THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

F

Thursday 13 June 2013 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A153/01 Modules B6 C6 P6 (Foundation Tier)

2440163107

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

MODIFIED LANGUAGE

A153/01

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 bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

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

Explaining motion

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

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

momentum = mass × velocity

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

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

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

Electric circuits

power = voltage × current

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

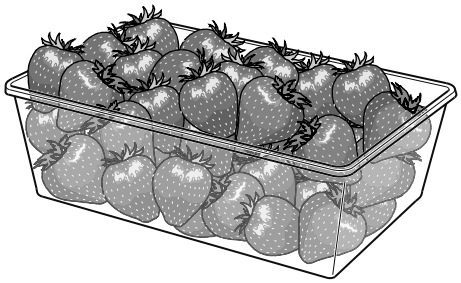
$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive materials

energy = mass × [speed of light in a vacuum]^2

Answer **all** the questions.

1 Some countries allow soft fruit to be sterilised by radiation. The fruit then has a much longer shelf-life in the shops.



Food is sterilised by radiation in a processing centre. The radiation does not harm the people who work there.

Describe how food is sterilised by radiation. Include safety aspects.

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

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

[Total: 6]

2 Technetium is often used as a radioactive tracer in hospitals.

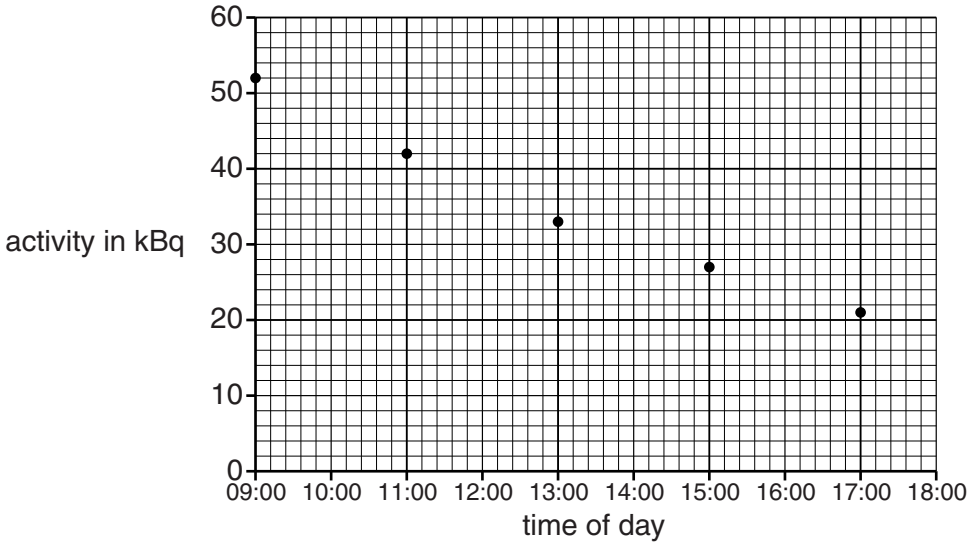
(a) Technetium comes from the radioactive decay of molybdenum.

It is important that the technetium is **not** contaminated with molybdenum.

Marie tests the purity of a sample of technetium.

She measures the activity of the sample at five different times.

Marie plots her results on a graph.



Marie uses this graph and the data in the table to make a conclusion.

Material	Half-life in hours
molybdenum	67
technetium	6

Marie concludes that the sample contains no molybdenum.

Is she correct? Justify your answer.

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

(b) Technetium is injected into patients to act as a tracer. This has both risks and benefits for the patients, workers and visitors at the hospital.

(i) Who at the hospital benefits **most** from the use of technetium?

Choose from the patients, the workers or the visitors.

Give a reason for your answer.

.....

.....

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

(ii) Who at the hospital is **least** at risk from the use of technetium?

Choose from the patients, the workers or the visitors.

Give a reason for your answer.

.....

.....

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

(iii) There are regulations about the use of technetium in hospitals.

Who decides the regulations?

Put a (ring) around the correct answer.

the doctors **the Government** **the manufacturers** **the patients**

[1]

[Total: 8]

3 Your level of background radiation depends on where you live.

Region of UK	Background radiation dose mSv per year
East Anglia	0.5
Cornwall	8
London	2

(a) Adele lived in London for 40 years.

(i) Calculate her total background radiation dose over 40 years.

total radiation dose = ... mSv **[1]**

(ii) Adele's risk of getting cancer from background radiation in those 40 years is 4 in 1000.

Adele thinks that her risk of getting cancer is proportional to her dose from the background radiation.

Suppose she lived in Cornwall instead of London.

What would her risk of getting cancer be using Adele's idea?

Put a (ring) around the correct answer.

1 in 1000 **4 in 1000** **8 in 1000** **16 in 1000**

[1]

(b) Why does exposure to background radiation increase her risk of getting cancer?

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

all radiation is reflected by her skin ☐

radiation breaks molecules into ions ☐

radiation only kills cells ☐

radiation passes straight through her ☐

[1]

(c) Bert is a radiographer at a hospital in Cumbria where the background radiation dose is 3 mSv per year.

The **total** allowed radiation dose for a radiographer is 20 mSv per year.

How much radiation dose, in mSv, is Bert allowed to receive from his work in a year?

Put a (ring) around the correct answer.

3 **17** **20** **23**

[1]

[Total: 4]

4 Uranium-235 is a nuclear fuel. It is used to make electricity in nuclear power stations.

Complete the sentences about an atom of uranium-235.

Choose words from this list.

electrons **neutrons** **protons**

At the centre of each atom is a nucleus which contains ..... and ..... .

The rest of the atom contains ..... . **[2]**

[Total: 2]

5 Jenny has a stroke.

Her stroke is caused by a blocked blood vessel in her brain.

Part of her brain is damaged.

She loses the ability to speak.

Jenny learns to speak again with practice.

(a) Put a tick (✓) in the box next to the correct word to complete each sentence.

The damaged part of her brain can be identified by an

IRM	
MIR	
MRI	

scan.

The damaged part of her brain is the

cortex.	
hypothalamus.	
pituitary.	

She can speak again because of the formation of new

spinal cord tissue.	
muscle fibres.	
neuron pathways.	

[2]

(b) As part of her treatment, Jenny has to memorise some words.

To help her remember the words, Jenny puts them into a pattern.

What else could Jenny do to help her remember the words?

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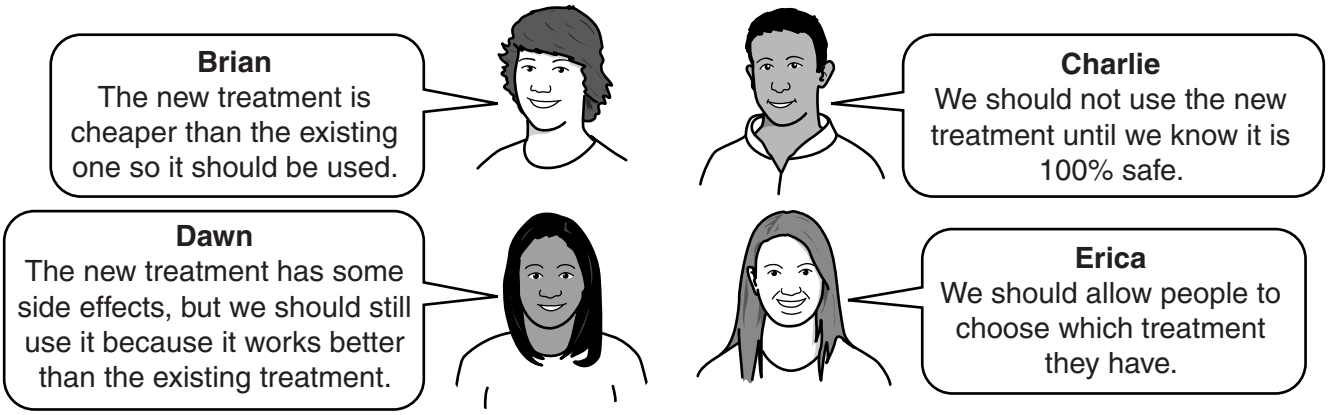
..... **[1]**

(c) Scientists develop a new treatment for people who have had a stroke.

They discuss whether the new treatment should replace the existing treatment.



(i) Which scientist argues that the right thing to do is the one which leads to the best outcome for most people involved?

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

(ii) Which scientist argues that it is right to do some things even if there are consequences?

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

[Total: 5]

6 Terry measures the speed of impulses travelling along different neurons.

These are Terry's results.

Diameter of neuron in μm	Length of neuron in cm	Speed of impulse in m/s
2	12	12
6	3	36
10	5	60
14	15	84
18	10	108

(a) Which are correct conclusions from the data?

Put ticks (✓) in the boxes next to the **two** correct conclusions.

As the diameter of the neuron increases, the speed of the impulse increases. ☐

As the diameter of the neuron increases, the speed of the impulse decreases. ☐

As the length of the neuron increases, the speed of the impulse increases. ☐

As the length of the neuron increases, the speed of the impulse decreases. ☐

There is a correlation between diameter and length. ☐

There is a correlation between diameter and speed. ☐

There is a correlation between length and speed. ☐

[2]

(b) All the neurons Terry tested had fatty sheaths.

He then tests a neuron which does **not** have a fatty sheath.

It is 10 μm in diameter and 5 cm long.

Predict the speed of impulse in this neuron.

Explain your answer.

.....

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

[Total: 4]

7 Kate is surprised by a camera flash.

She blinks her eyes.

This is an example of a simple reflex.

(a) Describe what happens in Kate's nervous system to make her blink.

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

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

(b) Kate tests her reactions using a reaction timer on her computer.

She presses a button as soon as she sees a dot appear on the screen.

She gets these results.

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Reaction time in ms	0.77	0.60	0.75	0.59	0.84

Kate concludes that her reaction time improves with practice.

Explain why Kate's conclusion is wrong.

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

[Total: 7]

8 Simple animals rely on reflex actions for most of their behaviour.

(a) Write down **one** way that reflex actions help a simple animal to survive.

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

(b) Other animals can be conditioned.

Pigs on a farm are always fed from a yellow bucket.

Eventually, the pigs salivate every time they see the yellow bucket, even if there is no food in it.

Explain why this is an example of conditioning.

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

[Total: 4]

9 Mark is doing a titration with hydrochloric acid and sodium hydroxide.

(a) Sodium hydroxide is an alkali.

Name **one** other alkali.

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

(b) Mark tries to write a word equation for the reaction.

He has several tries.

Put a tick (✓) in the box next to the correct equation.

acid + alkali + salt ⟶ water ☐

acid + alkali ⟶ salt + water ☐

acid ⟶ alkali + salt + water ☐

acid ⟶ alkali + salt ⟶ water ☐

[1]

(c) When nitric acid reacts with sodium hydroxide which salt is made?

Put a (ring) around the correct answer.

sodium chloride **sodium hydrate** **sodium nitrate** **sodium oxide**

[1]

(d) In his experiment Mark slowly adds acid to the alkali.
He measures the pH as it changes.

What can he use to measure the pH as it changes?

Suggest **two** different methods.

1 .....

2 .....

[2]

(e) Mark knows that one type of ion is made by all acids when the acids dissolve in water.

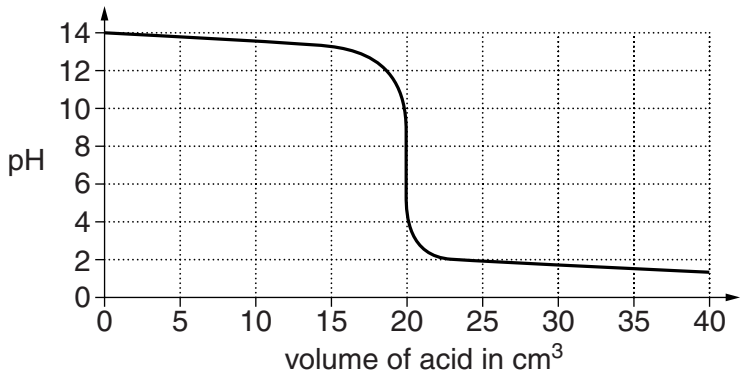
Put a (ring) around the formula of this ion.

H^+ **H^-** **OH^+** **OH^-**

[1]

(f) Mark adds acid to 25 cm^3 of alkali.

He draws a graph of the change in pH during his titration.



(i) Describe what happens to the pH during this titration.

Include numbers in your answer.

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

(ii) Look at the graph.

When all of the alkali has reacted the pH = 7.

What volume of acid is needed to react with the alkali? ..... **[1]**

(iii) What happens to the alkali as it reacts?

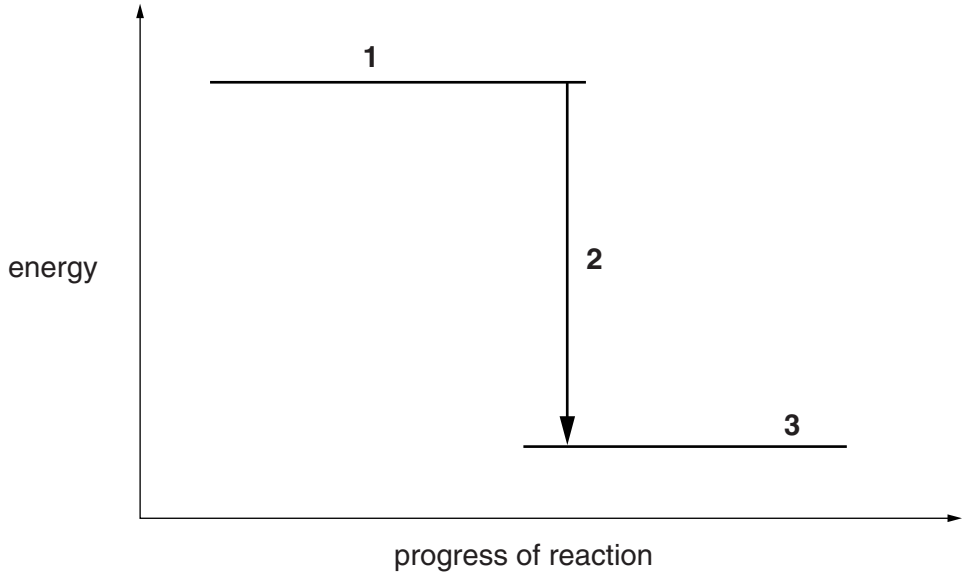
Put a tick (✓) in the box next to the correct answer.

The alkali is

neutralised.	
oxidised.	
recycled.	
removed.	

[1]

(g) Mark draws an energy level diagram for the reaction.



Mark labels the diagram.
What should he write at points **1**, **2** and **3** to show what this diagram tells you about the reaction?

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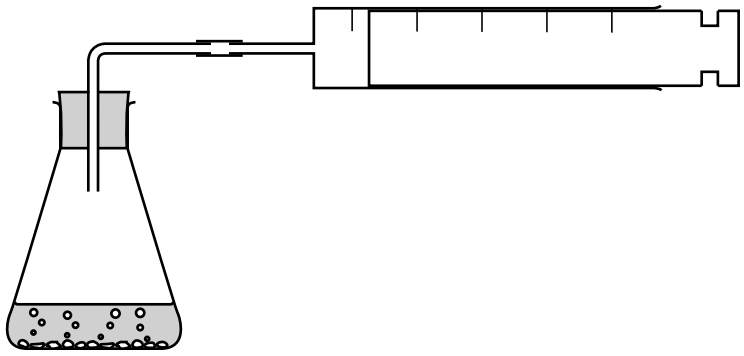
..... **[3]**

[Total: 14]

10 Sarah plans to investigate the rate of the reaction between marble chips and hydrochloric acid.



She plans two experiments to investigate the effect of changing the concentration of the acid. This is what she wrote.

> "In the first experiment I will use 10 g of marble chips in the flask.
> I will add 25 cm^3 of the acid.
> I will measure how fast the gas is given off.
>
> In the second experiment I will use another 10 g of marble chips.
> I will add 50 cm^3 of the same acid."

Evaluate this plan and suggest how the investigation could be improved.

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

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

[Total: 6]

END OF QUESTION PAPER

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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.