Candidate Forename		Candidate Surname	

Centre Number					Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A217/01

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

UNIT 3: Modules B6 C6 P6
(Foundation Tier)

FRIDAY 19 JUNE 2009: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper
A calculator may be used for this paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.

- Use black ink. Pencil may be used for graphs and diagrams only.

- Read each question carefully and make sure that you know what you have to do before starting your answer.

- Answer **ALL** the questions.

- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.

- The total number of marks for this paper is **42**.

- A list of physics equations is printed on pages 4 and 5.

- The Periodic Table is printed on page 35.

BLANK PAGE

TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

4

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

wave speed = frequency × wavelength

Answer <u>ALL</u> the questions.

1   Ben hurts his foot playing football. The hospital takes an X-ray image of his foot to see if any bones are broken.

   (a) Ben asks his friends why X-rays can be used to make an image of his bones.

ALAN
X-rays can pass through empty space.

BESS
Bone absorbs more X-rays than muscle.

CARLO
Muscle absorbs X-rays but bone does not.

DAVINA
Nothing can stop X-rays.

Who gives the **BEST** answer?

answer _____ **[1]**

(b) Ben knows that exposure to X-rays can be dangerous.

This is because X-ray photons carry a lot of energy and can damage cells.

Why do X-ray photons carry a lot of energy?

Put a tick (✔) in the box next to the correct reason.

X-rays are invisible. ☐

X-rays have a high frequency. ☐

X-rays can travel through a vacuum. ☐

[1]

(c) Here is an incomplete diagram of the electromagnetic spectrum.

Write **X-RAY** in the correct place.

radio		infrared		ultraviolet		gamma

[1]

8

(d) Complete the sentences. Choose words from the list.

<u>**AMPLITUDE**</u>

<u>**SOUND**</u>

<u>**SPEED**</u>

<u>**WAVELENGTH**</u>

Infrared and ultraviolet waves have the same

_____ through empty space.

Infrared and ultraviolet waves must have a

different _____ .

[2]

[Total: 5]

2 **Jake is a security guard. He uses radio waves to communicate with his boss.**

(a) The <u>AMPLITUDE</u> of the radio waves carries information about Jake's voice.
Which other wave property can be used instead?

Put a ⟨ring⟩ around the answer.

<u>**FREQUENCY**</u>

<u>**TRANSVERSE**</u>

<u>**SPEED**</u>

[1]

10

(b) The radio waves carry digital information.

Which of these wave patterns, <u>A</u>, <u>B</u> or <u>C</u>, shows <u>DIGITAL</u> information which has been <u>AMPLITUDE MODULATED</u> onto a wave?

A

B

C
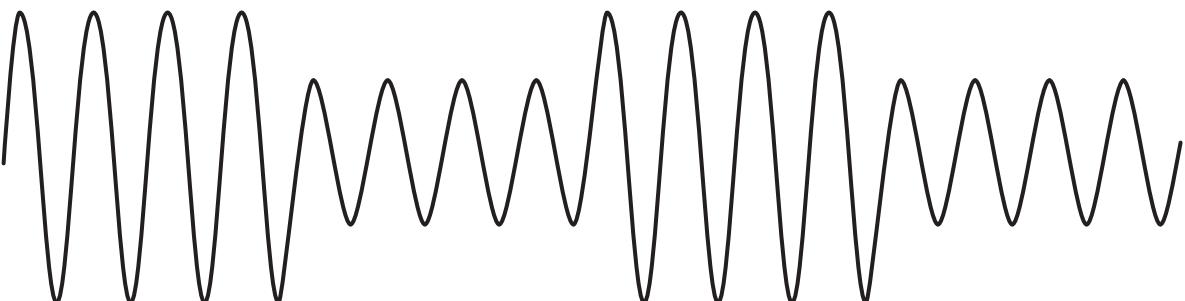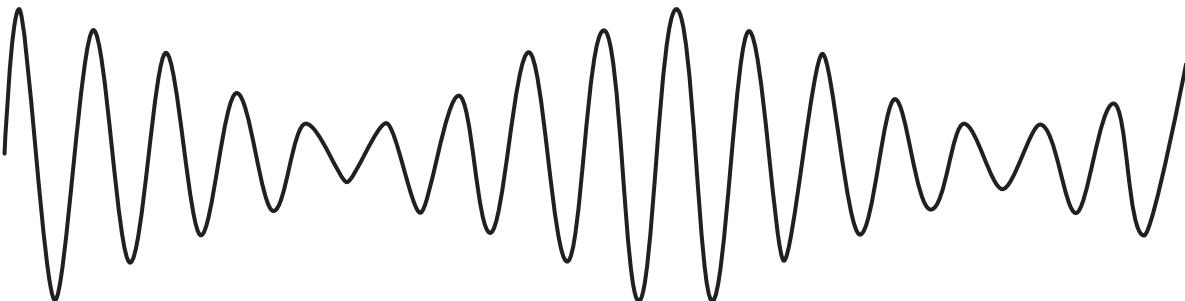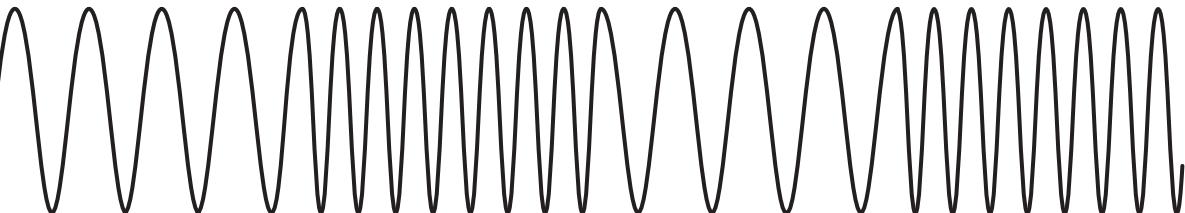
wave pattern _____ **[1]**

11

**(c) Put a (ring) around the correct word to complete the sentences.**

Jake uses his radio to call his boss.

The waves travel away from the radio to the

RECEIVER   TRANSMITTER.

As the waves travel, their amplitude

DECREASES   INCREASES   STAYS THE SAME.

The quality of the radio waves gets worse as

INFORMATION   NOISE   is added to them.

[2]

(d) Radio waves are <u>TRANSVERSE</u>. What does this mean?

Put a tick (✔) in the box next to the correct description.

The disturbance of the wave is ...

... in the same direction as the wave energy flow. ☐

... in the opposite direction to the wave energy flow. ☐

... at right angles to the direction of the wave energy flow. ☐

[1]

[Total: 5]

13

3 (a) Micky plays dominoes in a lesson about waves.

Each domino has a <u>WORD</u> at the top and a <u>MEANING</u> at the bottom.

Each word must be placed below its correct meaning, as shown below.

<u>A</u> **LONGITUDINAL**
number of waves per second from the source — meaning

<u>B</u> **FREQUENCY** — word
distance from one crest to the next
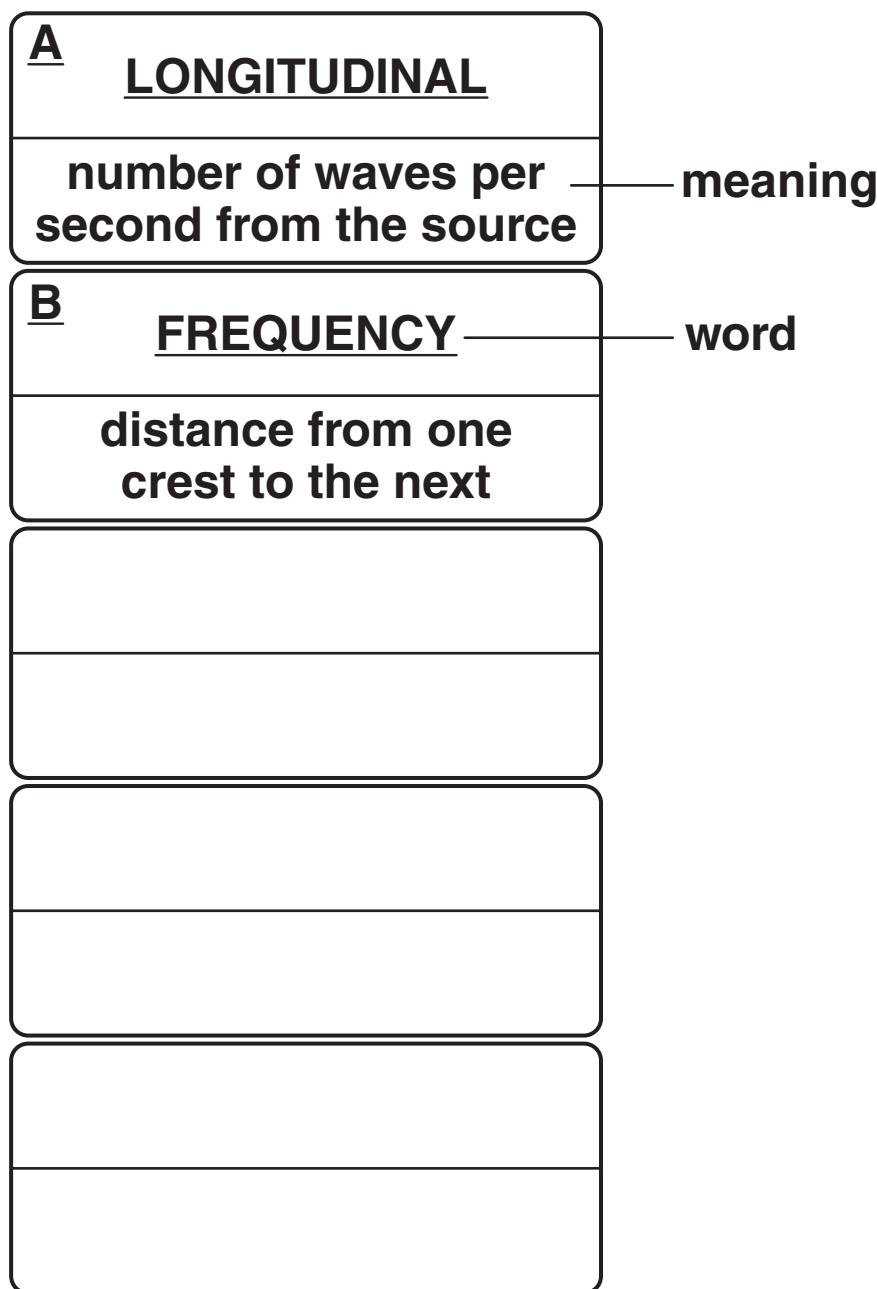
Here are the other three dominoes.

C	
AMPLITUDE	
how far a wave goes in a second	

D	
WAVELENGTH	
height of a crest	

E	
SPEED	
energy flow parallel to wave disturbance	

Write <u>C</u>, <u>D</u> or <u>E</u> in each blank domino on the page opposite, so that each word is below its correct meaning.

You may fill in the blank dominoes if it helps you work out the answers. **[2]**

15

(b) Which one of these actions could change the speed of a wave?

Put a tick (✔) in the box next to the correct answer.

change the intensity of the wave ☐

change the amplitude of the wave ☐

change the frequency of the wave source ☐

change the medium that the wave passes through ☐

[1]

16

(c) **Alice talks to Micky about their work.**

What do the sound waves transfer from Alice to Micky?

Put a (ring) around the correct answer.

<u>**ATOMS**</u>

<u>**ENERGY**</u>

<u>**RAYS**</u>

<u>**WAVELENGTHS**</u>

[1]

[Total: 4]

4 **Animals such as woodlice respond to changes in their environment.**

This process follows a series of steps.

(a) Complete the sentences to explain these steps.

Choose words from the list.

<u>**AN ACTION**</u>

<u>**AN EFFECTOR**</u>

<u>**A HORMONE**</u>

<u>**A MOTOR NEURON**</u>

<u>**A RECEPTOR**</u>

<u>**A SENSORY NEURON**</u>

<u>**A STIMULUS**</u>

<u>**A SYNAPSE**</u>

The change in the environment is _____.

The change is detected by _____ .

Information is carried to the central nervous

system by _____ .

Information is carried from the central nervous

system by _____ .

The response is carried out by _____.

[4]

18

(b) Woodlice move away from light.

Which of these sentences explains the reason for this response?

Put a tick (✔) in the box next to the <u>BEST</u> answer.

They prefer dry conditions. ☐

They are afraid of the light. ☐

Their food source is always in the dark. ☐

Dark conditions are more favourable for their survival. ☐

[1]

(c) Which of these terms describes the behaviour of simple animals such as woodlice?

Put a tick (✔) in the box next to the <u>BEST</u> answer.

a complex response ☐

a simple reflex ☐

a learned response ☐

a learned reflex ☐

[1]

[Total: 6]

5 **(a)** Label the diagram, shown opposite, of a motor neuron.

Choose words from the list.

<u>AXON</u>

<u>CHLOROPLAST</u>

<u>FATTY SHEATH</u>

<u>NUCLEUS</u>

<u>RIBOSOME</u>

(b) What happens when a motor neuron is stimulated?

Put a tick (✔) in the box next to the correct answer.

It gets shorter. ☐

It moves to where it is needed. ☐

It transmits an electrical impulse. ☐

[1]

[Total: 4]

20

[3]

21
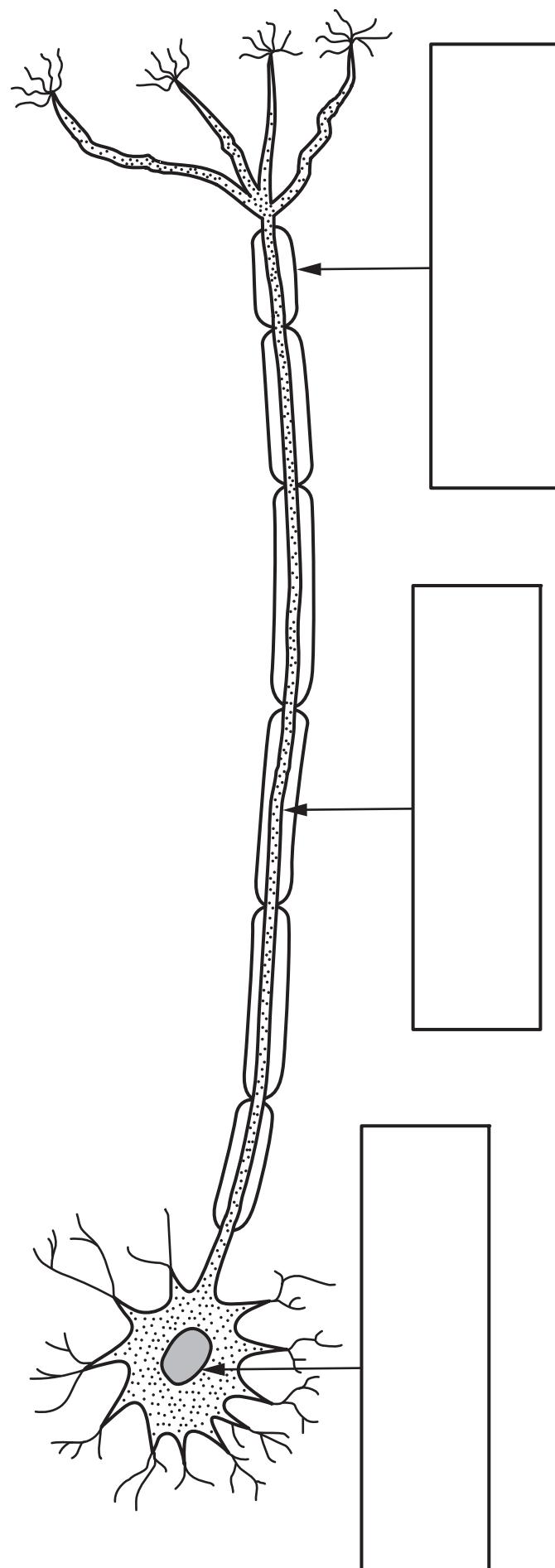
6 **Baby Sam is learning to crawl.**

The brain is responsible for memory and for learning.

(a) Draw a straight line from each <u>FUNCTION</u> to its correct <u>DESCRIPTION</u>.

<u>FUNCTION</u>	<u>DESCRIPTION</u>
	the result of experience or repetition
memory	**an involuntary response to a stimulus**
learning	**the storage and retrieval of information**
	a voluntary response to a stimulus

[2]

22

(b) Babies learn new skills as they develop.

The sentences explain how this happens.
They are in the wrong order.

<u>A</u> If the experience is repeated the link becomes
   stronger.

<u>B</u> It is easier for impulses to pass along the link.

<u>C</u> When a baby tries something new, links
   between neurons are made in the brain.

<u>D</u> The response gets easier to make.

Fill in the boxes to show the correct order. The first
one has been done for you.

C			

[2]

[Total: 4]

23

7 **The pie chart shows the EU chemical industry sales for 2003.**
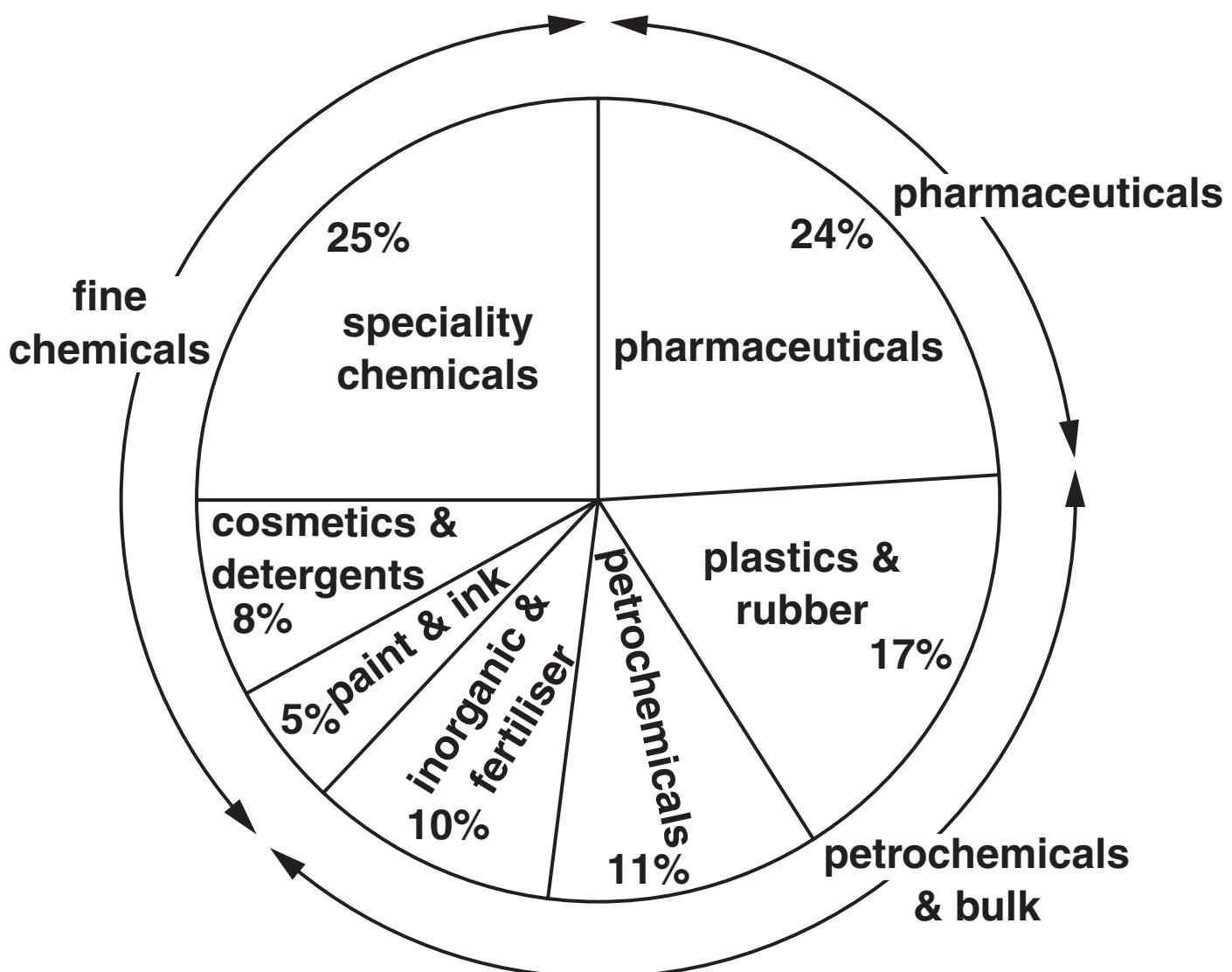
Mary combines these sectors to show the sales of the three main areas of the chemical industry.

(a) Complete the table to show the total size of the three main areas.

AREA	TOTAL % SALES
pharmaceuticals	
petrochemicals & bulk	
fine chemicals	

[2]

(b) The total sales of the industry are about 450 billion euros.

Using the information in the pie chart, put a (ring) around the total sales of the pharmaceuticals in billions of euros.

$$450 \times \frac{24}{100} \qquad 450 \times \frac{100}{24} \qquad 450 \times \frac{38}{100} \qquad 450 \times \frac{100}{38}$$

[1]

[Total: 3]

25

8 **Foods such as fruit taste pleasant because they contain small amounts of acid.**

(a) Sometimes, extra acid is added to foods.

Acids which can be added to food are given E numbers.

ACID	E NUMBER
ethanoic acid	E260
citric acid	E330
tartaric acid	E334
hydrogen chloride	E507
sulfuric acid	E513

Give one E number for an acid which is solid when pure.

answer _____

Give one E number for an acid which is a liquid when pure.

answer _____

Give one E number for an acid which is a gas when pure.

answer _____ [2]

(b) Acids in food show the normal reactions of an acid.

Write the labels <u>ACID</u>, <u>ALKALI</u>, <u>SALT</u> and <u>WATER</u> in the boxes. One has been done for you.

CH_3COOH + $NaOH$ → H_2O + CH_3COONa

acid			

[1]

[Total: 3]

27

9 **Bobby reacts marble chips (calcium carbonate) with acid.**

He measures the change in mass as the acid reacts.
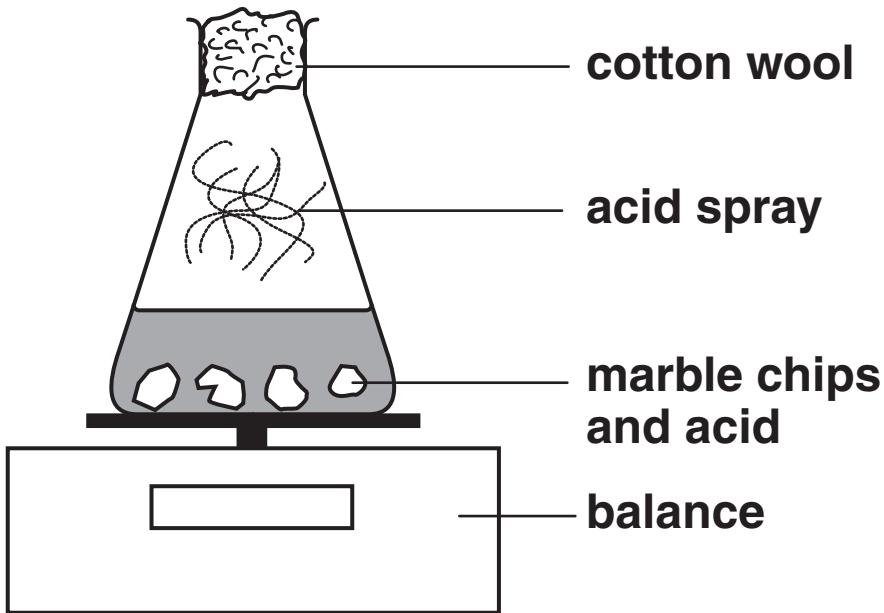
(a) **Why does he put cotton wool in the top of the flask?**
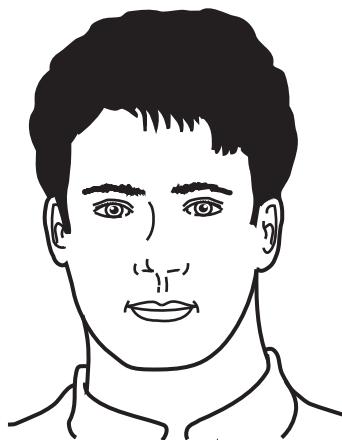
SU
To stop any air getting in.

JIM
To stop any gas getting out.

MIKE
To stop any marble chips getting out.

KATE
To stop any spray from the bubbles getting out.

Who gives the BEST answer?

answer _____ **[1]**

29

(b) Bobby starts the reaction by adding some acid.

He adds extra acid part way through.
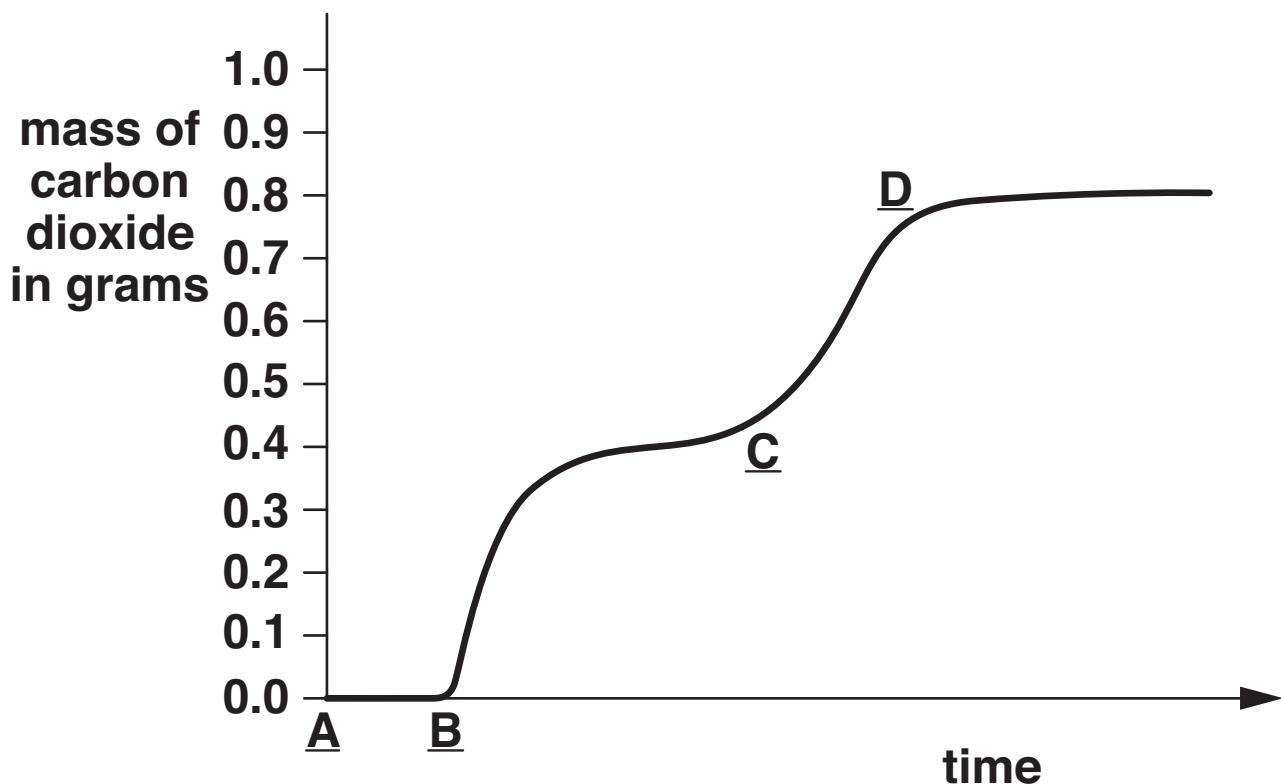
(i) Put a (ring) around the letter below that shows where he added the acid to **START** the reaction.

A   B   C   D   [1]

(ii) Put a (ring) around the letter below that shows where he added the extra acid.

A   B   C   D   [1]

(iii) Put a (ring) around the mass of carbon dioxide given off by the end of the experiment.

0.4 g   0.5 g   0.6 g   0.8 g   1.0 g   [1]

[Total: 4]

10 Benzoic acid is added to foods as a preservative.

Benzoic acid forms solid crystals which must be purified before the acid is used.

(a) The table shows different methods of purifying chemicals, and information about when you would use each method.

Draw lines to link each <u>METHOD</u> to the correct piece of <u>INFORMATION</u>.

One has been done for you.

<u>**METHOD**</u>   <u>**INFORMATION**</u>

METHOD	**INFORMATION**
crystallisation	**The solid substance is coated with a solution containing impurities.**
evaporation	**The impurities are more soluble than the substance.**
filtration	**The substance is in a very dilute solution.**
washing	**The impurities do not dissolve.**

(crystallisation is linked to "The impurities are more soluble than the substance.")

[2]

(b) Terry does a titration to check the purity of some benzoic acid.

He wants to use an indicator which changes colour when the solution becomes slightly alkaline.

	INDICATOR	pH RANGE FOR COLOUR CHANGE
A	gentian violet	0 to 2
B	methyl red	4 to 6
C	litmus	5 to 8
D	phenolphthalein	8 to 10
E	nitramine	11 to 13

(i) Which indicator, A, B, C, D, or E, should he use?

answer _____ [1]

(ii) Terry does the titration five times.

He writes down his titration results.

titration number	1	2	3	4	5
volume of alkali in cm^3	25.9	25.1	25.0	25.0	25.0

Put a tick (✔) in the box next to the result that he should use for his calculations.

25.0 ☐

25.1 ☐

25.2 ☐

25.9 ☐

[1]

[Total: 4]

END OF QUESTION PAPER

BLANK PAGE

The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

Group 1	2												3	4	5	6	7	0
							1 **H** hydrogen 1											4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4												11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12												27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30		70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48		115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80		204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111								

Elements with atomic numbers 112-116 have been reported but not fully authenticated

*** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.**

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

35