OCR
Oxford Cambridge and RSA

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Monday 19 June 2017 – Morning

GCSE GATEWAY SCIENCE
FURTHER ADDITIONAL SCIENCE B

B761/02 Further Additional Science modules B5, C5, P5 (Higher Tier)

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)

Duration: 1 hour 15 minutes

* B 7 6 1 0 2 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil ( ).
- A list of equations can be found on page 2.
- The Periodic Table can be found on the back page.
- 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 **75**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output } (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$KE = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$GPE = mgh$$

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

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_pI_p = V_sI_s$$

Answer **all** the questions.

SECTION A – Module B5

1 **(a)** The hormone ADH (anti-diuretic hormone) controls water levels in the blood.

Where is ADH produced in the body?

..... **[1]**

(b) Contraceptive pills contain the hormones **oestrogen** and **progesterone**.

Explain how the contraceptive pills control human fertility.

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..... **[2]**

Question 2 begins on page 4

2 **(a)** Damaged body parts can be replaced with **biological** or **mechanical** parts.

Some replacement parts are put **inside** the body but some have to be used **outside** the body.

Put **two** ticks (✓) in each row of the table to describe each type of replacement part.

The first row has been done for you.

Replacement body part	Biological	Mechanical	Inside body	Outside body
kidney dialysis machine		✓		✓
artificial heart valve				
ovary transplant				

[2]

(b) Read the newspaper article.

First artificial windpipe transplant

The first artificial windpipe (trachea) was transplanted into a patient in 2011.

The patient's own windpipe had to be removed because of cancer.

The new windpipe was made of plastic, which was covered with the patient's own cells. The cells had been grown from some of the patient's own stem cells.

Use the information in the article as well as your scientific knowledge to answer the questions.

(i) Using artificial windpipes like the one in the article, is better than using either transplants from other people, or using completely artificial replacements.

Explain what the **advantages** are of using artificial windpipes like the one in the article.

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..... **[4]**

(ii) Some people think that using stem cells from embryos is wrong, because an embryo could have the potential to grow into a living person.

Would there be the same objections to using a patient's own stem cells to help make a new windpipe?

Explain your answer.

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..... **[2]**

3 Betty's heart rate is too slow and irregular.

Her doctor says this is a problem, and Betty should be given an artificial pacemaker.

(a) The artificial pacemaker does the job of the natural pacemaker cells in the heart.

Explain what the artificial pacemaker does to the heart.

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..... **[2]**

(b) Betty takes a drug called aspirin.

Aspirin makes it **less likely** she will have coronary heart disease or a heart attack.

Explain why.

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..... **[2]**

(c) The graph shows part of the sequence of Betty's cardiac cycle.

Item removed due to third party copyright restrictions.

(i) Which line shows the pressure in the ventricles?

Choose from **A**, **B** or **C**.

..... **[1]**

(ii) Which letter shows the time when the ventricles are contracting?

Choose from **D**, **E**, **F** or **G**.

..... **[1]**

(iii) Which letter shows the time when the atria are contracting?

Choose from **D**, **E**, **F** or **G**.

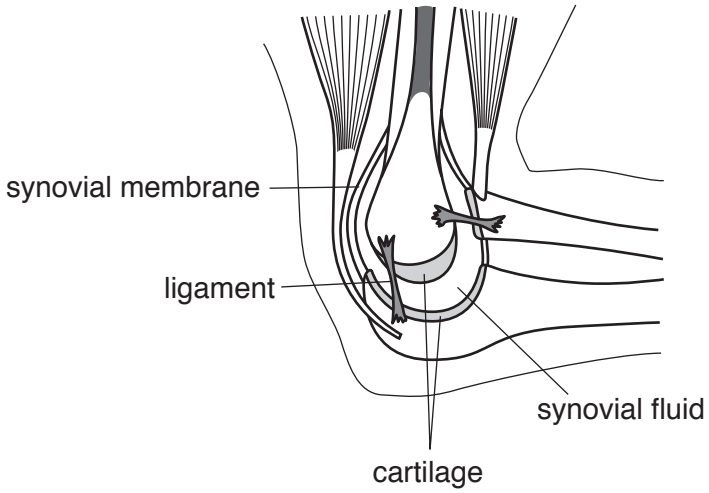
..... **[1]**

(iv) At what time do the atrio-ventricular valves close?

..... milliseconds **[1]**

4 The diagram shows an elbow joint.

This is an example of a hinge joint.



Describe the range of movement in the joint and explain the functions of the labelled parts.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

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Question 5 begins on page 10

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SECTION B – Module C5

5 Scientists are concerned about the amount of sodium ions in food.

The guideline daily amount (GDA) for sodium ions is 2.4 g.

David makes a loaf of bread.

He uses 8.0 g of salt.

His loaf has a mass of 500 g.

Salt is sodium chloride, NaC*l*.

(a) What mass of sodium ion does David use to make the loaf?

The relative atomic mass of C*l* = 35.5 and of Na = 23.

Mass of sodium ion = ... g **[2]**

(b) Should David eat a whole loaf of bread every day?

Explain your answer.

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..... **[1]**

6 Nick tests two solutions, **A** and **B**, with:

- barium chloride solution
- lead nitrate solution
- universal indicator paper.

Look at his table of results.

Test with	Colour with solution A	Colour with solution B
barium chloride solution	white precipitate	stays colourless
lead nitrate solution	stays colourless	yellow precipitate
universal indicator paper	red	green

Nick makes two conclusions.

- Solution **A** contains both hydrogen ions and sulfate ions
- Solution **B** contains chloride ions

Do Nick's results support **each** of these conclusions?

Explain your answer.

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..... **[3]**

7 Sulfamic acid reacts with sodium nitrite.

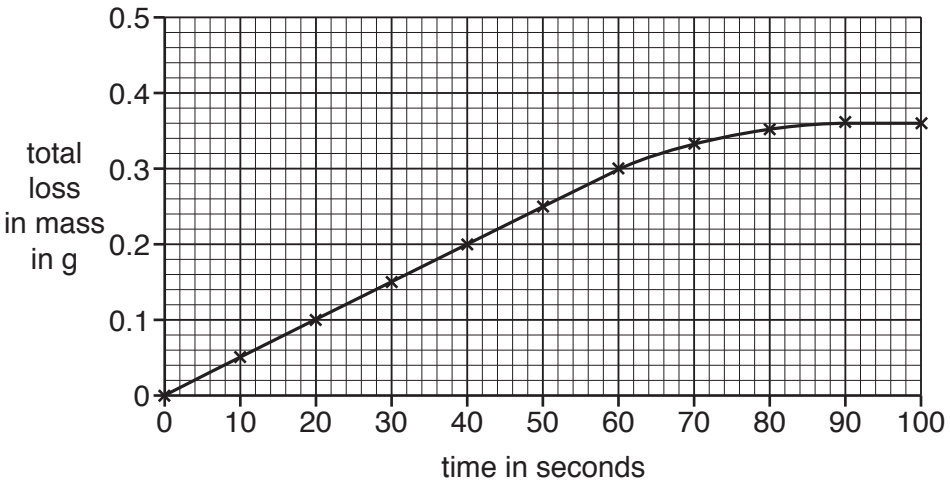
Look at the balanced symbol equation for this reaction.

$$NH_2SO_3H(aq) + NaNO_2(s) \rightarrow N_2(g) + H_2O(l) + NaHSO_4(aq)$$

Julie investigates the reaction between sulfamic acid and sodium nitrite.

She measures the total change in mass of the reaction mixture during the reaction.

Look at her results.



Describe, using a **labelled** diagram of the apparatus, the experiment Julie does to collect the results shown in the graph.

Explain the change in mass of the reaction mixture as time increases.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

8 Ethanoic acid is a **weak** acid and hydrochloric acid is a **strong** acid.

(a) Louise has a bottle of dilute ethanoic acid and another bottle of dilute hydrochloric acid.

Both acids have a concentration of 0.10 mol / dm^3.

Louise adds ethanoic acid and hydrochloric acid from the bottles to separate samples of calcium carbonate.

The hydrochloric acid reacts much faster than ethanoic acid.

Use the reacting particle model to explain why.

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..... **[2]**

(b) The balanced symbol equation for the reaction between hydrochloric acid and calcium carbonate is

$$2HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$$

Louise uses 25.0 cm^3 of the 0.1 mol / dm^3 hydrochloric acid.

(i) How many moles of hydrochloric acid did Louise use?

moles of hydrochloric acid = ... **[1]**

(ii) All of the hydrochloric acid reacts.

How many moles of carbon dioxide are made?

moles of carbon dioxide = ... **[1]**

(iii) Calculate the volume of carbon dioxide made at room temperature and pressure.

One mole of carbon dioxide has a volume of 24 dm^3 at room temperature and pressure.

volume of carbon dioxide = ... dm^3 **[1]**

(c) Ethanoic acid has the molecular formula $C_2H_4O_2$.

(i) What is the **empirical formula** for ethanoic acid?

..... **[1]**

(ii) Ethanoic acid reacts with calcium carbonate.

One of the products is calcium ethanoate, $Ca(CH_3COO)_2$.

Calculate the mass of 0.250 moles of calcium ethanoate.

The molar mass for calcium ethanoate is 158 g / mol.

Write your answer to 3 significant figures.

mass = ... g **[1]**

Question 9 begins on page 16

9 Sulfuric acid is made in the Contact Process.

In the Contact Process sulfur dioxide reacts with oxygen.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

(a) A catalyst is used in the Contact Process.

Write the name or formula of the catalyst.

..... **[1]**

(b) Describe **two other** conditions used in the Contact Process.

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..... **[2]**

(c) Explain why a catalyst is used in the Contact Process.

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..... **[1]**

10 The **relative atomic mass** of chlorine is 35.5.

Describe what is meant by relative atomic mass.

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..... **[2]**

Question 11 begins on page 18

SECTION C – Module P5

11 Artificial satellites orbit the Earth.

(a) A TV satellite is placed high above a point on the equator.

Its orbit around the Earth takes 24 hours.

What type of orbit does this TV satellite have?

Choose from the list.

geostationary orbit

low polar orbit

polar orbit

spiral orbit

..... **[1]**

(b) Other types of satellite have **lower** orbits.

These satellites travel faster than higher TV satellites.
They travel about 8000 m / s in a stable orbit.
This speed has to be maintained.

Explain what could happen if the speed of a satellite changes.
Use ideas about centripetal force in your answer.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(c) Satellites and the International Space Station are used to take images of the Earth.

These satellites and the International Space Station are kept at a **low** height (orbit) above the Earth.

Write about one **advantage** and one **disadvantage** of using a low height (orbit) above the Earth to take images.

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..... **[2]**

(d) Electromagnetic waves are used for communication.

Look at the information about different waves.

Wave	Frequency	Wavelength
X	20 MHz	15.0 m
Y	90 MHz	3.3 m
Z	50 GHz	0.006 m

Which **two** waves are **not** used for satellite communication?

Explain your answers by completing the sentences.

Wave ..... is **not** used for satellite communication because .....

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Wave ..... is **not** used for satellite communication because .....

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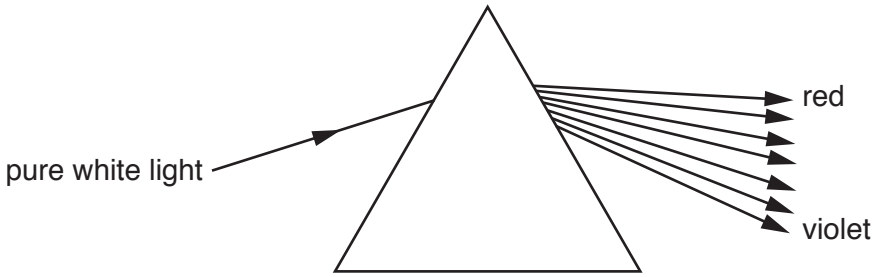
[4]

12 Look at the diagram of a prism in a vacuum.



The pure white light enters the prism.

The light is dispersed into a spectrum of colours (colours of the rainbow).

Explain why red and violet light refract differently.

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..... **[4]**

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Question 13 begins on page 22

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13 There are many different speed limits on UK roads.

Look at the table of speed limits in miles per hour (mph) and metres per second (m/s).

Speed limit in miles per hour (mph)	Speed limit in metres per second (m/s)
70	31.3
60	26.8
40	17.9
30	

(a) A moving car accelerates until it reaches the 30 mph speed limit.

(i) Use the data to complete the table of speed in m/s.

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..... **[1]**

(ii) Calculate the initial speed of the car in m/s if it accelerates at 2 m/s^2 for 6 seconds.

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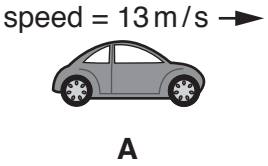
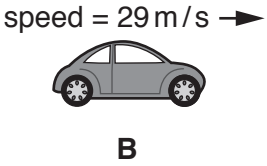
Answer ..... m/s **[1]**

(b) Look at the speeds of a car as it passes two points, **A** and **B**, on a road.



A



B

The car accelerates constantly from **A** to **B** covering a distance of 110 m.

Calculate the time taken to accelerate between **A** and **B**.

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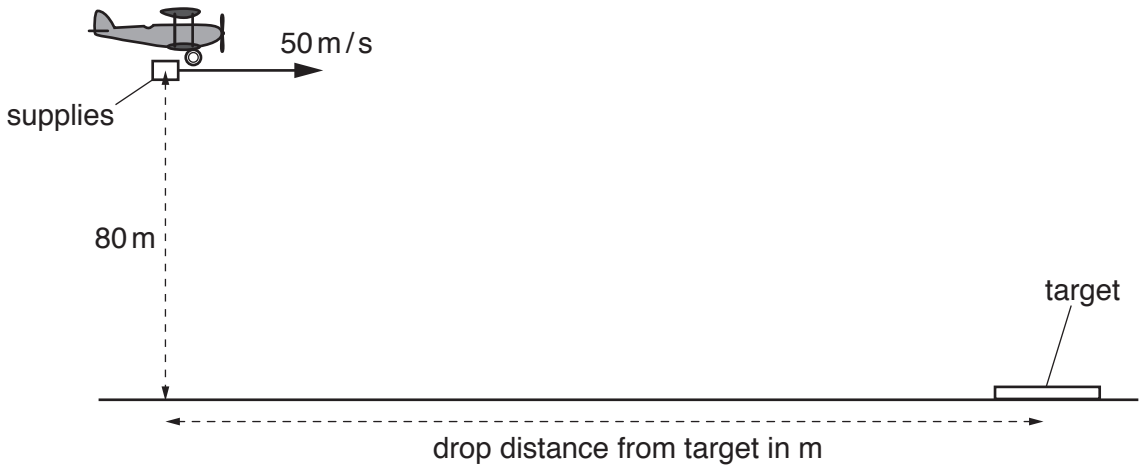
Answer ..... s **[2]**

14 Alice flies an aircraft at a fixed height of 80 m and at a steady speed of 50 m/s.

The acceleration due to gravity (g) = 10 m/s^2.

She needs to drop supplies on the target for people on the ground.

Look at the diagram. It is **not** to scale.



She needs to drop the supplies so they land on the target.

Use the data to calculate the drop distance from the target. Ignore air resistance.

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Answer ..... m **[4]**

END OF QUESTION PAPER

The Periodic Table of the Elements

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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.