# (Polymers: addition and condensation polymers)

## Q1.a)(2018)

Polymers are used to make fabrics.

**Table 1** shows some properties of two polymers.

**Table 1**

| Property | Polymer J | Polymer K |
|---|---|---|
| Density in g/cm$^3$ | 0.9 | 1.4 |
| Melting point in °C | 165 | 260 |
| Flame resistance | Poor | Good |
| Water absorption | Low | High |

Polymer fabrics are used to make firefighter uniforms.

Complete **Table 2** by deciding for each property whether polymer **J** or polymer **K** is **best** for firefighter uniforms.

Use **Table 1**.

Density has been completed for you.

**[2 marks]**

Tick **three** boxes.

**Table 2**

| Property | Polymer J | Polymer K |
|---|---|---|
| Density in g/cm$^3$ | ✓ | |
| Melting point in °C | | |
| Flame resistance | | |
| Water absorption | | |

## Q1.b)(2018)

A firefighter uniform made from polymer **J** has a mass of 6.0 kg

Calculate the mass of a uniform of the same size made from polymer **K**.

Use **Table 1** and the equation:

$$\text{mass of uniform made from polymer K} = \frac{\text{density of polymer K}}{\text{density of polymer J}} \times 6.0$$

**[2 marks]**

Mass of uniform made from polymer **K** = _____ kg

Q1.c)(2018)

Polymers **J** and **K** are both thermosoftening polymers.

Polymer **L** is a thermosetting polymer.

Why would polymer **L** be better than polymers **J** and **K** for firefighter uniforms?

**[1 mark]**

Tick **one** box.

- Polymer **L** burns easily ☐
- Polymer **L** does not biodegrade ☐
- Polymer **L** will not melt ☐

Q1.d)(2018)

Polymers **J** and **K** are made from crude oil.

In the past, firefighter uniforms were made from wool.

Wool is obtained from sheep.

Why are many fabrics made from polymers instead of wool?

**[1 mark]**

Tick **one** box.

- Polymers are man-made ☐
- Polymers are more hard-wearing ☐
- Wool is more easily available ☐
- Wool is more flame resistant ☐

Q1.e)(2018)

Why is wool more sustainable than polymers **J** and **K** for making firefighter uniforms?

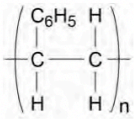
**[2 marks]**

Q2.(2018)

Disposable cups are made from coated paper or poly(styrene).

**Figure 4** represents the structure of poly(styrene).

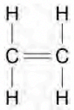
**Figure 4**

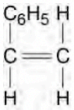


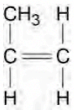
Which small molecule is used to produce poly(styrene)?

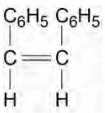
**[1 mark]**

Tick **one** box.

 ☐

 ☐

 ☐

 ☐

## Q3.(2018)

Which process is used to make poly(styrene) from small molecules?

**[1 mark]**

Tick **one** box.

Cracking ☐

Distillation ☐

Fermentation ☐

Polymerisation ☐

## Q4.(2018)

Complete the sentences.

Choose answers from the box.

**[3 marks]**

| | | | |
|---|---|---|---|
| **ceramics** | **composites** | **four** | **many** |
| **monomers** | **polymers** | **two** | |

Poly(styrene) is produced from small molecules called _____.

When poly(styrene) is made, _____ styrene molecules join to form large molecules.

These large molecules are called _____.

Q5.(2020)

Poly(propene) is produced from an alkene.

Complete the sentences.

**[2 marks]**

The name for very large molecules such as poly(propene) is _____.

The name of the alkene used to produce poly(propene) is _____.

Q6.(2020)

What type of bond joins the atoms in a molecule of poly(propene)?

**[1 mark]**

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

Q7.a)(2020)

**Table 4** shows information about two polymers used to make plates.

**Table 4**

| Polymer | Effect of heating the polymer |
|---|---|
| **A** | does not melt |
| **B** | melts at 50 °C |

What type of polymer is polymer **A**?

Use **Table 4**.

**[1 mark]**

Q7.b)(2020)

Why does polymer **A** behave differently to polymer **B** when heated?

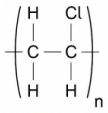
You should refer to crosslinks in your answer.

**[1 mark]**

Q8.(2021)

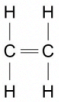
**Figure 3** shows the displayed structural formula of poly(chloroethene).

**Figure 3**



Which monomer is used to make poly(chloroethene)? **[1 mark]**

Tick (✓) **one** box.



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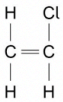

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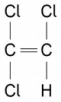

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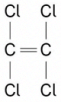

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## Q9.(2021)

Poly(propene) is a polymer.

What is the name of the monomer used to produce poly(propene)? **[1 mark]**

Tick (✓) **one** box.

Propane ☐

Propanoic acid ☐

Propanol ☐

Propene ☐

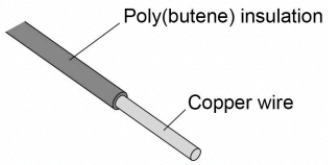
## Q10.a)(2022)

This question is about copper wire and copper compounds.

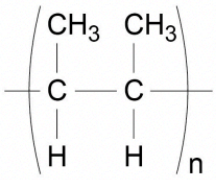
Copper is used to make electrical wires.

**Figure 9** shows how copper electrical wire is insulated using an addition polymer called poly(butene).

**Figure 9**




The addition polymer poly(butene) has the displayed structural formula:

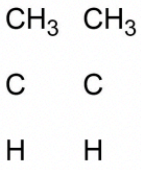



Poly(butene) is produced from the monomer butene.

Complete **Figure 10** to show the displayed structural formula of butene.

**[2 marks]**

**Figure 10**




Q10.b)(2022)

Copper can be obtained by recycling scrap copper wire.

Suggest why poly(butene) insulation must be removed from scrap copper wire before the copper is recycled.

**[1 mark]**

Q10.c)(2022)

Describe how scrap copper wire can be recycled to make new copper water pipes.

**[2 marks]**

## Q10.d)(2022)

Suggest **two** reasons why recycling scrap copper is more sustainable than extracting copper from copper ores.

**[2 marks]**

1

2

## Q10.e)(2022)

Copper sulfate is a compound of copper.

Copper sulfate solution contains copper(II) ions and sulfate ions.

A solution can be added to copper sulfate solution to show the presence of copper(II) ions.

Name the solution added.

Give the result of the test.

**[2 marks]**

Name of solution added

Result

## Q10.f)(2022)

Describe **one** test to show the presence of sulfate ions in copper sulfate solution.

Give the result of the test.

**[2 marks]**

Test

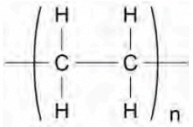
Result

## Q11.(2023)

Which structure is the repeating unit of poly(propene)?

**[1 mark]**

Tick (✓) **one** box.



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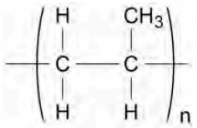

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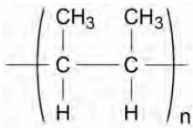

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## Q12.(2023)

Poly(propene) is produced in three stages:

- **Stage 1:** separating large alkane molecules from crude oil
- **Stage 2:** producing propene molecules from large alkane molecules
- **Stage 3:** joining many propene molecules together.

Name **Stage 1**, **Stage 2** and **Stage 3**.

Choose answers from the box.

**[3 marks]**

| | | |
|---|---|---|
| **cracking** | **fermentation** | **fractional distillation** |
| **polymerisation** | **reverse osmosis** | |

**Stage 1** is _____.

**Stage 2** is _____.

**Stage 3** is _____.

## Q13.(2023)

A molecule of hexene contains a double carbon–carbon bond.

Many hexene molecules join together to form poly(hexene).

Which **two** words describe a hexene molecule in this process?

**[2 marks]**

Tick (✓) **two** boxes.

- Alkene ☐
- Catalyst ☐
- Composite ☐
- Element ☐
- Monomer ☐

Q14.(2024)

The glucose produced during photosynthesis can form naturally occurring polymers.

Which **two** are naturally occurring polymers that can be produced from glucose?

**[2 marks]**

Tick (✓) **two** boxes.

- Cellulose ☐
- DNA ☐
- Poly(propene) ☐
- Protein ☐
- Starch ☐

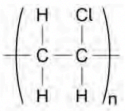
Q15.(2024)

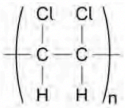
Chloroethene can be used to produce a polymer called poly(chloroethene).

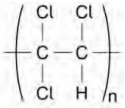
The displayed structural formula of chloroethene is

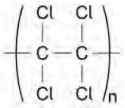
Which represents the structure of poly(chloroethene)? **[1 mark]**

Tick (✓) **one** box.

 ☐

 ☐

 ☐

 ☐

## Q16.a)(2024)

Ethene can be used to produce another polymer called poly(ethene).

**Table 3** shows information about poly(chloroethene) and poly(ethene).

**Table 3**

| | **Poly(chloroethene)** | **Poly(ethene)** |
|---|---|---|
| Density in g/cm$^3$ | 1.5 | 0.9 |
| Temperature at which polymer completely melts in °C | 260 | 120 |

Determine the simplest whole number ratio of the density of poly(chloroethene) : density of poly(ethene). **[3 marks]**

Simplest whole number ratio = _____ : _____

Q16.b)(2024)

Poly(ethene) **and** poly(chloroethene) can both be used to make pipes.

Suggest why neither polymer is suitable for pipes carrying steam at a temperature of 300 °C.

Use **Table 3**.

**[1 mark]**

Q16.c)(2024)

Poly(ethene) and paper can both be used to make shopping bags.

Poly(ethene) is produced from crude oil. Paper is produced from trees.

Suggest **one** reason why paper is more sustainable than poly(ethene) for making shopping bags.

**[1 mark]**