**Q1.** Fertilisers are formulations.

(a)  What is a formulation?

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**(1)**

(b)  A bag of fertiliser contains 14.52 kg of ammonium nitrate (NH4NO3).

Relative formula mass (*M*r): NH4NO3 = 80

Calculate the number of moles of ammonium nitrate in the bag of fertiliser.

Give your answer in standard form to 2 significant figures.

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Moles of ammonium nitrate = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mol

**(4)**

(c)  The fertiliser also contains potassium chloride.

Explain why potassium chloride has a high melting point.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(4)**

**(Total 9 marks)**

**Q2.** Tablets to cure indigestion contain a mixture that has been designed as a useful product.

(a)     Complete the sentence. Choose the answer from the box.

|  |  |  |  |
| --- | --- | --- | --- |
| **catalyst** | **formulation** | **hydrocarbon** | **solvent** |

Tablets to cure indigestion are an example of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

The table shows the substances in one tablet.

|  |  |
| --- | --- |
| **Substance** | **Mass in mg** |
| Sodium hydrogencarbonate | 64 |
| Calcium carbonate | 522 |
| Magnesium carbonate | 68 |

(b)     The total mass of these substances in the tablet is 654 mg

What is the approximate fraction of magnesium carbonate in the total mass of these substances?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

**(1)**

(c)     The tablets also contain sugar.

Suggest why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(d)     Sodium hydrogencarbonate cures indigestion by reacting with acid in the stomach.

What type of reaction is this?

Tick **one** box.

|  |  |
| --- | --- |
| Combustion |  |
| Displacement |  |
| Neutralisation |  |

**(1)**

A student adds an indigestion tablet to dilute hydrochloric acid.

(e)     The gas produced is bubbled through limewater.

The gas turns the limewater milky.

Name the gas produced.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(f)      Water is also produced.

Which **two** statements are reasons why water is a liquid at room temperature?

Tick **two** boxes.

|  |  |
| --- | --- |
| Water has a boiling point of 100 °C |  |
| Water has a giant covalent structure |  |
| Water has a melting point lower than room temperature |  |
| Water has delocalised electrons |  |
| Water is made of ions |  |

**(2)**

(g)      Calcium chloride is also produced.

•        The formula for a calcium ion is Ca2+

•        The formula for a chloride ion is Cl–

What is the formula of calcium chloride?

Tick **one** box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CaCl |  | Ca2Cl |  | CaCl2 |  | Ca2Cl2 |  |

**(1)**

Mark schemes

**Q1.**

(a)  a mixture designed as a useful product

**1**

(b)  mass = 14 520 g

**1**

****

*allow correct substitution of incorrectly converted mass*

*must use Mr given (80) to gain marks in steps 2 and 3*

**1**

(=) 181.5 (mol)

**1**

(=) 1.8 × 102 (mol)

*allow answer correctly given in standard form to correct sig figs from an incorrect calculation*

**1**

*an answer of 1.8 × 102 (mol) gains* ***4*** *marks*

(c)  (giant) lattice

*allow giant structure*

**1**

ionic

**1**

strong bonds **or** strong electrostatic forces

*do* ***not*** *accept strong intermolecular forces / bonds*

**1**

large amounts of energy needed to overcome

*ignore heat*

**1**

***max 2 marks*** *for incorrect reference to bonding* ***or*** *structure* ***or*** *particles*

**[9]**

**Q2.**

(a)     formulation

**1**

(b)     1/10

**1**

(c)     make them palatable

**1**

(d)     neutralisation

**1**

(e)     carbon dioxide

**1**

(f)      water has a boiling point of 100 °C

**1**

water has a melting point lower than room temperature

**1**

(g)     CaCl2

**1**

(h)     crushed

**1**

melted

*must be in this order*

**1**

**[10]**