

GCSE Chemistry

Worksheet: Ceramics, polymers and composites

TIME 25 min	TOTAL 25 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Ceramics, polymers and composites

NAME _____	CLASS _____	DATE _____
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1

Which property is typical of a thermosetting polymer?

Tick (✓) **one** box.

It melts easily when heated

☐

It has only weak forces between separate chains

☐

It does not soften when heated, because of covalent cross-links

☐

It is always transparent

☐

[1 mark]

0 1 . 2

Give **one** everyday example of a product made from a thermosetting polymer.

.....

.....

[1 mark]

0 2

0 2 . 1

Soda-lime glass is made by heating a mixture of sand, sodium carbonate and one other substance.

Name the other substance.

.....

.....

.....

.....

[1 mark]

0 2 . 2

Describe how clay ceramics are made.

.....

.....

.....

.....

[2 marks]

0 2 . 3

Give **one** example of a clay ceramic.

.....

.....

[1 mark]

0 3

Table 1 compares two samples of poly(propene) with different average chain lengths.

Table 1

Sample	Mean number of carbon atoms per chain	Melting point in °C	Strength
P	2000	130	lower
Q	15 000	165	higher

0 3 . 1 Describe the relationship shown between chain length and melting point.

.....

.....

[1 mark]

0 3 . 2 Explain why a polymer with longer chains tends to have a higher melting point and greater strength than the same polymer with shorter chains.

.....

.....

.....

.....

[2 marks]

.....

0 4

Polymers can be thermosoftening or thermosetting.

0 4 . 1

Explain the difference between thermosoftening polymers and thermosetting polymers.

Refer to their structures and what happens when they are heated.

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.....

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[4 marks]

0 4 . 2

Which type of polymer should be used to make a saucepan handle?
Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 5

A company is designing a lightweight, transparent visor for a motorcycle helmet, which must resist scratching and impact.

0 5 . 1

Evaluate whether a thermosoftening polymer or glass would be more suitable for the visor.

[3 marks]

0 6

0 6 . 1

Explain why composite materials, such as fibreglass, combine a fibre or fragment material with a second material (the matrix) that binds them together, rather than using the fibres alone.

[2 marks]

0 7

Low density (LD) poly(ethene) and high density (HD) poly(ethene) are both produced from ethene.

0 7 . 1

Explain how two different types of poly(ethene) can be produced from the same monomer.

.....

.....

.....

.....

[2 marks]

0 7 . 2

The chains in HD poly(ethene) have fewer branches than the chains in LD poly(ethene).

Suggest why HD poly(ethene) has a higher density.

.....

.....

[1 mark]

0 7 . 3

Most composites are made of two materials.

Name the **two** parts of a composite and describe the job of each.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Ceramics, polymers and composites · 25 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: It does not soften when heated, because of covalent cross-links

01.2 [1 mark]

- e.g. an electrical plug casing, a saucepan handle, or melamine kitchenware (any genuine thermosetting product) (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Answer: limestone

- limestone / calcium carbonate (1)
-

02.2 [2 marks]

- wet clay is shaped (1)
 - and then heated in a furnace (1)
-

02.3 [1 mark]

- pottery / bricks / tiles (1)
-

Question 3 (3 marks)

03.1 [1 mark]

- as the mean chain length increases, the melting point increases (1)
-

03.2 [2 marks]

- longer chains have more contact / a larger area of contact with neighbouring chains (1)
 - so there are more (cumulative) intermolecular forces between chains, which need more energy to overcome, giving a higher melting point and greater strength (1)
-

Question 4 (6 marks)

04.1 [4 marks]

- thermosoftening polymers are made of individual polymer chains (with weak intermolecular forces between them) (1)
- when heated the chains can slide over each other, so the polymer softens / melts (1)
- thermosetting polymers have cross-links (covalent bonds) between the chains (1)
- so they do not melt when heated (1)

04.2 [2 marks]

- thermosetting (1)
- it does not soften / melt when heated (1)

Question 5 (3 marks)

05.1 [3 marks]

- glass is transparent and scratch-resistant, but it is heavier and can shatter into sharp pieces on impact, which would be dangerous (1)
- a thermosoftening polymer, e.g. polycarbonate, is transparent, much lighter than glass, and resists shattering (deforms rather than fragmenting) on impact, but may scratch more easily than glass unless specially coated (1)
- a (coated) thermosoftening polymer is usually the better overall compromise for this use, since impact safety and low weight are especially important for a helmet visor (1)

Question 6 (2 marks)

06.1 [2 marks]

- individual fibres are very strong when pulled but can bend and are not rigid on their own, so would not hold a useful shape (1)
 - the matrix binds the fibres together and transfers force between them, so the composite as a whole is both strong and holds a rigid, useful shape (1)
-

Question 7 (5 marks)

07.1 [2 marks]

- different reaction conditions are used (e.g. temperature, pressure) (1)
- and different catalysts (1)

Notes: Allow 'the properties of a polymer depend on the conditions under which it is made' for 1 mark.

07.2 [1 mark]

- chains with fewer branches can pack more closely together (1)
-

07.3 [2 marks]

- matrix / binder, which surrounds and binds together the other material (1)
 - reinforcement (fibres or fragments), which gives the composite its strength (1)
-