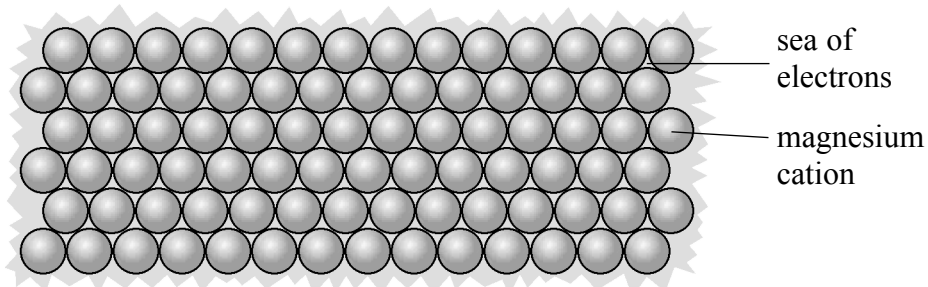
Q3

(Total 8 marks)

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4. The diagram shows the structure of magnesium metal.



(a) Explain how magnesium metal conducts an electric current.

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(1)

(b) When magnesium is added to dilute hydrochloric acid, HCl, it forms hydrogen and a solution of magnesium chloride, MgCl₂.

Write the balanced equation for this reaction.

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(2)

(c) When the same reaction is repeated but with the acid at a higher temperature, the reaction is faster.

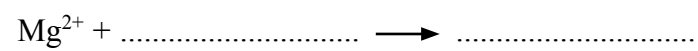
Explain, in terms of particles, why the reaction is faster.

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(3)



(d) When molten magnesium chloride is electrolysed, magnesium cations, Mg^{2+} , form magnesium atoms at the cathode.
Complete the half equation for this reaction.



(1)

Q4

(Total 7 marks)

TOTAL FOR PAPER: 30 MARKS

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