

Unit 1 – Atomic Structure and Bonding Revision PPQu

1. This question is about states of matter.

- (a) Use the words solid, liquid or gas to give the initial and final state of matter for each of the changes listed in the table.

The first one has been done for you.

(3)

| Change | Initial state | Final state |
|-------------|---------------|-------------|
| melting | solid | liquid |
| sublimation | solid | gas |
| condensing | gas | liquid |
| evaporation | liquid | gas |

OR gas → solid

- (b) Particles in a solid are closely packed, arranged in a regular pattern and vibrate about fixed positions.

Describe the arrangement and movement of the particles in a gas.

(3)

3 from:

- Particles are spread out
- Particles are randomly arranged
- Particles move freely / randomly
- Particles move quickly

(Total for question = 6 marks)

- (a) The table shows the number of protons, neutrons and electrons in species F, G and H.

| | Species F | Species G | Species H |
|---------------------|-----------|-----------|-----------|
| number of protons | 7 | 7 | 7 |
| number of neutrons | 7 | 8 | 7 |
| number of electrons | 7 | 7 | 10 |

- (i) Give the mass number of F. (1)

↳ protons + neutrons

14

- (ii) Give the electronic configuration of G. (1)

↳ electrons in each shell

2,5

- (iii) Explain why F and G are isotopes of the same element. - Same protons, diff neutrons (2)
Refer to subatomic particles in your answer.

- F + G have the same number of protons
- & different numbers of neutrons

- (iv) Explain why H is a negative ion. - more electrons than protons (2)
Refer to subatomic particles and their charges in your answer.

- H has (3) more electrons than protons
- Electrons have a negative charge & protons have a positive charge

- (b) A sample of carbon contains atoms of mass number 12 and 13
The table shows the percentages of these atoms in the sample.

| Mass number | Percentage (%) |
|-------------|----------------|
| 12 | 98.930 |
| 13 | 1.070 |

Calculate the relative atomic mass (A_r) of this sample of carbon.

Give your answer to two decimal places.

(2)

$$RAM = \frac{\text{mass} \times \text{abundance}}{100}$$

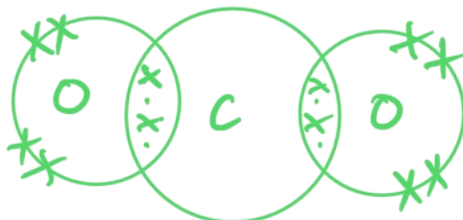
$$= \frac{(12 \times 98.930) + (13 \times 1.070)}{100} = 12.0107$$

relative atomic mass =12.01 (2dp).....

(Total for question = 8 marks)

3. This question is about carbon and its compounds.

- (a) (i) Draw a dot-and-cross diagram to show the outer shell electrons in a molecule of carbon dioxide, CO_2 (2)



m1: 4 electrons
shared between
C & each O

m2: rest of O's
electrons

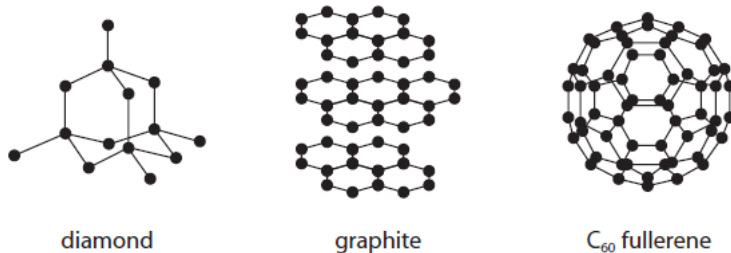
- (ii) The atoms in carbon dioxide are held together by covalent bonds.

Describe the forces of attraction in a covalent bond.

(2)

- attraction between the shared/bonding
electrons
- & positive nuclei (NOT nucleus!)

(b) The diagram shows three different structures of carbon.



(i) Explain why graphite conducts electricity.

(2)

- Graphite has delocalised electrons
- Which can move

(ii) Explain why diamond has a much higher melting point than C₆₀ fullerene.
Refer to structure and bonding in your answer.

(5)

↳ Giant lattice OR molecule ↳ ionic OR covalent

Diamond bond + structure { Diamond is a giant covalent structure
• With very strong covalent bonds to break
(which take a lot of energy to break)

C₆₀ bond + structure { Whereas C₆₀ is a molecular structure
• With weak intermolecular forces
(which require less energy to overcome)

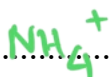
Energy comparison { More energy is needed to break covalent bonds in diamond than intermolecular forces in C₆₀

(Total for question = 11 marks)

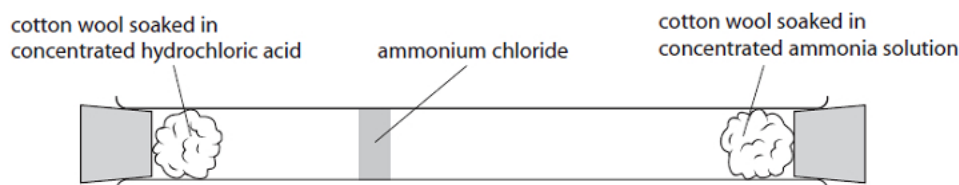
4. This question is about ammonium chloride.

(a) Give the formula of the ammonium ion. —charged

(1)



(b) The diagram shows the formation of ammonium chloride in a glass tube.



(i) Explain how the mean speed of ammonia molecules compares with the mean speed of hydrogen chloride molecules. (2)

· Ammonia moves faster

· As the ring of ammonium chloride has formed closer to the hydrogen chloride end

(ii) Gas particles travel very quickly. Give two reasons why it takes several minutes for the ammonium chloride to form. (2)

1 2 from:

· Particles move randomly

2 · Particles collide with air (in the tube)

· Particles collide with walls/sides of the tube

(Total for question = 5 marks)

TOTAL MARKS FOR QUESTIONS: 30

Extension

5. The formation of ions and covalent bonds involves electrons.

The table gives the electronic configurations of atoms of hydrogen, lithium and chlorine.

| Element | Electronic configuration of atom |
|----------|----------------------------------|
| hydrogen | 1 |
| lithium | 2.1 |
| chlorine | 2.8.7 |

(a) Describe the different roles of electrons in the formation of

- ions in lithium chloride
- covalent bonds in hydrogen chloride

(3)

In Lithium chloride:

m1: lithium loses an electron to form an ion

m2: Chlorine gains an electron to form an ion

In hydrogen chloride

m3: Chlorine & hydrogen each share one electron
OR share a pair of electrons

Bond strength
Structure
→ Energy required

→ Comparison needed

(b) Explain why lithium chloride has a higher melting point than hydrogen chloride.
Refer to structure and bonding in your answer. (5)

LiCl { m1: Lithium chloride is a giant structure
m2: with strong (electrostatic) forces of attraction
m3: between cations & anions

HCl { m4: HCl is a molecular structure
m5: with weak intermolecular forces (between molecules)

Compare { m6: more energy is needed to break the bonds in LiCl (than the intermolecular forces in HCl)

(Total marks for extension question: 8 marks)