Exampro GCSE Chemistry

C2 Chapter 2 Higher

Name:

Class:

Author:

Date:

Time: 49

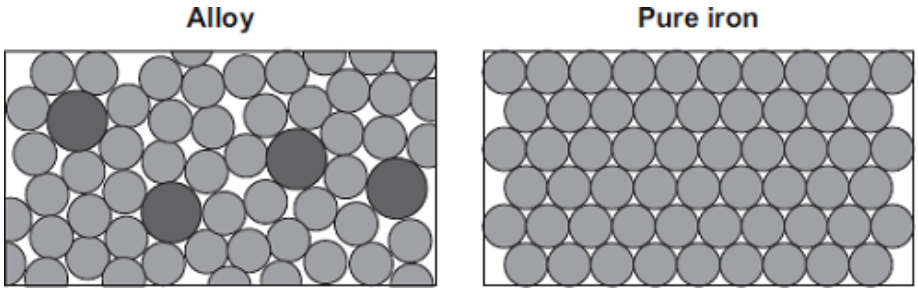
Marks: 49

Comments:

Q1. Oil rigs are used to drill for crude oil.

(a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.



Use the diagrams to explain why the alloy is harder than pure iron.

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(2)

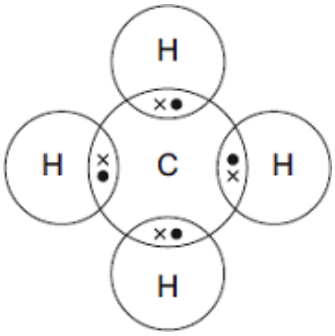
(b) Drill heads contain diamonds.

Tick (✓) **two** reasons why diamonds are hard.

Reason	Tick (✓)
Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2)

(c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



(i) Draw a ring around the correct answer to complete the sentence.

Methane is

a compound.
an element.
a mixture.

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

The formula of methane is

C_4H_4
C_4H
CH_4

(1)

(iii) Name the type of bond between the carbon and hydrogen atoms in methane.

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(1)

(d) Explain why methane is a gas at 20°C.

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(2)
(Total 9 marks)

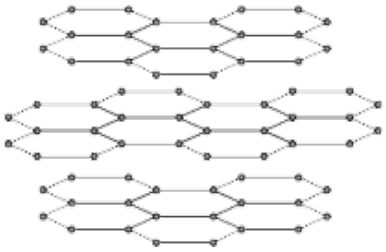
Q2. Read the information

Graphene

Scientists have made a new substance called graphene.
The bonding and structure of graphene are similar to graphite.

Graphene is made of a single layer of the same atoms as graphite.

Graphene



Graphite

Use the information above and your knowledge of graphite to answer the questions.

(a) This part of the question is about graphene.

Choose the correct answer to complete each sentence.

(i)

ionic	**covalent**	**metallic**

The bonds between the atoms in graphene are .....

(1)

(ii)

chromium	**carbon**	**chlorine**

Graphene is made of ..... atoms.

(1)

(iii)

2	**3**	**4**

In graphene each atom bonds to ..... other atoms.

(1)

(b) This part of the question is about graphite.

Graphite is used in pencils.

Explain why. Use the diagrams to help you.

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(2)
(Total 5 marks)

Q3. Read the article and then answer the questions that follow.

Nanotennis!

Tennis balls contain air under pressure, which gives them their bounce. Normal tennis balls are changed at regular intervals during tennis matches because they slowly lose some of the air. This means that a large number of balls are needed for a tennis tournament, using up a lot of materials.

'Nanocoated' tennis balls have a 'nanosize' layer of butyl rubber. This layer slows down the escape of air so that the ball does not lose its pressure as quickly. The 'nanocoated' tennis balls last much longer and do not need to be replaced as often.

(a) How does the 'nanosize' layer make the tennis balls last longer?

.....

.....

(1)

(b) Put a tick (✓) next to the best description of a ‘nanosize’ layer.

Description	(✓)
A layer one atom thick.	
A layer a few hundred atoms thick.	
A layer millions of atoms thick.	

(1)

(c) Suggest why using ‘nanocoated’ tennis balls would be good for the environment.

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(2)

(Total 4 marks)

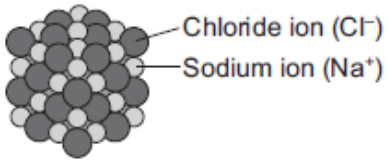
Q4. In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Explain why chlorine (Cl_2) is a gas at room temperature, but sodium chloride (NaCl) is a solid at room temperature.

Chlorine

Cl — Cl

Sodium chloride



Include a description of the bonding and structure of chlorine and sodium chloride in your answer.

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Extra space .....

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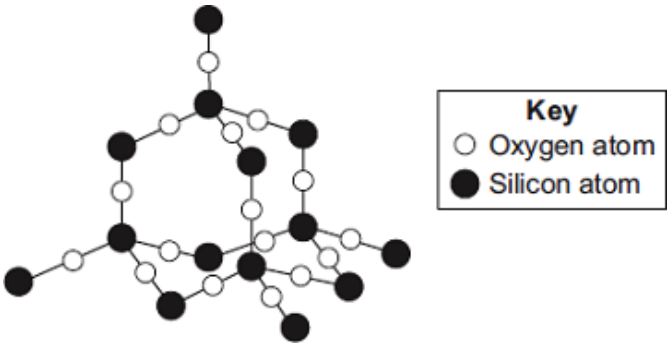
(Total 6 marks)

Q5. Silicon dioxide is used as a lining for furnaces.

Furnaces can be used to melt iron for recycling.

The diagram shows a small part of the structure of silicon dioxide.



Explain why silicon dioxide is a suitable material for lining furnaces.

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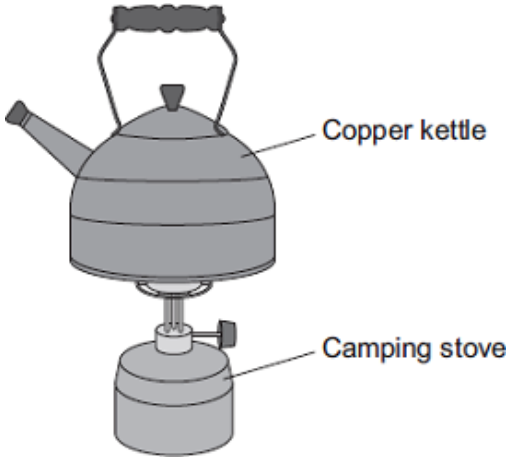
(Total 4 marks)

Q6. The picture shows a copper kettle being heated on a camping stove.

Copper is a good material for making a kettle because:

- it has a high melting point
- it is a very good conductor of heat.



(a) Explain why copper, like many other metals, has a high melting point.

Your answer should describe the structure and bonding of a metal.

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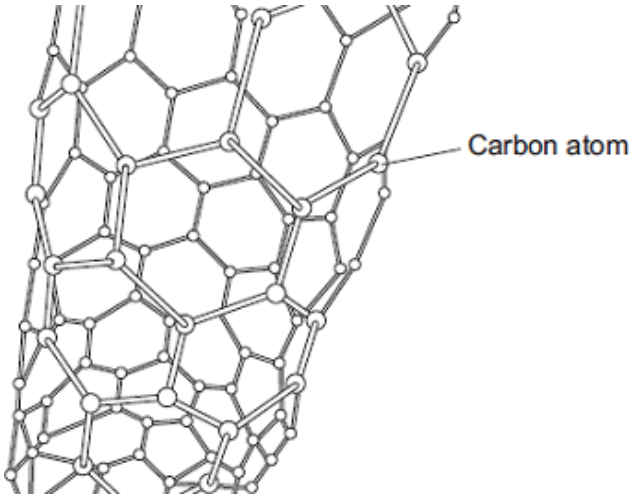
(4)

(b) Aeroplanes contain many miles of electrical wiring made from copper. This adds to the mass of the aeroplane.

It has been suggested that the electrical wiring made from copper could be replaced by carbon nanotubes which are less dense than copper.

The diagram shows the structure of a carbon nanotube.



(i) What does the term 'nano' tell you about the carbon nanotubes?

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(1)

(ii) Like graphite, each carbon atom in the carbon nanotube is joined to three other carbon atoms.

Explain why the carbon nanotube can conduct electricity.

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(2)

(Total 7 marks)

Q7. Spacecraft have been to the planets Venus and Mars. The spacecraft have sent back information about the atmosphere of each planet.

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(a) The main gas in the atmosphere of Mars is carbon dioxide.

Explain why, in terms of structure, carbon dioxide is a gas, even at low temperatures.

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(3)

(b) Gas chromatography linked to a mass spectrometer (GC-MS) is used to identify substances found on Mars.

(i) What is the purpose of gas chromatography?

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(1)

(ii) What information do the molecular ion peaks from the mass spectrometer give about the substances?

.....

(1)

(c) The atmosphere on Venus contains droplets of sulfuric acid solution.

(i) Suggest a pH value for sulfuric acid solution.

pH = ...

(1)

(ii) Name the ion which makes sulfuric acid solution acidic.

.....

(1)

(d) The atmosphere of Venus contains the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

Describe the similarities and the differences in the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

You should refer to the sub-atomic particles in each isotope.

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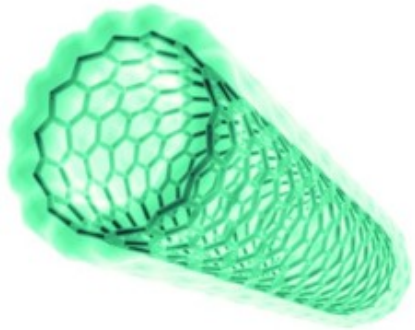
(3)

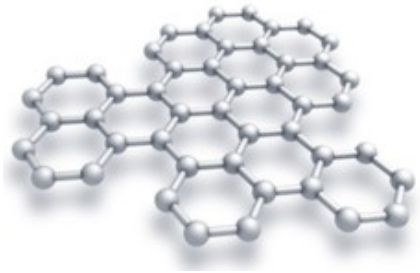
(Total 10 marks)

Q8. Carbon atoms are used to make nanotubes.



Carbon atoms in a nanotube are bonded like a single layer of graphite.

The figure below shows the structure of a single layer of graphite.



(a) Suggest why carbon nanotubes are used as lubricants.

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(2)

(b) Explain why graphite can conduct electricity.

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(2)
(Total 4 marks)

M1. (a) (alloy) atoms / ions / particles not in layers

accept layers are distorted

accept different (size) particles / atoms

1

so, (alloy) layers / atoms / ions / particles can't slide

*if no other mark awarded allow (an alloy) is a mixture of metals for **1** mark*

1

(b) diamonds have a giant covalent structure

1

diamonds have strong bonds between carbon atoms

1

(c) (i) a compound

1

(ii) CH_4

1

(iii) covalent

1

(d) methane has a low boiling point
or boiling point less than 20°C molecules

1

because it has small molecules

accept it has forces between molecules

*accept weak forces between molecules for **2** marks*

1

[9]

M2. (a) (i) covalent

*two different answers indicated gains **0** marks*

1

(ii) carbon

*two different answers indicated gains **0** marks*

1

(iii) 3

*two different answers indicated gains **0** marks*

1

(b) layers can slide / slip

1

because there are no bonds between layers

accept because weak forces / bonds between layers

or so (pieces of) graphite rubs / breaks off

or graphite left on the paper

1

[5]

M3. (a) Stops / reduces air from escaping (owtte)

*allow keeping shape **or** keeping it hard*

1

(b) a layer a few hundred atoms thick

1

(c) any **two** from:

- last longer
- use fewer balls
- less materials **or** save resources
- less manufactured

  accept less factories
- less energy
- less fuel
- less pollution / greenhouse effect / global warming
- less waste

  ignore references to cost / recycling

  *any **two** ideas*

2

[4]

M4. Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

0 marks
No relevant content

Level 1 (1–2 marks)
*There is a statement about the bonding and / or structure **or** melting / boiling point of chlorine **or** sodium chloride.*

Level 2 (3–4 marks)
*There are statements about the bonding and / or structure of chlorine **or** sodium chloride.*

Level 3 (5–6 marks)
*There are statements about the bonding and / or structure of chlorine **and** sodium chloride.*

*There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.*

Examples of chemistry points made in response:

Chlorine:

covalent bonds between atoms

forming (simple) molecules

no / weak attraction / bonds between molecules

low boiling point

Sodium chloride:

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

large amounts of energy needed to break bonds

high melting point

[6]

M5. high melting point

*reference to incorrect bonding **or** incorrect particles **or** incorrect structure = max **3***
accept will not melt (at high temperatures)
ignore withstand high temperatures

1

because a lot of energy needed to break bonds

1

because it is covalent **or** has strong bonds

accept bonds are hard to break

1

and because it is a giant structure **or** a macromolecule **or** a lattice

ignore many bonds

1

[4]

M6. (a) *reference to incorrect bonding **or** incorrect structure **or** incorrect particles = max **3***

giant structure / lattice

ignore many bonds

1

made up of positive ions surrounded by delocalized / free electrons

allow positive ions surrounded by a sea of electons

1

with strong bonds / attractions

allow hard to break for strong

1

so a lot of energy is needed to break these bonds / attractions / forces

ignore high temperature

ignore heat

1

(b) (i) that they are very small

or

1-100 nanometres **or** a few(hundred) atoms

accept tiny / really small / a lot smaller / any indication of very small eg. microscopic, smaller than the eye can see

ignore incorrect numerical values if very small is given

1

(ii) delocalised / free electrons

allow sea of electrons

1

one non-bonded electron from each atom

accept electron(s) moving through the structure / nanotube

allow electron(s) carry / form / pass current / charge

1

[7]

M7. (a) has simple / small molecules

accept molecular covalent

1

the intermolecular forces / intermolecular bonds (are weak)

*do **not** accept weak covalent bonds **or** reference to incorrect bonding*

1

only need a small amount of energy to be overcome

accept only need a small amount of energy to separate the molecules

*if no other mark awarded, allow it has a low boiling point for **1** mark*

1

(b) (i) to separate

1

(ii) (relative) molecular mass

allow M_r / (R)MM / relative mass / mass of molecule / (R)FM

1

(c) (i) any pH value from 0 to 6.9

1

(ii) hydrogen

allow H^+

ignore H / H_2 / H^-

1

(d) any **three** from:

- same number of protons

  accept same atomic number
  numbers if given must be correct

- ^{2}H has one neutron

- ^{1}H has no neutrons

  *accept different mass number **or** different number of neutrons for **1** mark*

  ignore relative atomic mass

- same number of electrons

  numbers if given must be correct

3

[10]

M8. (a) nanotubes can slide (over each other)

allow nanotubes can roll (over each other)

1

because no (covalent) bonds between the nanotubes

*accept weak forces between the nanotubes **or** weak intermolecular forces*

allow layers for nanotubes throughout

1

(b) delocalised electrons

accept free electrons

1

so (delocalised) electrons can move <u>through the graphite</u>

accept so (delocalised) electrons can carry charge <u>through the graphite</u>

1

[4]