All questions are for both separate science and combined science students

Q1.

This question is about carbon and carbon compounds.

An atom of carbon is represented as:

$$\begin{matrix}\text{(Mass number)} & 13 \\ \text{(Atomic number)} & 6\end{matrix}\ \mathrm{C}$$

(a) What is the number of protons in this atom of carbon?

Tick (✓) **one** box.

1 ☐ 6 ☐ 7 ☐ 13 ☐

(1)

(b) What is the number of neutrons in this atom of carbon?

Tick (✓) **one** box.

1 ☐ 6 ☐ 7 ☐ 13 ☐

(1)

(c) What is the number of electrons in this atom of carbon?

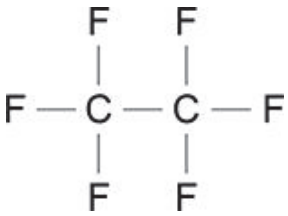
Tick (✓) **one** box.

1 ☐ 6 ☐ 7 ☐ 13 ☐

(1)

(d) **Figure 1** shows the structure of a carbon compound.

Figure 1



Complete the formula of the carbon compound.

C__ F__

(1)

(e) Methane:

- is a carbon compound
- exists as small molecules
- has a low boiling point.

What is the reason for the low boiling point of methane?

Tick (✓) **one** box.

Covalent bonds **and** intermolecular forces are weak. ☐

Only covalent bonds are weak. ☐

Only intermolecular forces are weak. ☐

(1)

(f) Buckminsterfullerene (C_{60}) is a form of carbon.

Buckminsterfullerene was the first fullerene to be discovered.

What is the shape of a buckminsterfullerene molecule?

Tick (✓) **one** box.

Cubic ☐

Cylindrical ☐

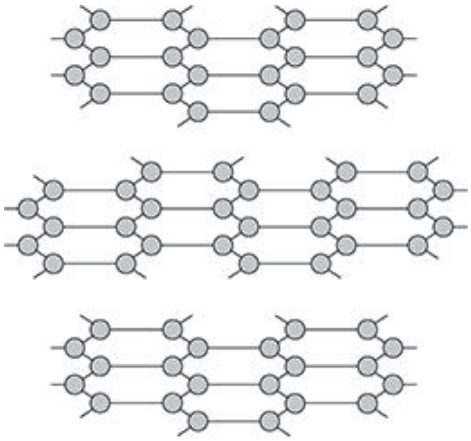
Spherical ☐

(1)

(g) Graphite is a form of carbon.

Figure 2 represents the structure of graphite.

Figure 2



Key

○ = carbon atom

How many covalent bonds does each carbon atom form in graphite?

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

(1)

(h) Diamond is another form of carbon.

Figure 3 represents the structure of diamond.

Figure 3

Key

= carbon atom

Describe the structure and bonding in diamond.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q2.

This question is about carbon.

(a) Which type of substance is carbon?

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

(1)

(b) Carbon has isotopes with mass numbers 12, 13 and 14.

Complete the sentences.

Choose answers from the box.

electrons	**ions**	**molecules**	**neutrons**	**protons**

The isotopes of carbon have the same number of _____.

The isotopes of carbon have a different number of _____.

(2)

(c) 12 g of carbon contains 6.02×10^{23} atoms.

Which expression is used to calculate the mass of one atom of carbon? **(HT only)**

Tick (✓) **one** box.

$\frac{12}{6.02 \times 10^{23}}$ ☐

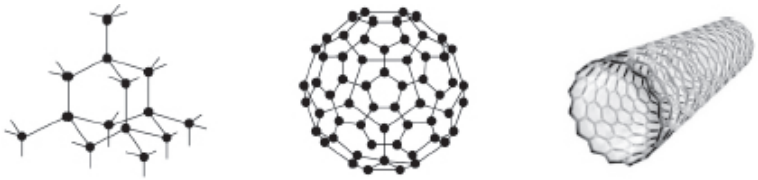
$\frac{6.02 \times 10^{23}}{12}$ ☐

$12 \times 6.02 \times 10^{23}$ ☐

(1)

(d) **Figure 1** shows diagrams that represent different forms of carbon.

Figure 1



A B C

Which diagram in **Figure 1** represents Buckminsterfullerene?

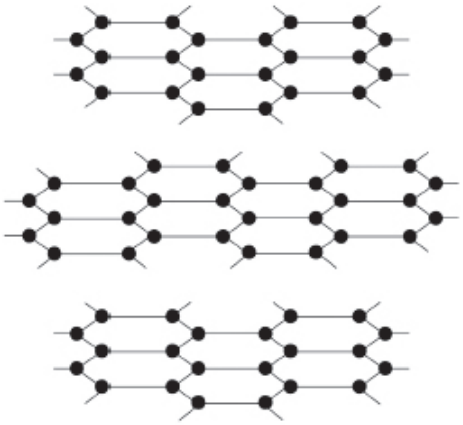
Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(e) **Figure 2** represents part of the structure of graphite.

Figure 2



Draw **one** line from each property of graphite to the structural feature that is the reason for that property.

Property	Structural feature
	Graphite has hexagonal rings of carbon atoms.
Graphite conducts electricity.	
	The bonds between carbon atoms in the layers are strong.
	There are no covalent bonds between layers of atoms.
Graphite is soft.	
	There are delocalised electrons in graphite.

(2)

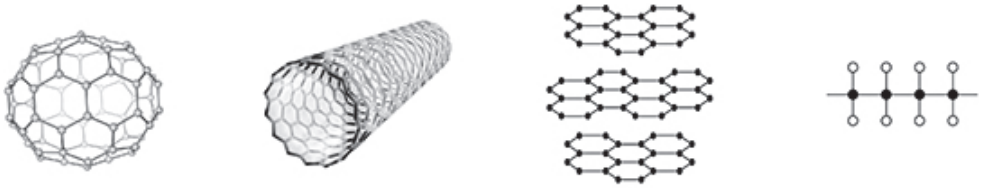
(Total 7 marks)

Q3.

This question is about carbon and compounds of carbon.

Figure 1 shows diagrams that represent different structures.

Figure 1



Use **Figure 1** to answer parts (a) and (b).

(a) Which diagram represents graphite?

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

(b) Which diagram represents poly(ethene)?

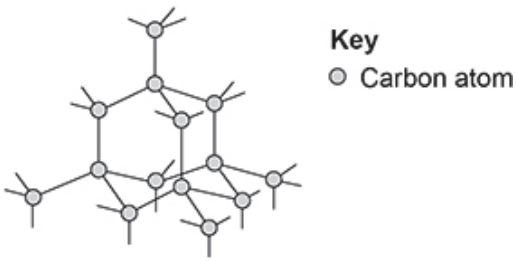
Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

Figure 2 represents the structure of diamond.

Figure 2



(c) How many covalent bonds does each carbon atom form in diamond?

_____

(1)

(d) Which is a property of diamond?

Tick (✓) **one** box.

Conducts electricity ☐

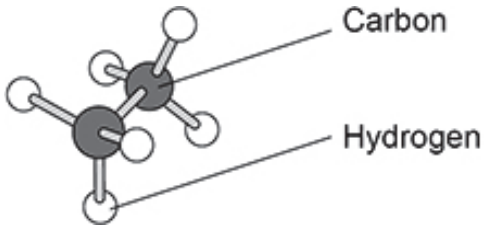
Low melting point ☐

Very hard ☐

(1)

(e) **Figure 3** shows a model of a molecule.

Figure 3



Complete the molecular formula of the molecule.

Molecular formula = C__ H__

(1)

Carbonic acid is a compound of carbon.

The formula of carbonic acid is H_2CO_3

(f) Which ion is produced by carbonic acid in aqueous solution?

Tick (✓) **one** box.

H^+ ☐ OH^- ☐ O^{2-} ☐

(1)

(g) Calculate the relative formula mass (M_r) of carbonic acid (H_2CO_3).

Relative atomic masses (A_r): H = 1 C = 12 O = 16

_____

_____

_____

Relative formula mass (M_r) = _____

(2)

(Total 8 marks)