

1. Hydrogen reacts much more readily with alkenes than with alkanes.

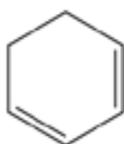
Why is this?

- A Alkenes are polar molecules whereas alkanes are not.
- B All atoms in an alkane have a full outer shell of electrons.
- C The bond enthalpy of C–C σ bonds is **higher** than that of π bonds.
- D The bond enthalpy of C–C σ bonds is **lower** than that of π bonds.

Your answer

[1]

2. The structure of a hydrocarbon is shown below.



Which terms describe this hydrocarbon?

- A Alicyclic and saturated
- B Aliphatic and alicyclic
- C Aliphatic and aromatic
- D Aromatic and unsaturated

Your answer

[1]

3. Which diagram shows a p-orbital?

| | |
|---|---|
| A |  |
| B |  |
| C |  |
| D |  |

Your answer

[1]

6. Oxygen has the electron configuration $1s^2 2s^2 2p^4$.

How are the electrons in an atom of oxygen arranged in the p-orbitals?

- A

| | | |
|----|----|--|
| ↑↑ | ↑↑ | |
|----|----|--|
- B

| | | |
|----|----|--|
| ↑↓ | ↑↓ | |
|----|----|--|
- C

| | | |
|----|---|---|
| ↑↑ | ↑ | ↑ |
|----|---|---|
- D

| | | |
|----|---|---|
| ↑↓ | ↑ | ↑ |
|----|---|---|

Your answer

[1]

7(a). Hydrogen and oxygen have different electronegativities.

What is meant by the term **electronegativity**?

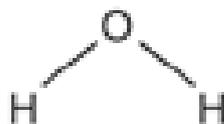
[2]

(b). H_2O is a polar molecule that has hydrogen bonding.

- i. Complete the diagram below to show hydrogen bonding between the H_2O molecule shown and another H_2O molecule.

Include relevant dipoles and lone pairs.

Label the hydrogen bond.



[2]

- ii. Explain why molecules of H_2O are polar.

[1]

- iii. One unusual property of H_2O is that ice floats on water.

Explain why ice has a lower density than water.

----- [1]

(c). Solid ammonia, NH_3 , contains hydrogen bonds.

- i. Suggest why solid ammonia has a lower melting point than ice.

----- [2]

- ii. When ammonia dissolves in water, ammonium ions, NH_4^+ , are formed.

Draw a 'dot-and-cross' diagram to show the bonding in an NH_4^+ ion.

Show outer electrons only.

[2]

- iii. Outline how you would test for the presence of NH_4^+ ions in a solution.

Your answer should include observations.

----- [2]

8. This question is about periodicity and the reaction of some Group 2 metals.

Periodicity is the repeating trend in properties of elements across different periods in the periodic table.

i. Complete the table below with the electron configurations and blocks.

| | Group 2 | Group 17 (7) |
|-----------------|-----------------------------|-----------------------------|
| Period 2 | Be 1s ² | F 1s ² |
| Period 3 | Mg 1s ² | Cl 1s ² |
| Block | | |

[3]

ii. Use your answers to (i) to explain why electron configuration is an example of a periodic trend.

[2]

iii. Mg forms 2+ ions but Cl usually forms 1- ions in their reactions. Explain why.

[2]

iv. Magnesium reacts with oxygen in the air.

Write the equation for this reaction.

[1]

- ii. Complete the electron configuration of a titanium atom.

1s²

- iii. Complete the table to show the number of protons, neutrons and electrons in a ⁴⁸Ti²⁺ ion.

| | Protons | Neutrons | Electrons |
|------------------------------------|---------|----------|-----------|
| ⁴⁸ Ti ²⁺ ion | | | |

[1]

13. This question is about atomic structure and formulae.

Complete the table for an atom and an ion of **two** different elements.

| Element | Mass number | Protons | Neutrons | Electron configuration | Charge |
|---------|-------------|---------|----------|---|--------|
| | | 28 | 34 | | 0 |
| | 33 | | | 1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ | 3- |

[2]

14. What is the number of paired orbitals in a sulfur atom?

- A 4
B 6
C 7
D 8

Your answer

[1]

END OF QUESTION PAPER