OXFORD

INTERNATIONAL AQA EXAMINATIONS

Topic Test: OxfordAQA International GCSE Chemistry 9202

Structure, bonding and the properties of matter

Name: _____

Class: _____

Date: _____

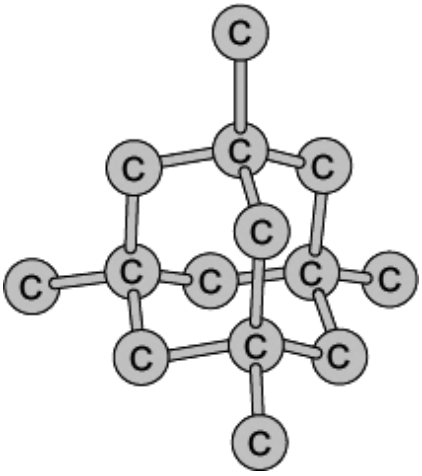
Time: **49 minutes**

Marks: **49 marks**

Comments:

1 Liquids containing nanoparticles of diamond are used as abrasives.
Nanoparticles of diamond can be used to grind down surfaces to give them a very smooth polished finish.

Abrasive liquid containing nanoparticles of diamond



Model of part of the diamond structure

(a) Diamond is made of one element.
Draw a ring around the name of this element.

calcium **carbon** **chromium** **cobalt**

(1)

(b) Tick (✓) **two** statements in the table which explain why diamond is hard.

Statement	Tick (✓)
It is made of layers.	
It has weak covalent bonds.	
Each atom is joined to four other atoms.	
It has a giant structure.	
It has strong ionic bonds.	

(2)

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

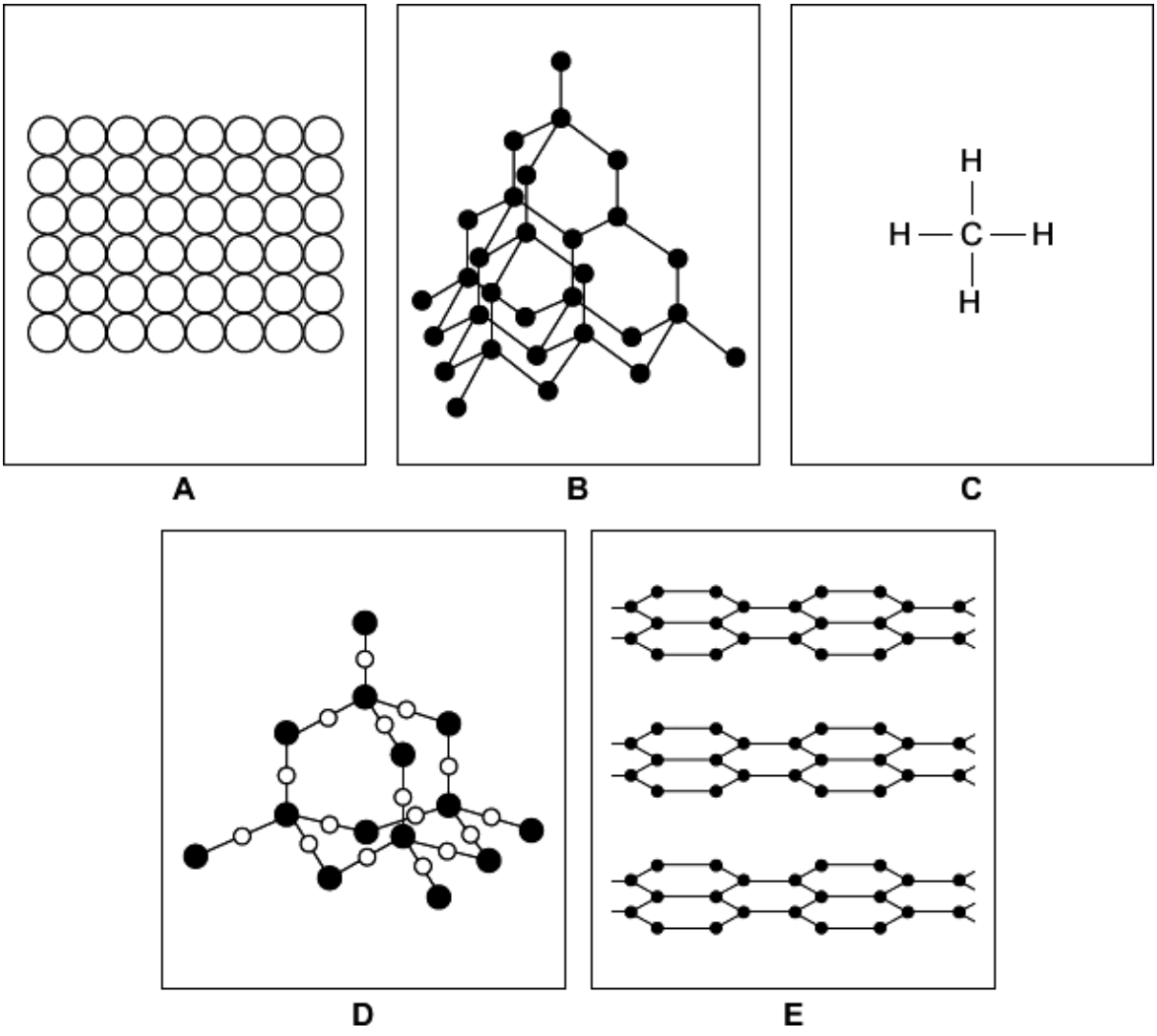
Nanoparticles of diamond are

very small.
large.
very large.

(1)

(Total 4 marks)

2 The diagrams represent the structures of five substances, **A**, **B**, **C**, **D** and **E**.



(a) Give **one** substance, **A**, **B**, **C**, **D** or **E**, that:

(i) has a very low boiling point

(1)

(ii) is a compound

(1)

(iii) is a metal.

(1)

(b) Draw a ring around the type of bonding holding the atoms together in substance **C**.

covalent **ionic** **metallic**

(1)

(c) Explain why substance **E** is soft and slippery.

_____

_____

_____

_____

(2)

(Total 6 marks)

3 The drawing shows a container of a compound called magnesium chloride.

(i) How many elements are joined together to form magnesium chloride?

_____

(1)

(ii) Magnesium chloride is an ionic compound. What are the names of its ions?

_____ ions and _____ ions

(1)

(iii) How many **negative** ions are there in the formula for magnesium chloride?

_____

(1)

(iv) Complete the sentence.

Ions are atoms, or groups of atoms, which have lost or gained

_____ .

(1)

(v) Suggest **three** properties which magnesium chloride has because it is an ionic compound.

Property 1 _____

_____

Property 2 _____

_____

Property 3 _____

_____

(3)

(Total 7 marks)

4 The picture shows a wooden bowl.
The pieces of wood used for this bowl were dyed different colours.

By Bertramz (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

The artist who made the bowl explained why he dissolved the coloured dyes in methanol.

> I use different coloured dyes dissolved in methanol.
> I use methanol because with dyes dissolved in water the wood needs to be soaked for a longer time.
> The bowl dries more quickly if I use methanol instead of water.

(a) The artist uses methanol instead of water.

Give **two** reasons why.

1. _____

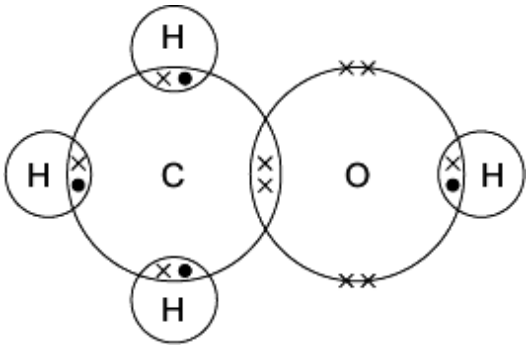
_____

2. _____

_____

(2)

(b) The diagram shows how the atoms are bonded in methanol.



Draw a ring around:

(i) the formula of methanol

CH_4O **CH^4O** **CHO_4**

(1)

(ii) the type of bonding in methanol.

covalent **ionic** **metallic**

(1)

(c) Methanol has a low boiling point.

Tick (✓) the reason why.

Reason why	Tick (✓)
It has a giant covalent structure.	
It is made of small molecules.	
It has a giant metallic structure.	

(1)

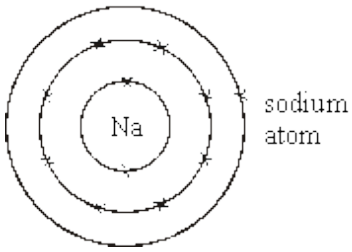
(Total 5 marks)

5 (a) The electronic structure of a sodium atom can be written 2,8,1.
Write the electronic structure of a potassium atom in the same way.

_____

(1)

(b) The electronic structure of a sodium atom can also be represented as in the diagram below.



(i) Draw a similar diagram for a fluorine atom.

(ii) Draw similar diagrams to show the electronic structure of the particles in sodium fluoride.

(4)

(Total 5 marks)

6 This question is about some compounds made from iodine.

(a) Lead iodide can be made by mixing a solution containing lead ions with a solution containing iodide ions. Lead iodide is formed as a precipitate.

$$Pb^{2+}(aq) + 2I^{-}(aq) \longrightarrow PbI_2(s)$$

The table below gives information about the solubility of some compounds.

Soluble compounds	Insoluble compounds
All sodium and potassium salts	
All nitrates	
Most chlorides, bromides and iodides	Silver and lead chlorides, bromides and iodides

Use the table to help you to name:

(i) A soluble compound which contains lead ions_____

(1)

(ii) A soluble compound which contains iodide ions

_____

(1)

(b) Magnesium iodide can be made by reacting magnesium with iodine.

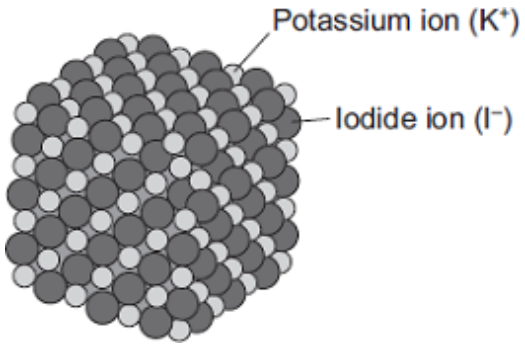
$$Mg + I_2 \longrightarrow MgI_2$$

Magnesium iodide is an ionic compound. It contains magnesium ions (Mg^{2+}) and iodide ions (I^-).

Describe, in terms of electrons, what happens when magnesium reacts with iodine.

(4)

(c) The diagram shows the structure of potassium iodide.



Explain why a high temperature is needed to melt potassium iodide.

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

7 Glass is made from silicon dioxide.

© Velirina/iStock/Thinkstock

(a) Silicon dioxide has a very high melting point.

Other substances are added to silicon dioxide to make glass. Glass melts at a lower temperature than silicon dioxide.

Suggest why.

_____

_____

(1)

(b) Sodium oxide is one of the substances added to silicon dioxide to make glass.

(i) Sodium oxide contains Na^+ ions and O^{2-} ions.

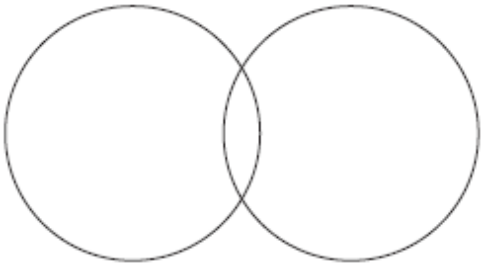
Give the formula of sodium oxide.

_____

(1)

(ii) Sodium oxide is made by heating sodium metal in oxygen gas.

Complete the diagram to show the outer electrons in an oxygen molecule (O_2).



(2)

(c) Glass can be coloured using tiny particles of gold. Gold is a metal.

Describe the structure of a metal.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

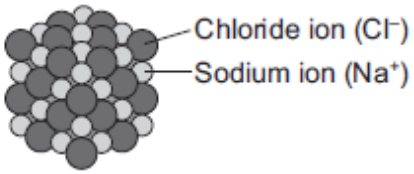
8 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

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.

Extra space

(Total 6 marks)

1 (a) carbon

1

(b) each atom is joined to four other atoms

1

It has a giant structure

1

(c) very small

1

[4]

2 (a) (i) C

1

(ii) C **or** D

1

(iii) A

1

(b) covalent

1

(c) layers

1

can slide / move over each other

accept are weakly bonded (owtte)
allow no bonds between layers
ignore slip / rub

1

[6]

3 (i) two

or 2

1

(ii) magnesium **and** chloride

either order
not *positive / negative*
do not credit'chlorine'
accept Mg^{++} ***and*** Cl^{-}
do not credit just Mg and Cl^{-}
accept cation(s) ***and*** *anion(s)*

1

(iii) 2

1

(iv) electrons

accept charges

1

(v) any **three** from

- (is a) giant structure/lattice structure
- crystalline / hard

  accept just 'crystals(s)'
- high melting point / solid
- high boiling point
- conductor (of electricity) when dissolved **in** water

  ***or** conductor (of electricity) when ions are free to move*
- conductor (of electricity) when molten
- soluble in water

3

[7]

4 (a) any **two** from

assume it = methanol

allow converse for water

- shorter / quicker soaking time

  allow it is quicker
- takes less time / quicker to dry

  or faster evaporation
- dissolves quicker / better in methanol

2

(b) (i) CH_4O

1

(ii) covalent

1

(c) it is made of small molecules

1

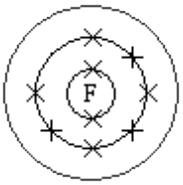
[5]

5 (a) 2, 8, 8, 1

for 1 mark

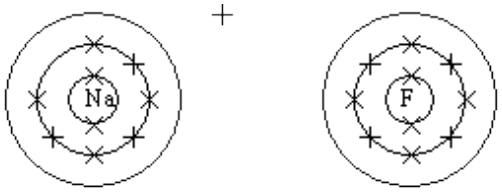
1

(b)

(i) 

for 1 mark

Ignore symbol in middle but structure must be drawn NOT 2,7

(ii) 

(1) for charges

(1) for each structure

If covalent; can score mark for changes but not for diagram
Arrow showing electron transfer from metal atom to non-metal atom = 2 marks
If the ions are not identified then cannot score mark for changes

4

[5]

6

(a) (i) lead nitrate

accept $Pb(NO_3)_2$

do not accept nitride

ignore (all) nitrate(s)

1

(ii) sodium iodide / potassium iodide

accept NaI / KI

accept other correct soluble iodides eg HI, MgI_2

do not accept sodium iodine / potassium iodine

1

(b) *metallic / sharing / covalent **or** molecule = max **3***

magnesium <u>loses **2** electrons</u>

all three underlined ideas must be present

*two underlined ideas = **1** mark eg magnesium loses electrons*

or

magnesium gains 2 electrons

or

magnesium loses 2 ions

*nb magnesium **ion** loses 2 electrons = **1** mark*

*2 errors = **0** marks eg magnesium gains electrons*

2

iodine gains **1 / an** electron

all four underlined ideas must be present

*three underlined ideas = **1** mark eg iodine gains electron(s)*

or

iodine loses 1 / an electron

or

iodide gains 1 / an ion

or

iodide (ion) gains 1 / an electron

*2 errors = **0** marks*

2

(c) attractions / forces (of attraction) / bonds are strong **or** lot of energy needed to break bonds / forces / attractions

*max 2 if reference to incorrect bonding **or** incorrect structure **or** incorrect particles*

1

because oppositely charged ions attract **or** electrostatic attraction between ions

1

in giant structure **or** lattice

ignore many bonds

ignore ionic bonding unqualified

1

[9]

7 (a) *weaker bonds*

allow (other substances) react with the silicon dioxide

or

fewer bonds

ignore weaker / fewer forces

or

disruption to lattice

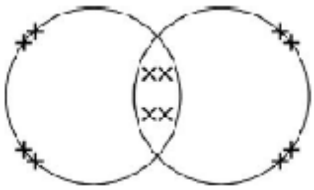
*do **not** accept reference to intermolecular forces / bonds*

1

(b) (i) Na_2O

*do **not** accept brackets or charges in the formula*

1

(ii) 

electrons can be shown as dots, crosses, e or any combination

2 bonding pairs

accept 4 electrons within the overlap

1

2 lone pairs on each oxygen

accept 4 non-bonding electrons on each oxygen

1

(c) *lattice / regular pattern / layers / giant structure / close-packed arrangement*

1

(of) positive ions **or** (of) atoms

1

(with) delocalised / free electrons

*reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **2***

1

[7]

8 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]