Properties of Materials – 2022 GCSE Gateway Chemistry A

1. May/2022/Paper_ J248/01/No.3

Which substance has **four** covalent bonds to each carbon atom?

A Carbon nanotubes

B Diamond

C Graphene

D Graphite

Your answer ☐ **[1]**

2. May/2022/Paper_ J248/01/No.7

Which description is correct for melting ice?

A There is a chemical change and a change of state.

B There is a chemical change and a reaction occurs.

C There is a physical change and a change of state.

D There is a physical change and a reaction occurs.

Your answer ☐ **[1]**

3. May/2022/Paper_ J248/01/No.14

The element mercury is a liquid at 25 °C.

Which row about mercury is correct?

	Melting Point (°C)	**Boiling Point (°C)**
A	above 25	above 25
B	below 25	below 25
C	below 25	above 25
D	above 25	below 25

Your answer ☐ **[1]**

4. May/2022/Paper_ J248/01/No.19(a)

A student investigates dyes.

(a) Some dyes are nanoparticles.

(i) What is the size of a nanoparticle?

Tick (✓) **one** box.

Less than 1 nm ☐

Between 1 and 100 nm ☐

Between 100 and 1000 nm ☐

Greater than 1000 nm ☐

[1]

(ii) Some people think using nanoparticulate materials is dangerous. Other people want to keep using them.

State **one advantage** and **one disadvantage** of using nanoparticulate materials.

Advantage .....

.....

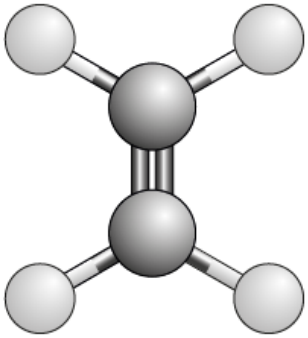
Disadvantage .....

.....

[2]

5. May/2022/Paper_ J248/01/No.21

The diagram shows a ball and stick model for ethene, C_2H_4.



(a) Which statements about this ball and stick model of ethene are correct?

Tick (✓) **two** boxes.

The model shows how many electrons the carbon atoms have. ☐

The model shows how many electrons the hydrogen atoms have. ☐

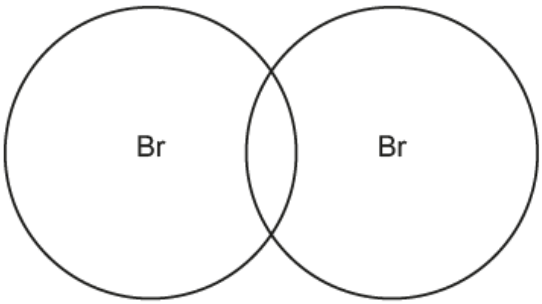
The model shows how much space each atom fills. ☐

The model shows that the carbon atoms are bigger than the hydrogen atoms. ☐

The model shows the difference between double bonds and single bonds. ☐

[2]

(b) Molecules can be drawn using dot and cross diagrams.



Complete the dot and cross diagram for bromine, Br_2.

Show the electrons in the outer shells only.

[2]

(c) At room temperature, ethene is a gas and bromine is a liquid.

Use the particle model to describe **two** differences between the movement or arrangement of the particles in ethene and the particles in bromine.

1 .....

.....

2 .....

.....

[2]

(d) Ethene reacts with bromine to make a product.

The relative formula mass of the product is 187.8.

There are **2** carbon atoms and **4** hydrogen atoms in the product.

Calculate how many bromine atoms are in the product.

Number of bromine atoms = ... **[3]**

6. May/2022/Paper_ J248/03/No.6

Which statement about carbon allotropes is correct?

A Buckminsterfullerene is a type of carbon nanotube.

B Carbon atoms in diamond and graphite form 4 covalent bonds.

C Graphene and graphite both have carbon atoms arranged in layers.

D Strong covalent bonds cause diamond to have a high melting point.

Your answer ☐ **[1]**

7. May/2022/Paper_ J248/03/No.12

A scientist investigates the melting point of some substances that may contain paracetamol as shown in the table.

The melting point of pure paracetamol is 169 °C.

Substance	Melting point (°C)
1	169
2	156
3	166 – 169
4	170 – 174

Which statement about the results is correct?

A All of the substances contain paracetamol.

B Substance 2 does not contain paracetamol.

C Substance 3 is pure paracetamol.

D Substance 4 is impure paracetamol.

Your answer ☐ **[1]**

8. May/2022/Paper_ J248/03/No.16(c)

(c) At room temperature, ethene is a gas and bromine is a liquid.

Use the particle model to describe **two** differences between the movement or arrangement of the particles in ethene and the particles in bromine.

1 .....

.....

2 .....

.....

[2]

9. May/2022/Paper_ J248/03/No.21(b)

(b) Some information about phosphorus compounds is shown in the table.

Name	Formula	Melting point (°C)	Boiling point (°C)	State at room temperature
Phosphorus trichloride	PCl_3	–94	76	.....
Phosphorus pentachloride	PCl_5	161	167	.....
Phosphorus trifluoride	PF_3	–152	–102	.....

(i) Complete the table. **[2]**

(ii) Put a (ring) around the compound with the weakest intermolecular forces.

Phosphorus trichloride

Phosphorus pentachloride

Phosphorus trifluoride

Explain your answer using information from the table.

.....

.....

.....

..... **[3]**

(iii) The scientist thinks phosphorus trichloride is a **giant covalent** compound.

Explain why the scientist is incorrect.

.....

.....

..... **[2]**

10. May/2022/Paper_ J248/04/No.12

Which type of material is glass?

A Alloy

B Ceramic

C Composite

D Polymer

Your answer ☐ **[1]**