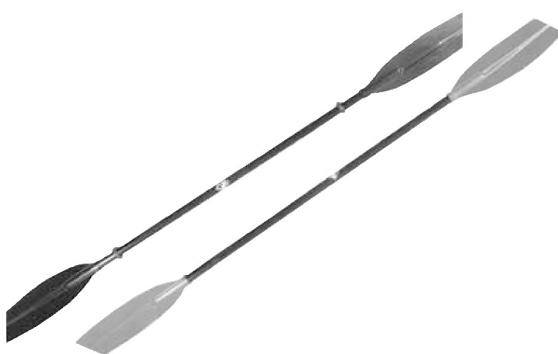


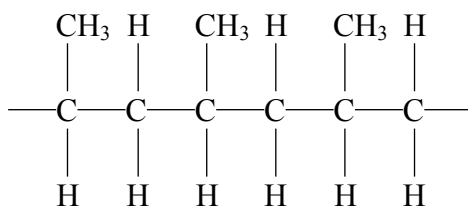
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1. Poly(propene) is an addition polymer with many uses. Canoe paddles are often made of poly(propene).



Poly(propene) is formed from propene, C_3H_6 . A section of a poly(propene) chain which is formed from three propene molecules is shown.



- (a) (i) What is a polymer?

.....
 (1)

- (ii) Why is poly(propene) described as an **addition** polymer?

.....
 (1)

- (b) Draw the structure of a propene molecule, C_3H_6 , showing all covalent bonds.

(2)



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(c) In terms of the covalent bonds, explain how molecules of propene combine to form a poly(propene) molecule.

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

(2)

(d) Poly(propene) is a thermoplastic.

If the canoe paddle is heated, but not to a temperature at which it burns, its shape changes.

Explain, in terms of its structure, why this happens.

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

(2)

(e) The following symbol appears on the canoe paddle to show that the poly(propene) can be recycled.



Give **one** reason why recycling is important.

.....
.....

(1)

Q1

(Total 9 marks)



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2. Sodium and chlorine react to form sodium chloride.

- (a) A sodium atom has a mass number of 23 and an atomic number of 11. Use this information to complete the table to show the number of protons, neutrons and electrons in this atom. The information for a chlorine atom, mass number 35, atomic number 17, has been provided.

atom	number of protons	number of neutrons	number of electrons
chlorine	17	18	17
sodium			

(2)

- (b) (i) Describe, in terms of electron transfer, how a sodium atom and a chlorine atom react to form particles in sodium chloride.

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

(2)

- (ii) Give the name of the type of bonding in sodium chloride.

.....

(1)

- (c) Sodium chloride has a high melting point of 801 °C. Explain why sodium chloride has a high melting point.

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

(2)

(Total 7 marks)

Q2



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3. The noble gases are in group 0 of the periodic table.

(a) Argon is the most abundant noble gas.
It has been used for many years in lightbulbs.

(i) The atomic number of argon is 18.

Give the electronic structure of an argon atom.

.....
(1)

(ii) State and explain, in terms of the electronic structure, why argon is used in lightbulbs.

.....
.....
.....
(2)

(b) Neon exists as two isotopes.

isotope	atomic number	mass number	abundance (%)
neon-20	10	20	90.9
neon-22	10	22	9.10

Calculate the relative atomic mass of neon to 3 significant figures.

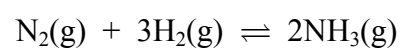
Answer =
(2)

(Total 5 marks)

Q3



4. Ammonia, NH_3 , is made from nitrogen and hydrogen gases, by the Haber process. The reaction can reach equilibrium. The equation for the reaction is



The conditions are a pressure of 150 atmospheres and an iron catalyst at 450°C .

- (a) The boiling point of nitrogen is -196°C . Explain why nitrogen has a very low boiling point.

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

(2)

- (b) Draw the dot and cross diagram of a molecule of ammonia, NH_3 . Show the outer shell electrons only.

(2)

- (c) The forward reaction is exothermic.

State and explain what would happen to the equilibrium yield of ammonia if a higher temperature of 600°C were used.

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

(2)



Leave
blank

(d) Explain why a catalyst is used in the process.

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

(1)

(e) Ammonia reacts with nitric acid to form ammonium nitrate.
Write the balanced equation for this reaction.

.....

(2)

Q4

(Total 9 marks)

TOTAL FOR PAPER: 30 MARKS

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