OCR
RECOGNISING ACHIEVEMENT

H

A215/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A
UNIT 1 – Modules B4 C4 P4 (Higher Tier)
SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Time: 40 minutes

Candidates answer on the question paper
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATE

- The number of marks for each question 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 page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**5**	
2	**5**	
3	**1**	
4	**1**	
5	**2**	
6	**4**	
7	**5**	
8	**5**	
9	**4**	
10	**7**	
11	**3**	
TOTAL	**42**	

This document consists of **17** printed pages and **3** blank pages.

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 x time for which it acts

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

change in energy = work done

change in GPE = weight x vertical height difference

kinetic energy = ½ × mass x [velocity]2

Electric Circuits

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

$$\frac{\text{Voltage across primary coil}}{\text{Voltage across secondary coil}} = \frac{\text{Number of turns in primary coil}}{\text{Number of turns in secondary coil}}$$

energy transferred = power x time

power = potential difference x current

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

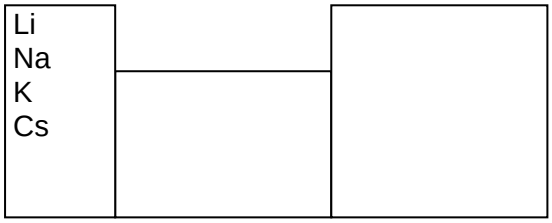
The Wave Model of Radiation

wave speed = frequency × wavelength

Answer **all** the questions.

1 Jenny studies four elements Li, Na, K and Cs.

She finds this information in a book.



PERIODIC TABLE

	boiling point in °C
Li	1342
Na	883
K	760

(a) The book does not list data for the element Cs.

Suggest a value for the boiling point of Cs.

Give reasons for your answer. boiling point = ...°C

.....

.....

.....

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

(b) Jenny carefully adds some potassium to cold water.

Describe what she sees.

Include a word equation for the reaction.

.....

.....

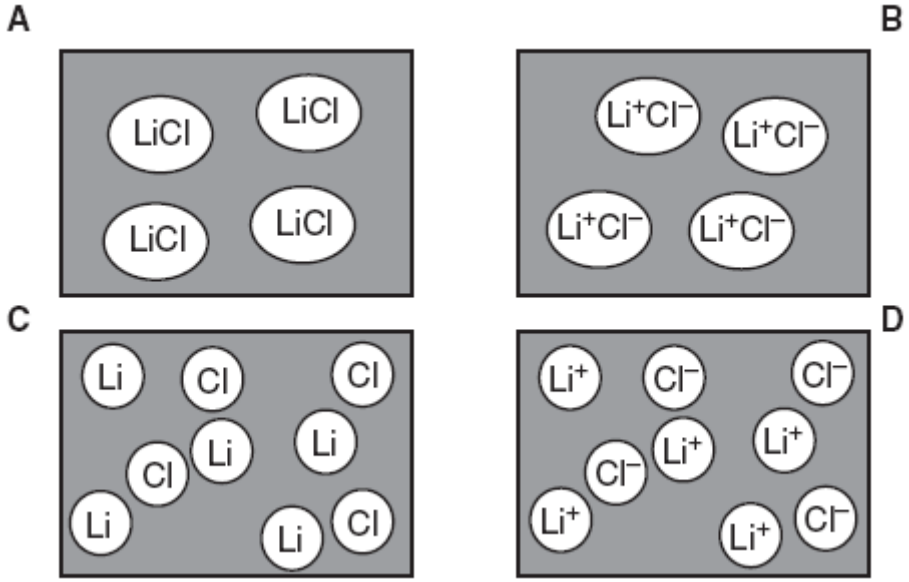
.....

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

[Total: 5]

2 Lithium chloride is an ionic compound. It dissolves in water.

(a) Which diagram, **A, B, C** or **D**, shows the particles in a lithium chloride solution?



[1]

(b) How can we be certain that lithium chloride is ionic?

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

Solid lithium conducts electricity. ☐

Solid lithium chloride conducts electricity. ☐

Molten lithium chloride conducts electricity. ☐

Lithium chloride has a high melting point. ☐

[1]

(c) Lithium reacts with bromine.

Balance the equation for this reaction.

☐ Li + Br_2 → ☐ LiBr

[2]

(d) Solid iron also reacts with bromine vapour. It makes crystals of iron bromide.

Add **state symbols** to the equation below.

$3Br_2(.....) + 2Fe(.....) \rightarrow 2FeBr_3(.....)$

[1]

[Total: 5]

3 When Bobby throws copper compounds into a flame, the flame gives a green light.

When Bobby throws calcium compounds into a flame, the flame gives a red light.

He uses a spectrometer to compare the spectrum of calcium with that of copper.

A spectrum is made of a series of lines.

Put a tick (✓) in the box next to the correct statement about a **calcium** spectrum.

The lines are in the same place as the copper lines. All the lines are red.	☐
The lines are in different places from the copper lines. Each line is a different colour.	☐
The lines are in the same place as the copper lines. Each line is a different colour.	☐
The lines are in different places from the copper lines. All the lines are green.	☐

[1]

[Total: 1]

4 The formula of sodium phosphate is Na_3PO_4. The sodium ion is Na^+.

Put a ring around the correct formula of the **phosphate** ion.

PO_4^{3+} PO_4^{4+} PO_4^{3-} PO_4^{4-}

[1]

[Total: 1]

5 The table shows the numbers of protons, neutrons and electrons in different particles **A, B, C, D** and **E.**

	A	B	C	D	E
number of protons	11	11	11	9	9
number of neutrons	11	12	11	10	10
number of electrons	11	11	10	9	10

Which particle has the greatest mass?.....

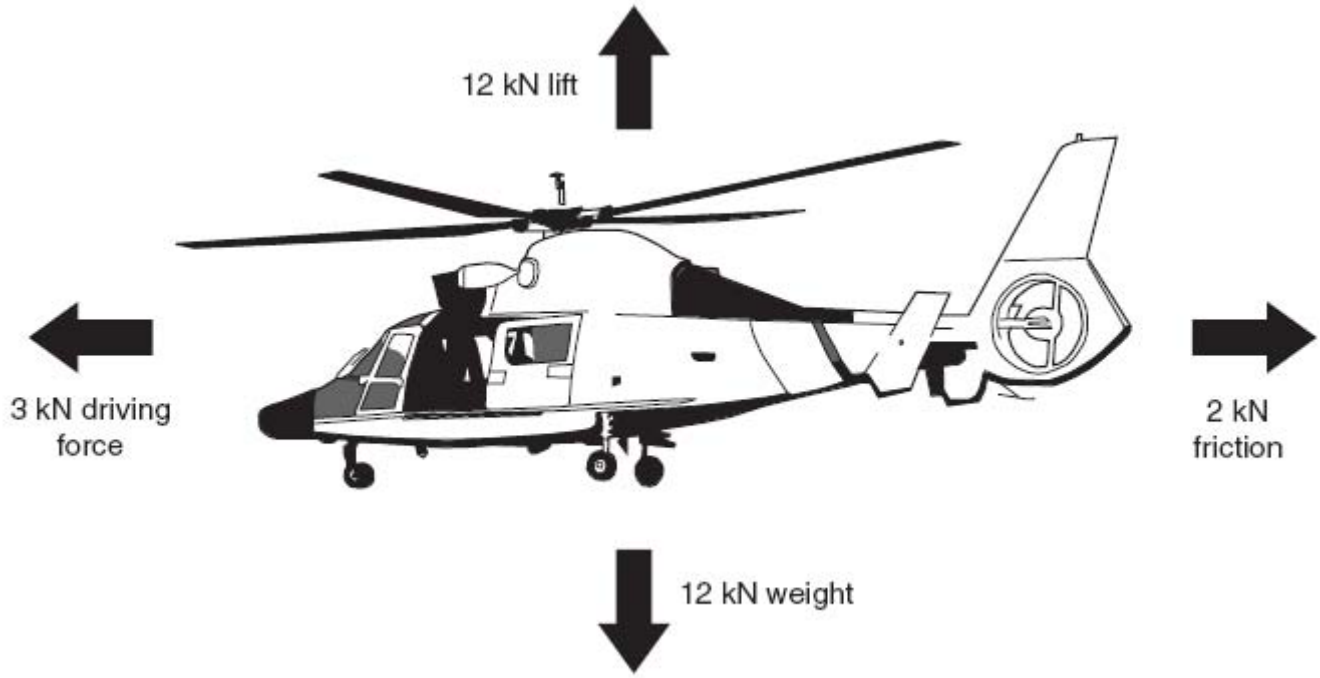
Which particle has a negative charge?.....

Which particles are atoms?.....

[2]

[Total: 2]

6 The diagram shows the forces acting on a helicopter in level flight.



(a) What is the **direction** of the resultant force on the helicopter?

Put a ring around the correct answer.

backwards **downwards** **forwards** **upwards** **[1]**

(b) What is the **size** of the resultant force on the helicopter?

Put a ring around the correct answer.

1 kN **2 kN** **3 kN** **5 kN** **12 kN** **[1]**

(c) Which quantities will be **increasing** for the helicopter?

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

height	☐
weight	☐
momentum	☐
kinetic energy	☐
gravitational potential energy	☐

[2]

[Total: 4]

7 Paul is a taxi driver in town.

He claims that his **speed** is always less than 50 km / h, and he can use **friction** to reduce his **velocity** to zero.

(a) Draw a straight line from each **quantity** to its correct **definition**.

quantity	definition
speed	the force needed to stop an object moving
friction	the distance moved by an object in each second
velocity	how fast and in what direction an object is moving
	a counter force arising from the motion of an object

[1]

(b) What is the correct way of converting 50 kilometres per hour into metres per second?

Put a ring around the correct answer.

$\frac{50\,000}{60}$ $\frac{50\,000}{3600}$ **50 000 x 3600** **50 000 x 60**

[1]

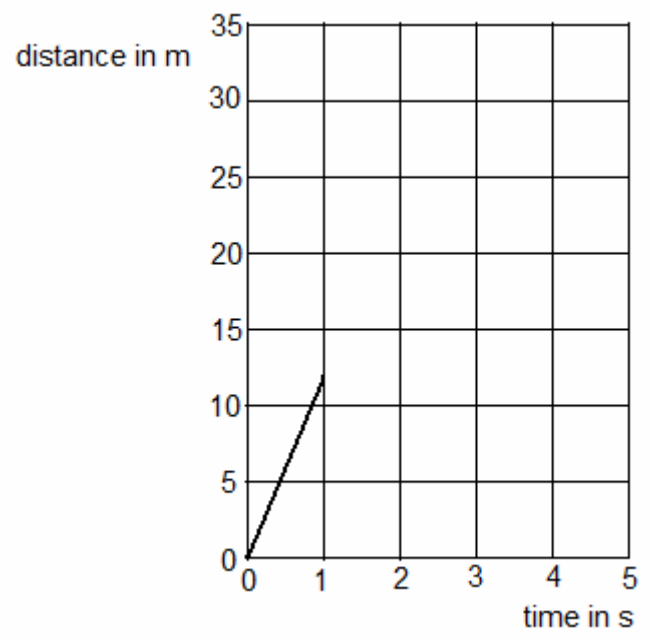
(c) Paul is travelling at 12 m / s when he slams on the brakes.

The speed of the car drops steadily to zero in just 3.0 s.

The car moves forwards by 18 m in that time.

Complete the distance-time graph for the car as it slows down.

The brakes are applied at 1.0 s.



[2]

(d) Why should Paul wear a seatbelt?

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

A seatbelt increases the counter force on him in a crash. ☐

A seatbelt transfers less energy to him as the car slows down. ☐

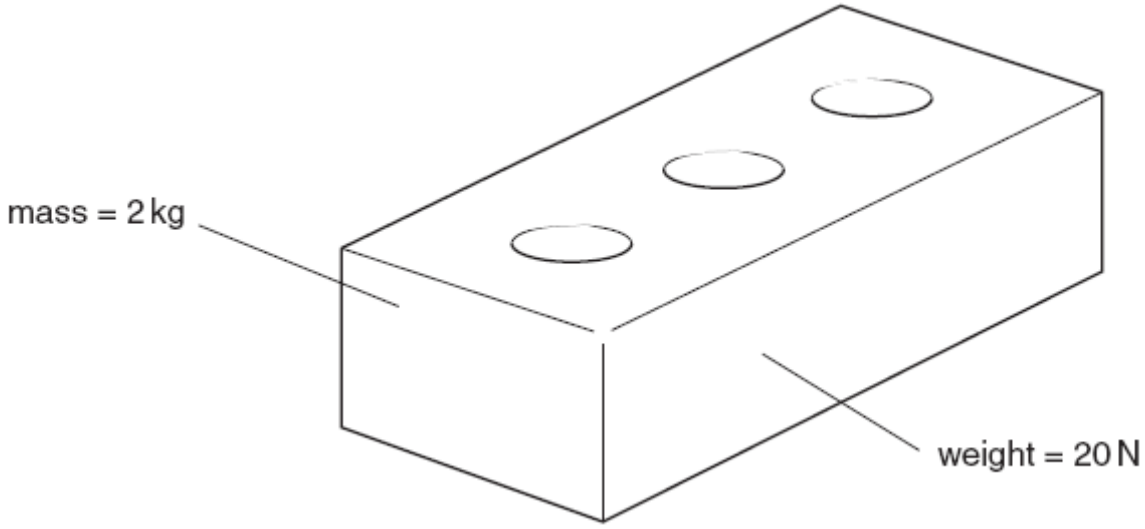
A seatbelt increases the time it takes for him to slow down in a crash. ☐

A seatbelt reduces the amount of momentum he needs to lose in a crash. ☐

[1]

[Total: 5]

8 Julie drops a brick into a deep well.



The brick falls through the air until it hits the water.

(a) Describe and explain the change of kinetic energy as the brick falls through the air.

.....

.....

.....

.....

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

(b) The brick is moving at 30 m / s when it hits the water.

The mass of the brick is 2 kg.

The weight of the brick is 20 N.

How much kinetic energy does it have?

Put a ring around the correct answer.

30 J

60 J

600 J

900 J

9000 J

[1]

(c) Julie knows that the brick's gravitational potential energy changes by 1000 J as it falls down the well into the water. She uses this to calculate the velocity of the brick when it hits the water.

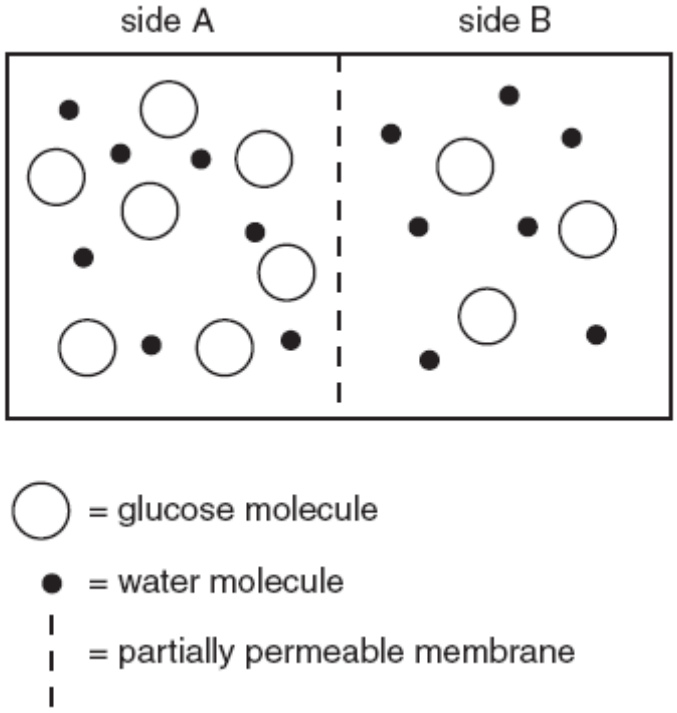
Put a ring around the correct calculation.

$\sqrt{\frac{1000}{\frac{1}{2} \times 2}}$ $\sqrt{\frac{1000}{10}}$ $\frac{1000}{10}$ $\frac{1000}{2}$

[1]

[Total: 5]

9 Andrew draws a model to show osmosis.



(a) What does side **B** in the model represent?

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

a concentrated solution ☐

a dilute solution ☐

pure water ☐

[1]

(b) Why did Andrew include a partially permeable membrane in his model?

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

To stop glucose molecules and water molecules from passing through. ☐

To stop glucose molecules from passing through. ☐

To stop water molecules from passing through. ☐

[1]

(c) What happens to the water molecules?

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

Water molecules move mostly from side **A** to side **B**. ☐

Water molecules move mostly from side **B** to side **A**. ☐

Water molecules move equally between side **A** and side **B**. ☐

Water molecules do not move between side **A** and side **B**. ☐

[1]

(d) What will happen when Andrew adds four more glucose molecules to **side B** in his model?

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

Water molecules move mostly from side **A** to side **B**. ☐

Water molecules move mostly from side **B** to side **A**. ☐

Water molecules move equally between side **A** and side **B**. ☐

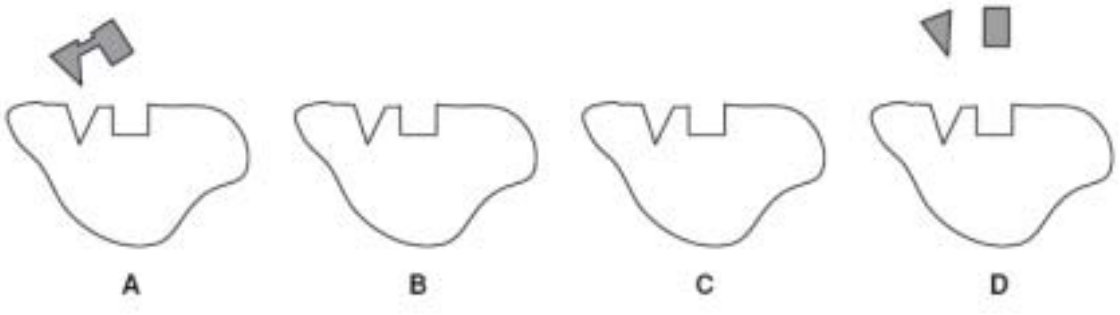
Water molecules do not move between side **A** and side **B**. ☐

[1]

[Total: 4]

10 Liz draws a model to show the different stages which take place when an enzyme speeds up the breakdown of a molecule.

(a) Complete diagrams B and C to show the stages in the breakdown of a molecule.



[2]

(b) What is the name of this model?

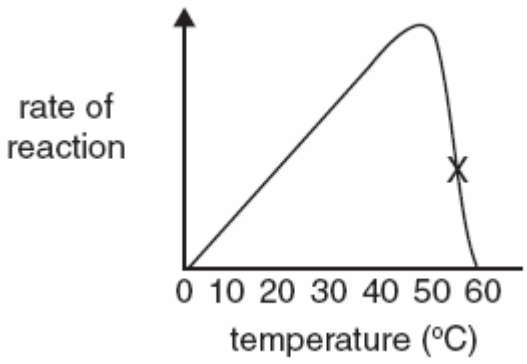
Put a ring around the correct answer.

kinetic theory model	**lock and key model**	**random collision model**	**nut and bolt model**

[1]

(c) Liz then carries out an experiment and draws a graph of her results.

The graph shows the rate of reaction of an enzyme at different temperatures.



Use the model of enzyme action to explain the shape of the graph.

.....

.....

.....

.....

.....

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

(d) Which variable can alter the shape of the active site of the enzyme?

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

concentration of enzyme	☐
concentration of substrate	☐
pH of mixture	☐
speed of collisions	☐

[1]

[Total: 7]

11 This question is about the hormone ADH.

(a) Which part of the body releases ADH?

Put a (ring) around the correct answer.

adrenal gland **kidney** **pituitary gland** **testes** **[1]**

(b) Describe the function of ADH and how it is transported around the body.

.....

.....

.....

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

[Total: 3]

END OF QUESTION PAPER

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE

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** berylliu m 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitroge n 7	16 **O** oxygen 8	19 **F** fluorin e 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magne sium 12											27 **Al** alumini um 13	28 **Si** silicon 14	31 **P** phosp horus 15	32 **S** sulfur 16	35.5 **Cl** chlorin e 17	40 **Ar** argon 18
39 **K** potassi um 19	40 **Ca** calciu m 20	45 **Sc** scandi um 21	48 **Ti** titaniu m 22	51 **V** vanadi um 23	52 **Cr** chromi um 24	55 **Mn** manga nese 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** germa nium3 2	75 **As** arsenic 33	79 **Se** seleniu m 34	80 **Br** bromin e 35	84 **Kr** krypto n 36
85 **Rb** rubidiu m 37	88 **Sr** stronti um 38	89 **Y** yttrium 39	91 **Zr** zirconi um 40	93 **Nb** niobiu m 41	96 **Mo** molybd enum 42	[98] **Tc** techne tium 43	101 **Ru** rutheni um 44	103 **Rh** rhodiu m 45	106 **Pd** palladi um 46	108 **Ag** silver 47	112 **Cd** cadmiu m 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimo ny 51	128 **Te** telluriu m 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesiu m 55	137 **Ba** barium 56	139 **La*** lantha num 57	178 **Hf** hafniu m 72	181 **Ta** tantalu m 73	184 **W** tungst en 74	186 **Re** rheniu m 75	190 **Os** osmiu m 76	192 **Ir** iridium 77	195 **Pt** platinu m 78	197 **Au** gold 79	201 **Hg** mercur y 80	204 **Tl** thalliu m 81	207 **Pb** lead 82	209 **Bi** bismut h 83	[209] **Po** poloniu m 84	[210] **At** astatin e 85	[222] **Rn** radon 86
[223] **Fr** franciu m 87	[226] **Ra** radium 88	[227] **Ac*** actiniu m 89	[261] **Rf** rutherf ordium 104	[262] **Db** dubniu m 105	[266] **Sg** seabor gium 106	[264] **Bh** bohriu m 107	[277] **Hs** hassiu m 108	[268] **Mt** meitne rium 109	[271] **Ds** darmst adtium 110	[272] **Rg** roentg enium 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

RECOGNISING ACHIEVEMENT

CONFIDENTIAL

GCSE Unit

MARK SCHEME

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Additional Science A (J631)
Modules B4, C4 and P4
Higher Tier

A215/02

Maximum Mark: 42

Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant - applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   <u>words</u> = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ORA = or reverse argument

   E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.
7. The list principle:
   If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

8. Marking method for tick boxes:

   Always check the additional guidance.

   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

   E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected Answers	Marks	Rationale
1	a		• answer between 740 and 640 • Cs below K (in the table) • boiling point decreases as you go down the table	3	
	b		any two of the following for [1] • fizzes • purple flame • melts • moves around on surface potassium + water = potassium hydroxide + hydrogen [1]	2	
			Total	**5**	

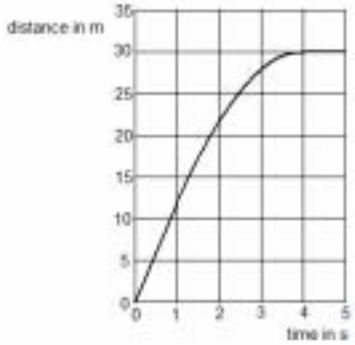
Question			Expected Answers	Marks	Rationale
2	a		D (1)	1	
	b		molten lithium chloride conducts ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ...
	c		2 2 (2)	2	each correct box for [1]
	d		g, s, s (1)	1	must **all** appear to be lower case, so G, s, s for [0]
			Total	**5**	

Question			Expected Answers	Marks	Rationale
3			different places, different colours ☐ ✓ ☐ ☐ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ...
			Total	**1**	

Question			Expected Answers	Marks	Rationale
4			PO_4^{3-} (1)	1	any clear indication of correct response for [1] e.g. underlining ...
			Total	**1**	

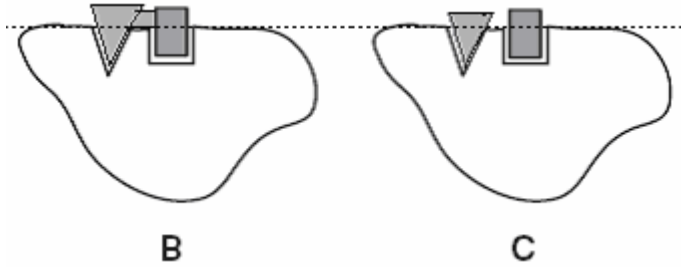
Question			Expected Answers	Marks	Rationale
5			B E B, A, D (any order)	2	3 correct = 2 marks 2 or 1 correct = 1 mark
			Total	**2**	

Question			Expected Answers	Marks	Rationale
6	a		forwards (1)	1	
	b		1 kN (1)	1	no error carried forward from 6 (a).
	c		momentum ☐ ✓ (1) kinetic energy ☐ ✓ (1) ☐	2	correct pattern of responses for [2] one mistake for [1] e.g. a third tick, second tick in the wrong place, missing tick ...
			Total	**4**	

Question			Expected Answers	Marks	Rationale
7	a		speed → friction → distance moved by an object in each second velocity → how fast and what direction counter force arising	1	correct pattern of three lines for [1] any additional lines for [0]
	b		50 000 (1) 3600	1	any clear indication of correct response for [1] e.g. underlining ...
	c		curved as shown from 1 s to 4 s for [1] horizontal at 30 m from 4 s to 5 s [1] 	2	
	d		air resistance dissipates energy ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ...
			Total	**5**	

Question			Expected Answers	Marks	Rationale
8	a		For answers where there is no clear hierarchical response. [3 marks] The candidate shows a good understanding of the whole argument, and covers all the necessary components. The answer is expressed clearly and logically. [2 marks] The candidate shows a partial understanding of the argument and covers two of the necessary components. The answer is expressed clearly and logically. [1 mark] The candidate shows a limited understanding of the argument and covers only one of the necessary components. The answer may not be expressed in a logical sequence.	3	Necessary components – speed of brick increases; kinetic energy increases; EITHER because work done by weight of brick as it falls; OR because gravitational potential energy decreases as brick falls;
	b		900 J (1)	1	
	c		$\sqrt{\frac{1000}{\frac{1}{2}\times 2}}$	1	any clear indication of correct response for [1] e.g. underlining ...
			Total	**5**	

Question			Expected Answers	Marks	Rationale
9	a		a dilute solution ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ... SECOND BOX
	b		stop glucose molecules passing ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ... SECOND BOX
	c		move mostly from side B to side A ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ... SECOND BOX
	d		equally between side A and side B ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ... THIRD BOX
			Total	**4**	

Question			Expected Answers	Marks	Rationale
10	**a**			2	B: some part of the molecule below the dotted line and the bond is intact for [1] C: some part of the molecule below the dotted line and the bond is broken for [1]
	b		lock and key model (1)	1	
	c		For answers where there is no clear hierarchical response. [3 marks] The candidate shows a good understanding of the effect of temperature on enzymes, and covers all the necessary components. The answer is expressed clearly and logically. [2 marks] The candidate shows a partial understanding of the argument and covers two of the necessary components. The answer is expressed clearly and logically. [1 mark] The candidate shows a limited understanding of the argument and covers only one of the necessary components. The answer is expressed clearly.	3	Necessary components – (Below 50°) increasing temperature increases frequency of collisions (increasing rate); shape of active site changes at high temperature (decreasing rate);] enzyme stops working / denatured; Accept increased energy of collisions in place of increased frequency.
	d		pH of mixture ✓ (1)	1	any clear indication of correct response for [1] e.g. cross in box, circling correct statement ...
			Total	**7**	

Question			Expected Answers	Marks	Rationale
11	**a**		pituitary gland (1)	1	any clear indication of correct response for [1] e.g. underlining ...
	b		controls the concentration of urine [1] transported by blood [1]	2	
			Total	**3**	

			Section total	**42**	