Surname	Centre Number	Candidate Number
Other Names		0

GCSE

3440U20-1

S19-3440U20-1

APPLIED SCIENCE (Single Award)

UNIT 2: Science to Support our Lifestyles

FOUNDATION TIER

TUESDAY, 14 MAY 2019 – AFTERNOON

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**7**	
3.	**4**	
4.	**8**	
5.	**8**	
6.	**10**	
7.	**6**	
8.	**7**	
9.	**19**	
Total	**75**	

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01

ADDITIONAL MATERIALS

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

Question **6***(a)*(ii) is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table is printed on page 24 of this examination paper.

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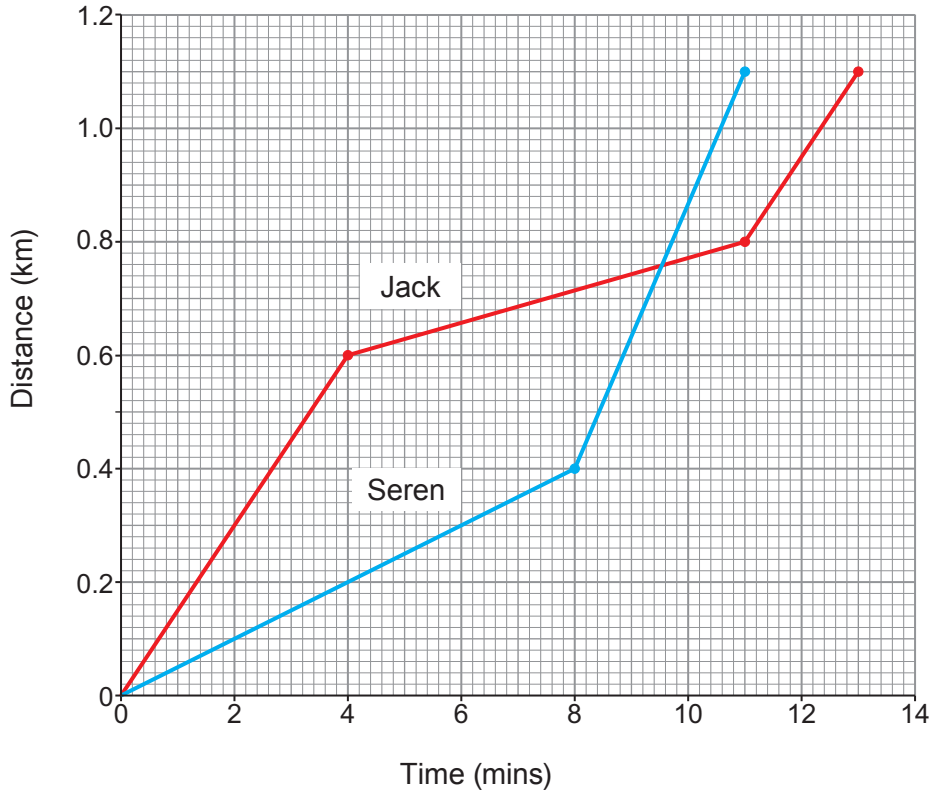
Answer **all** *questions.*

1. Jack and Seren walk from their home to their friend Andrew's house by two different routes.

The graph below shows their journeys to Andrew's house.



Use the graph to answer the following questions:

(a) State the distance from Jack and Seren's home to Andrew's house. [1]

Distance = ... km

(b) Describe how Seren's motion changed at 8 minutes. [1]

.....

(c) Seren arrived at Andrew's house first. Calculate the time she had to wait before Jack arrived. [1]

Time = ... minutes

Examiner only

(d) Underline the time period when Jack was moving more slowly than Seren. [1]

0 to 4 min 4 to 11 min 11 to 13 min

(e) Use the equation:

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

to calculate Seren's mean speed for the whole journey. [2]

Mean speed = ... km/minute

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6

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2. *(a)* Cardiff University has developed a drug to treat liver disease. Following successful initial testing it has moved to full clinical trial.

This clinical trial will be carried out as a double-blind trial on a large number of patients using the drug and a placebo.

Join each term to the correct purpose with a straight line. [3]

Term	Purpose
Double blind	More likely that side effects will be noticed
Large number of patients sampled	A dummy drug
Placebo	Used to work out the cost of the drug
	Patients and doctors do not know who gets the drug

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(b) The following table gives information about four other drugs, **W**, **X**, **Y** and **Z**.

Drug	Painkiller	Addictive	Prevents blood clots	Side effect	Anti-depressant
W	No	No	Yes	Poisonous if more than recommended dose taken	No
X	Weak	Yes	No	Can cause weight gain Can cause drowsiness	Yes
Y	Strong	No	Yes	Can lead to stomach bleeds	No
Z	Very strong	Yes	No	Can cause extreme drowsiness	No

(i) I. State **one** drug that should not be given to long-distance lorry drivers. [1]

.....

II. Give **one** reason for your answer. [1]

.....

.....

(ii) Jonathan has a pain in his leg caused by a blood clot.

I. State **one** drug that could be used to treat both symptoms. [1]

.....

II. Give **one** reason for your answer. [1]

.....

.....

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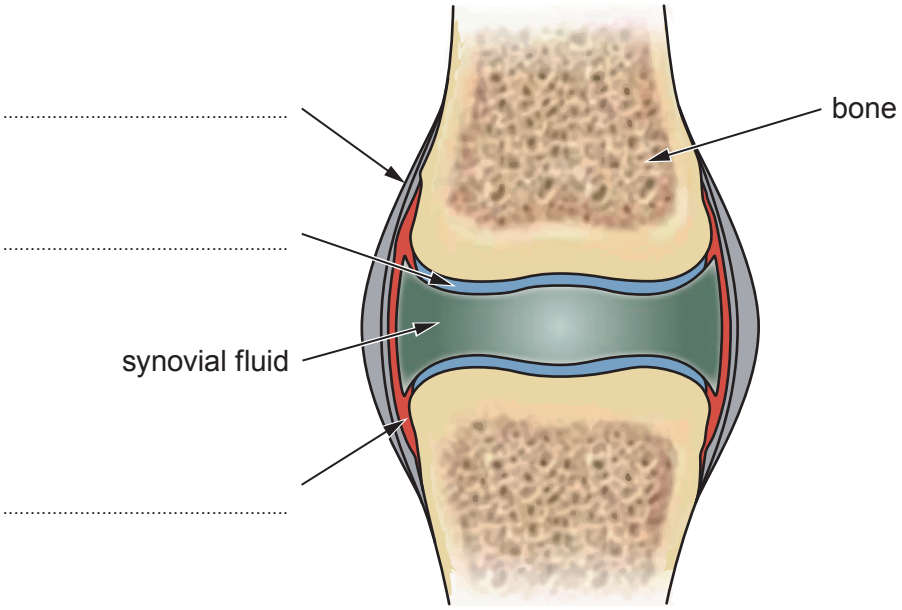
Turn over.

Examiner only

3. It is common for football and rugby players to suffer knee injuries.
The diagram below shows a knee joint.

(a) Label the diagram using only the words in the box. [3]

tendon	cartilage	muscle	synovial membrane	ligament



(b) State the role of synovial fluid in this joint. [1]

.....

4

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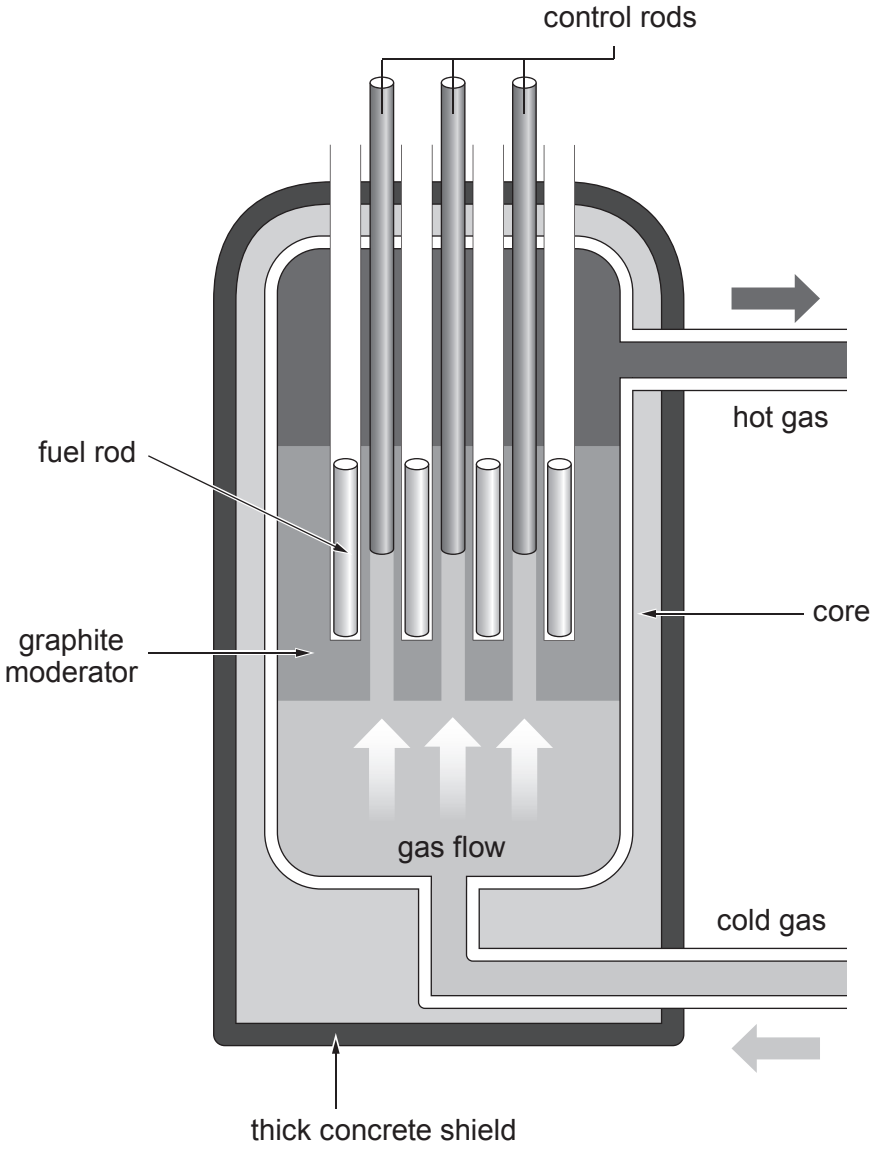
4. Nuclear fission reactors are designed with safety features to prevent nuclear accidents. However in Chernobyl in 1986, during testing, an accident caused a meltdown of the nuclear reactor.

The structure of a typical reactor is shown below.



(a) (i) Describe the role of the control rods in a nuclear fission reactor. [2]

.....

.....

(ii) State how the control rods can be used to stop nuclear reactions and prevent a reactor meltdown. [1]

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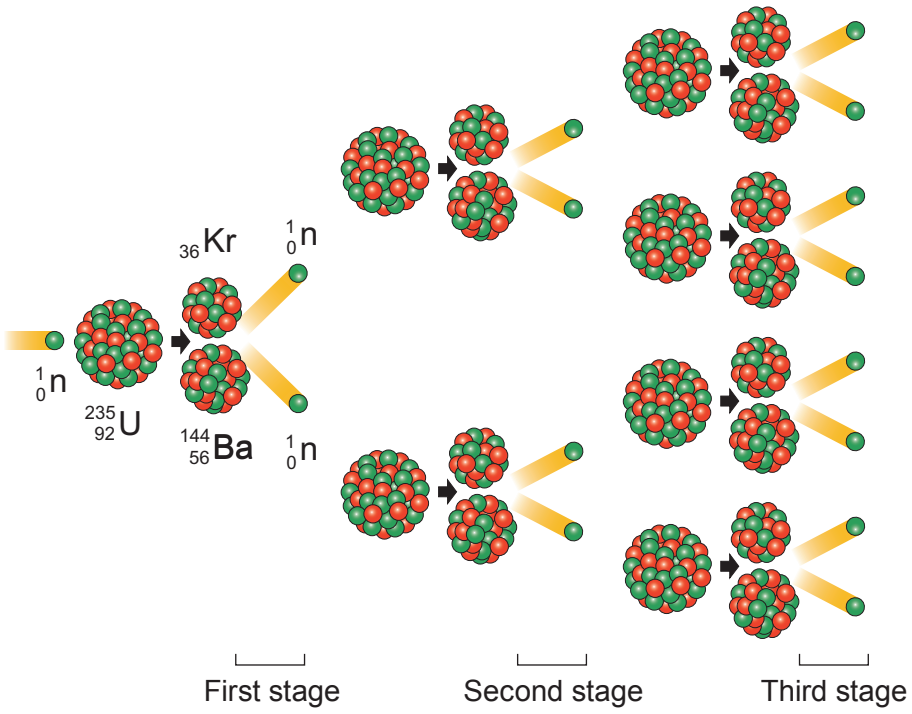
(b) The diagram below shows a series of fission reactions.



(i) Tick (✓) **three** statements that are true about this fission reaction. [3]

The diagram shows an uncontrolled chain reaction	
Fission means the joining together of two particles	
A neutron is absorbed by the U-235 nucleus	
After each stage the number of neutrons doubles	
After stage 4 there would be 12 neutrons	
Neutrons split during the reaction	

(ii) Complete the nuclear decay equation for the fission reaction shown in the diagram. [2]

$$^{1}_{0}n + {}^{235}_{92}U \rightarrow \text{.....}{}^{}_{36}Kr + {}^{144}_{56}Ba + \text{.....}{}^{1}_{0}n$$

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Turn over.

Examiner only

5. MRSA is resistant to antibiotics. Hospitals started to introduce control measures against MRSA in 2005.

(a) (i) State **two** reasons why the number of antibiotic-resistant bacteria such as MRSA is increasing. [2]

.....

.....

(ii) State **one** control measure used in hospitals to reduce MRSA infection. [1]

.....

(b) The table below shows the number of cases of MRSA identified in Welsh hospitals since 2005.

Year	Number of MRSA cases
2005	45
2006	30
2007	14
2008	13
2009	6
2010	4
2011	3
2012	1

(i) Plot a graph on the grid opposite to show the number of MRSA cases between 2005 and 2012 and draw a suitable line. [3]

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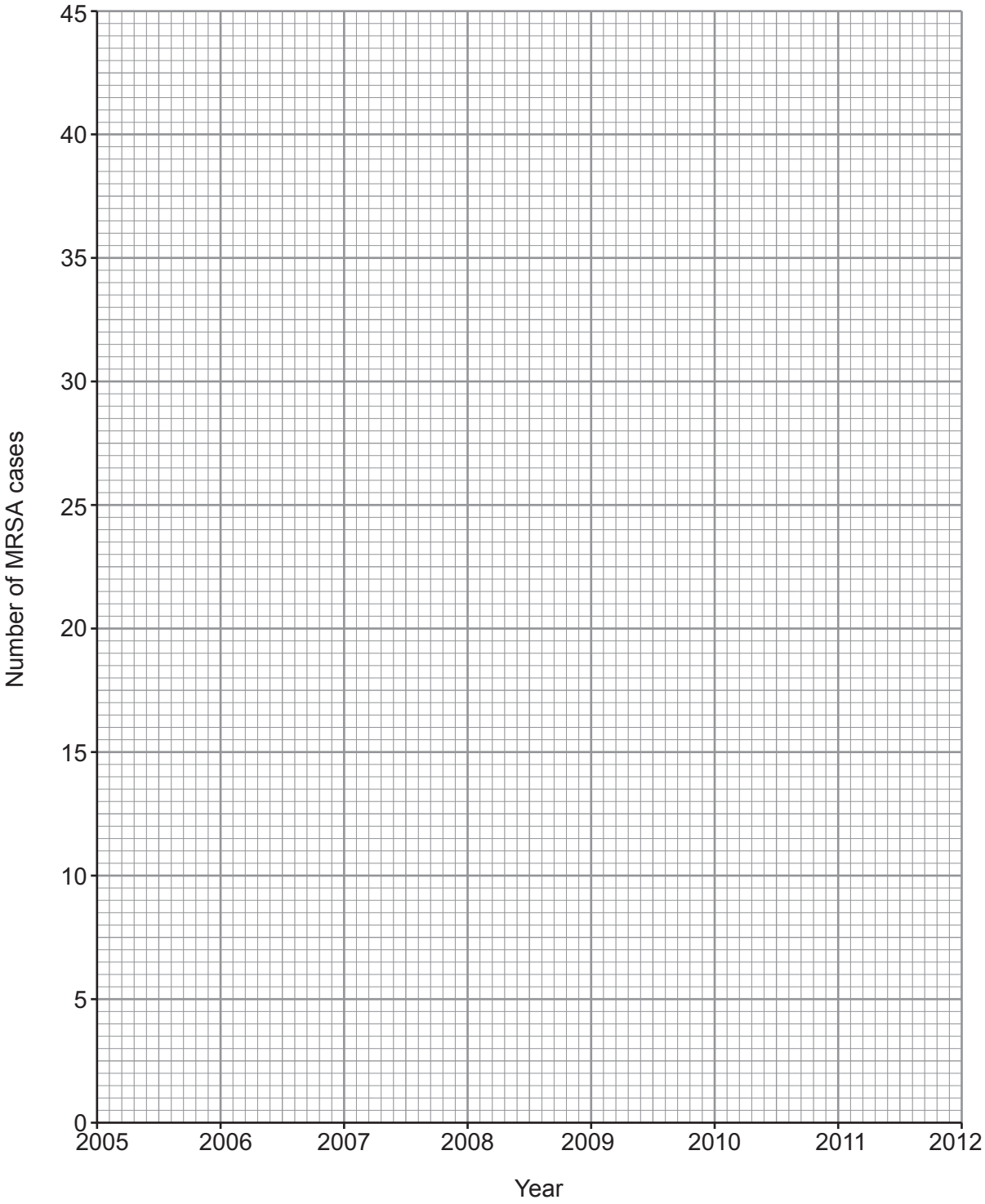

(ii) Explain what conclusions can be drawn from the data. [2]

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Examiner only

6. The Government advises the public on lifestyle choices.

- people should limit their weekly alcohol intake to no more than 14 units
- people should not smoke cigarettes

A survey was carried out to monitor how the smoking and drinking habits of a randomly selected group of 5000 adults in Wales changed over a 10 year period.

The table shows the results of the survey.

	1st year of survey		10th year of survey	
	Number	% of sample	Number	% of sample
cigarette smokers	1250	25	900	18
people who drank more alcohol than recommended	2000	40	2000	40

(a) (i) Suggest **two** reasons why the number of smokers changed over the 10 year period. [2]

.....

.....

(ii) Use the data and your knowledge to explain the short-term and the long-term effects of smoking on the health of the people surveyed. [6 QER]

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Examiner only

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(b) Typical drinks that contain one unit of alcohol are shown below.

Alex drinks 7 pints of beer and 6 small glasses of wine per week. Calculate the number of units that Alex drinks and state the advice you would give her in light of the Government guidelines. [2]

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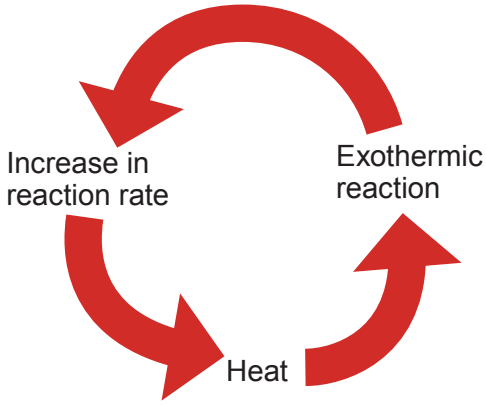
7. An electronics company recently recalled a range of mobile phones due to some of the batteries catching fire. This was caused by a thermal runaway reaction in the lithium-ion batteries.

The diagram below shows a thermal runaway reaction.



(a) (i) Describe what is meant by a *thermal runaway reaction*. [2]

.....

.....

(ii) State **one** way that thermal runaway can be prevented. [1]

.....

Examiner only

(b) The table below shows the temperature changes for four different reactions, **A**, **B**, **C** and **D**.

Reaction	Starting temperature (°C)	Final temperature (°C)
A	20	79
B	50	44
C	20	–10
D	–30	–12

(i) Reaction **A** could result in thermal runaway.

Use the information in the table to answer the following questions.

I. State which **other** reaction could result in thermal runaway. [1]

.....

II. State how you determined that this reaction was exothermic. [1]

.....

(ii) Complete the following sentence by underlining the correct term in the brackets. [1]

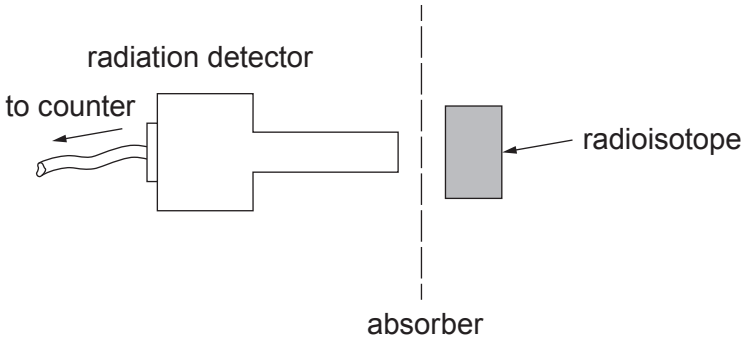
Reaction **A** is exothermic because the energy required to break bonds is

(***more than / less than / the same as***) the energy released in forming bonds.

6

Examiner only

8. The radiation emitted by radioisotopes can be investigated using the apparatus in the diagram below. A radioisotope was placed 1 cm from a radiation detector. Different absorbers were placed, one at a time, between the radioisotopes and the detector and the count rate measured.



The following table shows how the count rate for four different radioisotopes is affected by different absorbers.

Radioisotope	Count rate for different absorbers (counts per second)			
	air	paper	aluminum	lead
sulfur-35	200	199	58	25
radium-223	200	5	5	5
cobalt-57	250	141	140	20
strontium-90	220	221	5	5

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Use the information in the table opposite to answer the questions below.

(a) Estimate the value of the background radiation. [1]

..... counts per second

(b) (i) Explain what conclusions can be drawn about the types of radiation emitted by cobalt-57. [3]

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.....

.....

.....

(ii) It is suggested that radium-223 does not need to be stored in a metal box. Explain whether you agree with this suggestion. [3]

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7

Examiner only

9. Food manufacturers are required to measure the amount of energy contained in their food products.

(a) A cereal bar has the following information on its label.

	Per 100 g	Per cereal bar	RDA
Energy (kJ)	1 966	787	8 400

(i) Calculate the percentage of the recommended daily allowance (RDA) provided by **one** cereal bar. Give your answer to 2 significant figures. [2]

Percentage = ... %

(ii) Calculate the mass in grams of **one** cereal bar. [2]

Mass = ... g

(iii) Give a reason for not using the value for energy **per cereal bar** when comparing different brands. [1]

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(iv) Explain why the Government is concerned about constantly exceeding the RDA for energy. [3]

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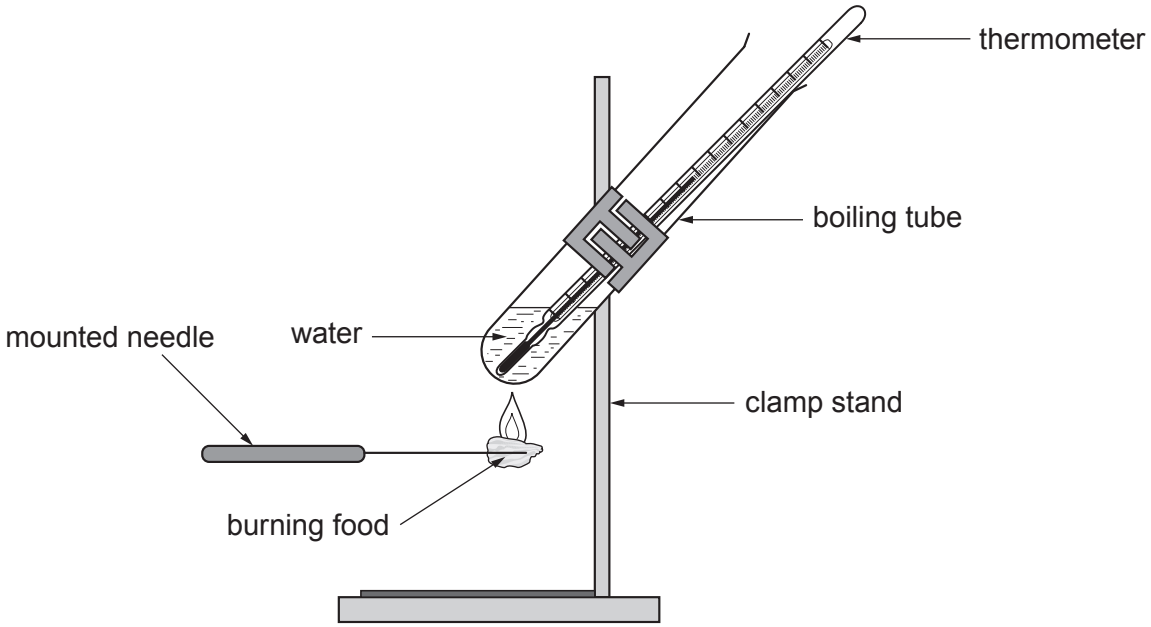
Examiner only

(b) A student used the following equipment to find the energy content of some foods.



(i) State the independent variable in this experiment. [1]

.....

(ii) State the dependent variable in this experiment. [1]

.....

(iii) State **one** variable that should be controlled in this experiment. [1]

.....

Examiner only

(c) The student obtained the following results.

Type of food	Mass of water (g)	Mass of food burned (g)	Temperature at start (°C)	Temperature at end (°C)	Temperature increase (°C)	Energy released (J)	Energy released per gram (J/g)
cheese biscuit	20	3.0	20	56	36	2268	756
corn snack	20	0.5	21	36	15	.....	1848
digestive biscuit	20	4.0	20	93	73	1636	409
cereal bar	20	4.0	22	48			

(i) How would the student make sure the results are reproducible? [1]

.....

(ii) Calculate the energy released by the **corn snack**. Write this value in the table. [1]

Space for working

(iii) Use the information in the table and the equation:

$$\text{Energy released per gram (J/g)} = \frac{\text{mass of water (g)} \times \text{temperature increase (°C)} \times 4.2}{\text{mass of food sample (g)}}$$

to calculate the energy released per gram for the **cereal bar**. [3]

Energy released per gram = ... J/g

Examiner only

(iv) The student suggests that a 30 g packet of corn snacks contains half the energy of four digestive biscuits of total mass 60 g.

Explain whether the student is correct. [3]

Space for working

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END OF PAPER

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THE PERIODIC TABLE

1	2	Group										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
86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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	179 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key