



General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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Single Award Science

Unit 4

Booklet B

Higher Tier

MV18

[GSA44]

TUESDAY 28 MAY 2019, AFTERNOON

Time

1 hour 15 minutes, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write on blank pages.

Complete in black ink only.

Answer **all** questions.

Information for Candidates

The total mark for this paper is 70.

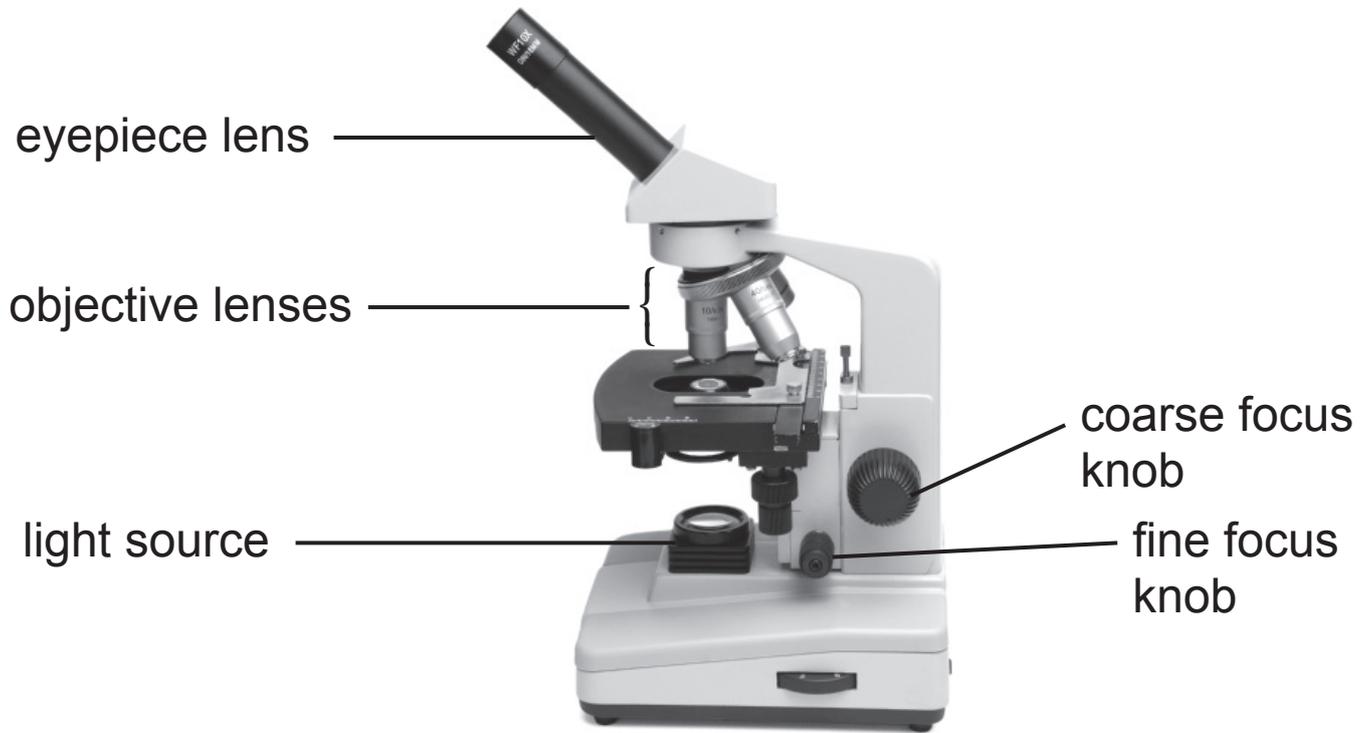
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **3(a)(i)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

Section A – Biology

- 1 (a) The diagram below shows a microscope that can be used to look at onion cells.



- (i) The eyepiece lens has the label '×10'. What does ×10 mean? [1 mark]
-

(ii) When viewing the onion cells for the first time it is useful to see as many cells as possible. Which objective lens will allow you to see the most cells?
[1 mark]

Choose from:

×4

×10

×40

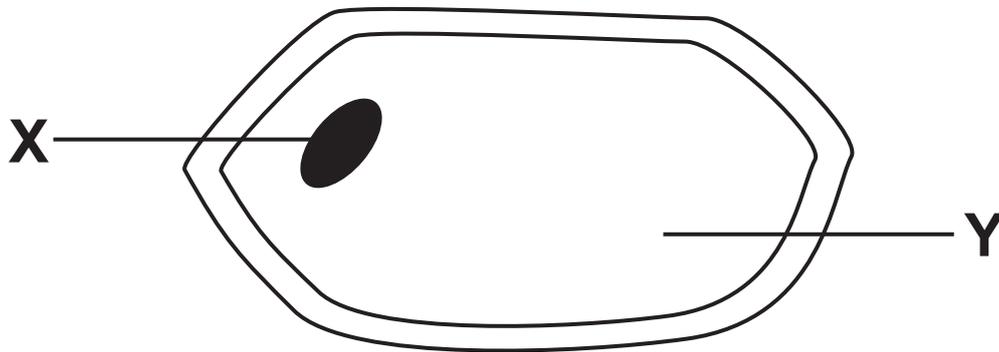
(b) When making a slide of onion cells a thin layer of onion skin should be used.

(i) Suggest **two** reasons why it is important that the layer is thin. [2 marks]

1. _____

2. _____

The diagram below shows the sketch of one onion cell as viewed under a microscope.



(ii) Name the parts labelled **X** and **Y**. [2 marks]

Choose from:

cytoplasm

chloroplast

nucleus

cell wall

cell membrane

vacuole

X _____

Y _____

2 (a) Paul tested a sample of food and found it contained both protein and sugar.

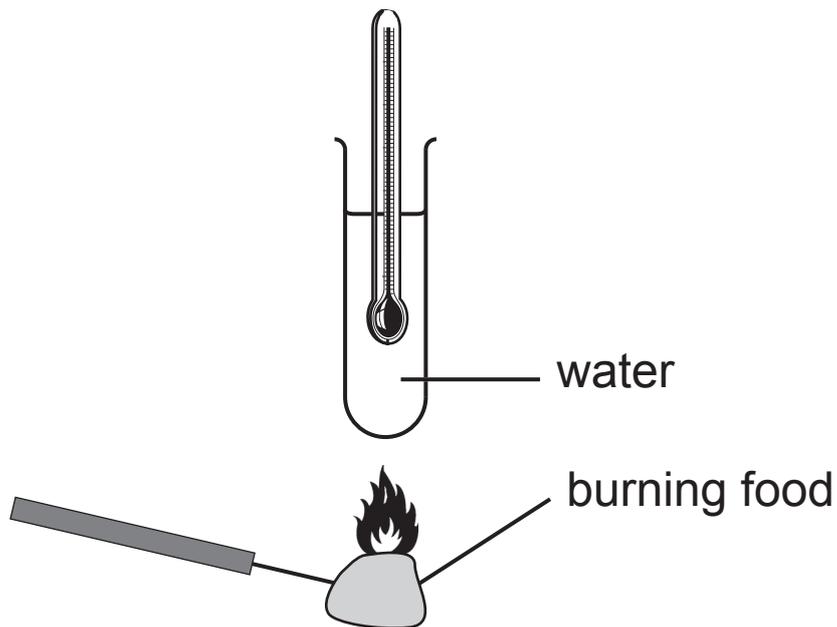
(i) Complete the table below. [2 marks]

Food type	Reagent	Initial colour	Final colour
protein		blue	
sugar	Benedict's	blue	brick red

(ii) Paul then tested a different sample of food for sugar. How could he tell that it did **not** contain sugar?
[1 mark]

(iii) After Paul adds Benedict's reagent to the sample of food, what must be done to complete the test?
[1 mark]

- (b) Jane investigated the energy content of a food sample using the apparatus shown below.



The temperature of the water at the start was 13°C and the final temperature was 21°C .

- (i) Calculate the temperature rise produced by this sample of food. [2 marks]

(Show your working out.)

_____ $^{\circ}\text{C}$

Another student repeated the investigation with a different sample of food.

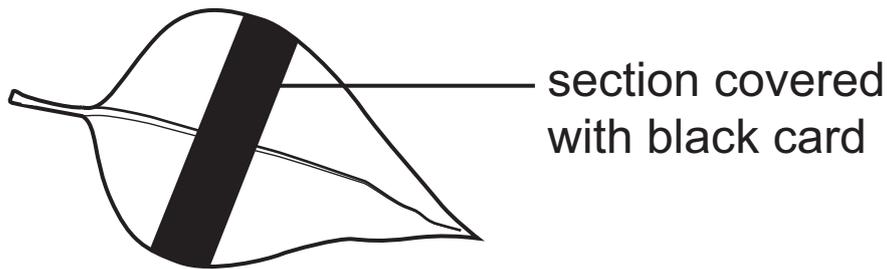
The starting temperature of the water was 18°C and the final temperature was 23°C .

He concluded that his piece of food contained more energy than Jane's food.

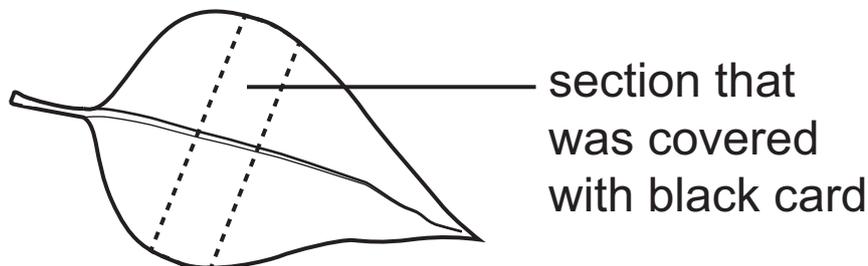
(ii) Explain why his conclusion was **incorrect**.

[1 mark]

The diagram below shows a leaf which has been partially covered with black card and left in bright light.



(ii) On the diagram below shade the parts of the leaf that would contain starch. [1 mark]



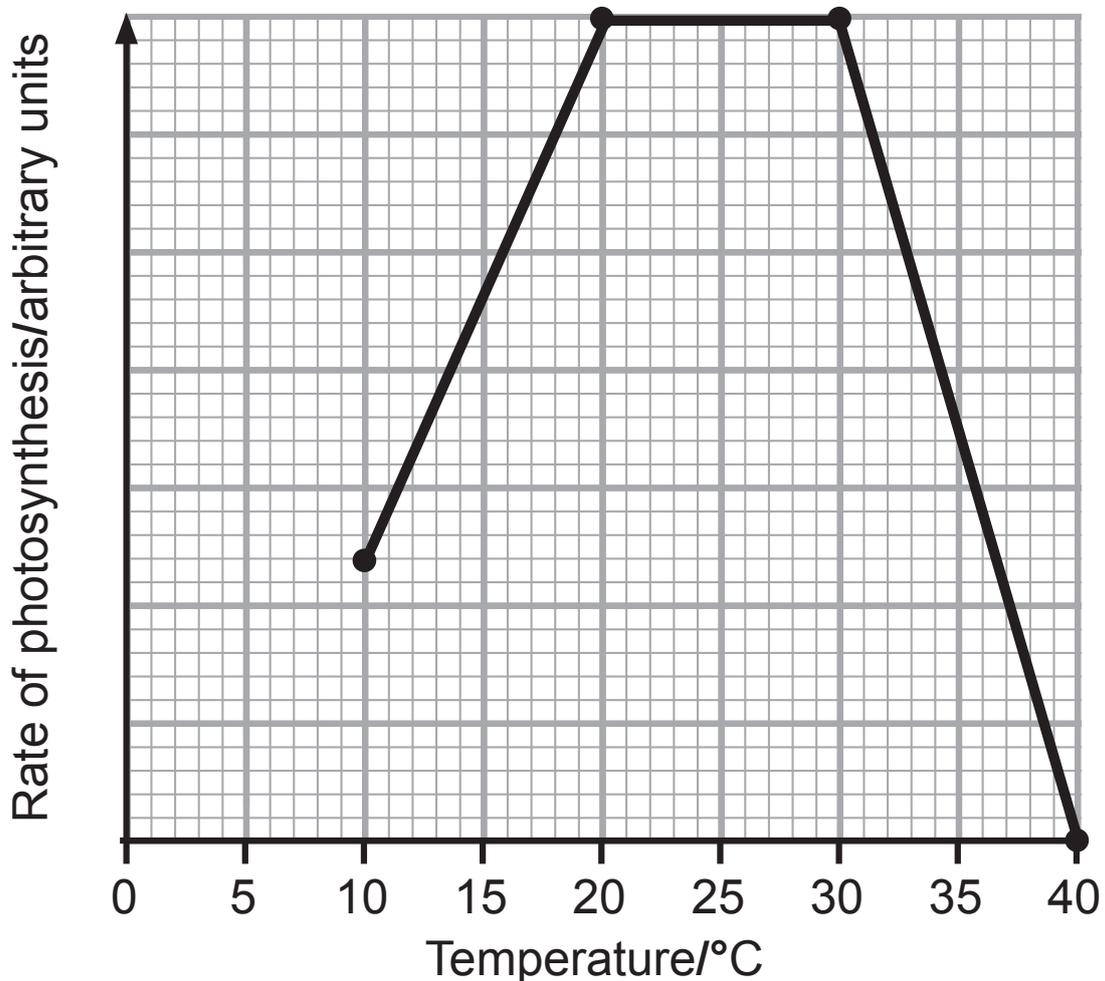
(b) A gardener wants to investigate factors that affect the rate of photosynthesis. She thinks the amount of light the plant gets is important.

Place a tick (✓) beside the most suitable hypothesis to test this idea. [1 mark]

Hypothesis	Tick (✓)
if a plant gets plenty of light it will grow well	
the more light a plant gets the healthier it will be	
the more light a plant gets the more it will photosynthesise	
if a plant gets light and water it will photosynthesise	

(c) Another gardener thinks the higher the temperature, the more a plant will photosynthesise. To investigate this he measured the rate of photosynthesis at different temperatures.

His results are shown below.



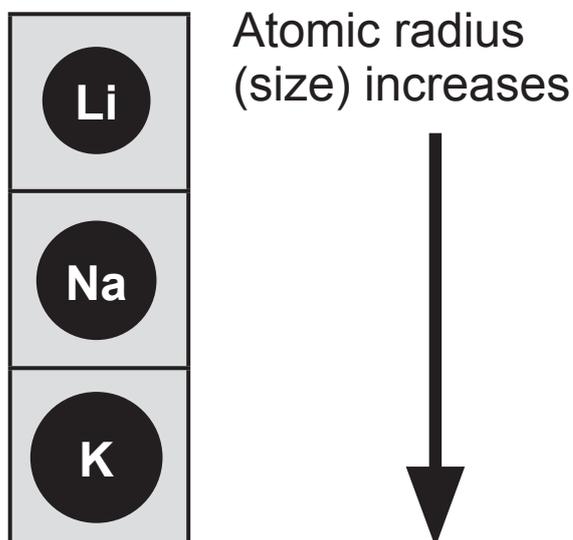
The gardener concluded that the best temperature for photosynthesis is between 20 °C and 30 °C.

(i) What evidence from the graph supports his conclusion? [1 mark]

(ii) What should he do to get a more accurate value for the best temperature for photosynthesis? [1 mark]

Section B – Chemistry

- 4 (a) James studied the alkali metals (Group 1). He found that the atoms of the elements increased in size going down the group.

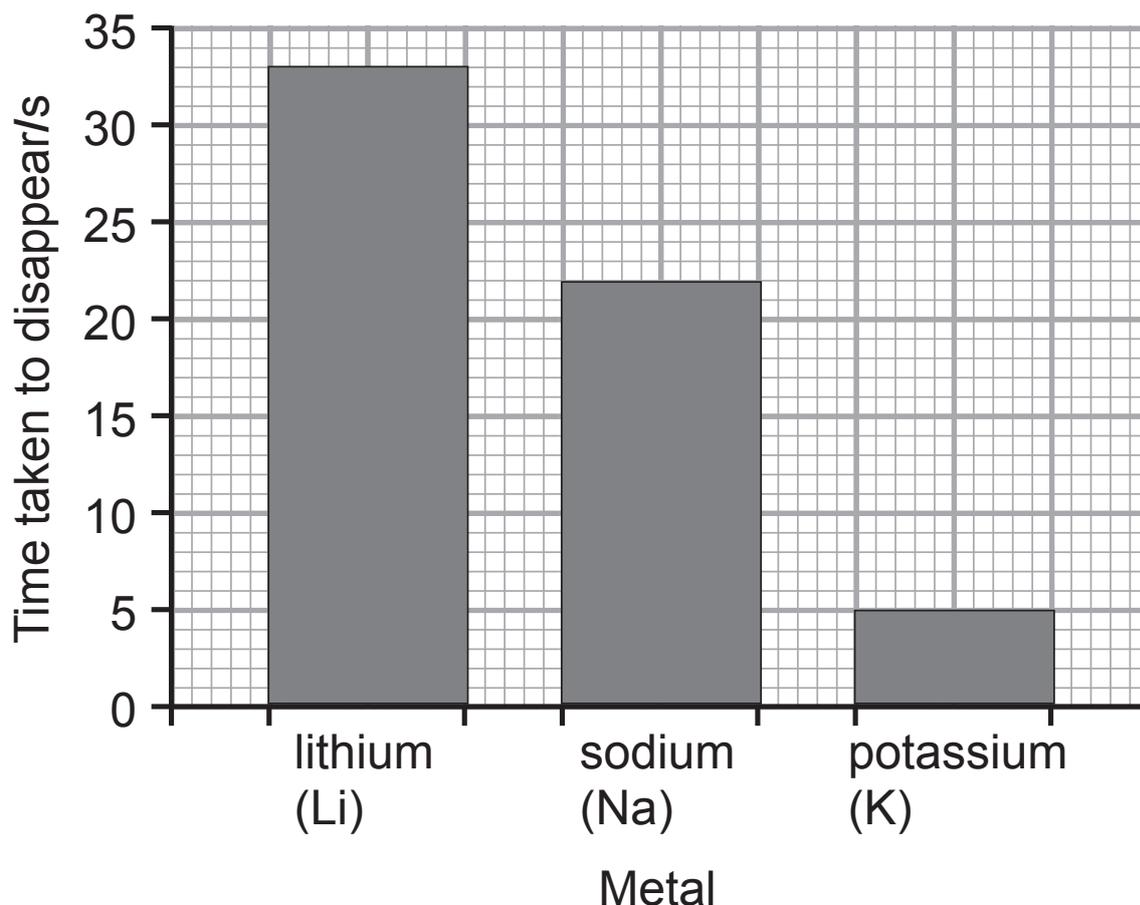


He suggested that because the atoms increased in size they could not move as fast and would be less reactive. To investigate this his teacher added a piece of each metal to water and timed how long it took for the metal to disappear.

- (i) Identify **one** possible risk in carrying out this investigation and suggest how to reduce the danger. [2 marks]

- (ii) State **one** thing that had to be done to make this a fair test. [1 mark]

The bar chart below shows the results of the investigation.

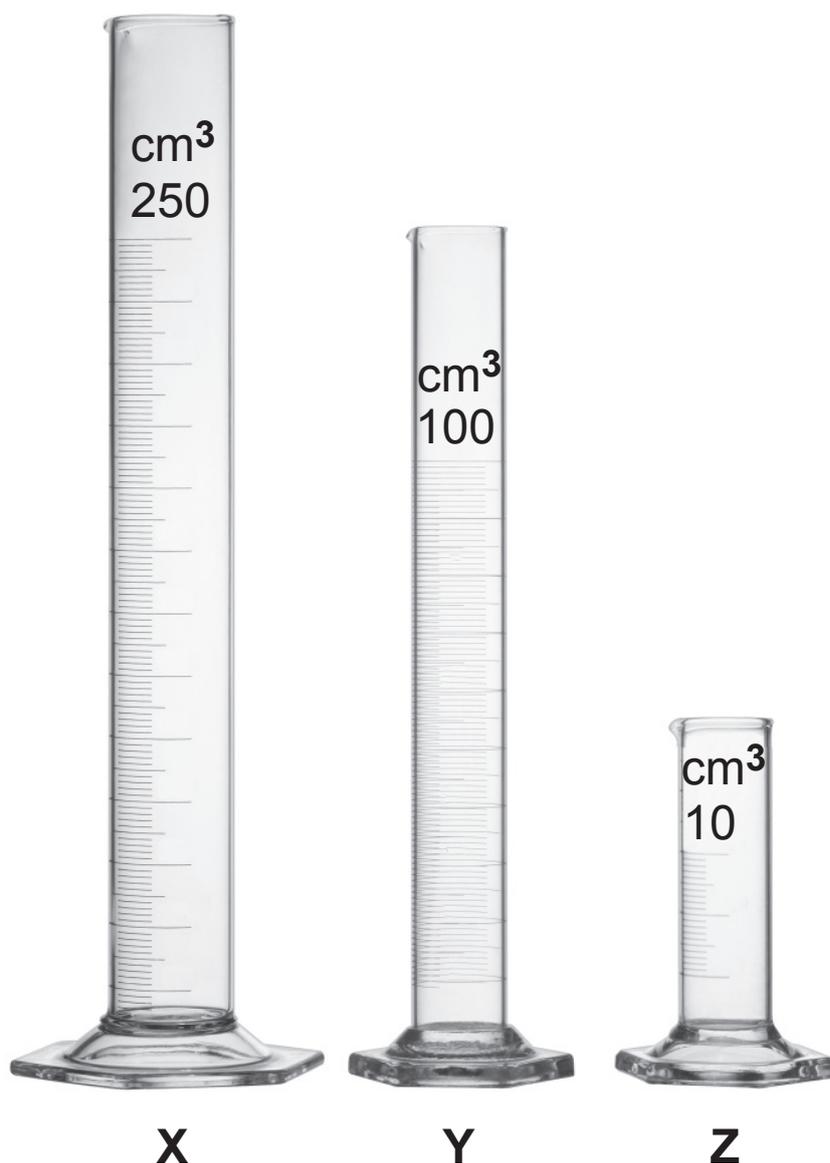


- (b) Was James correct in suggesting that the bigger atoms would be **less** reactive as you go down Group 1? Use the results in the bar chart to explain your answer.
[1 mark]

- (c) Name the gas produced in this experiment and describe the test James would carry out to identify this gas.
[3 marks]

- 5 Indigestion tablets are used to neutralise excess acid in the stomach. A student compared the effectiveness of four brands of tablets (**A**, **B**, **C** and **D**) by using the following method.
1. Crush the tablet.
 2. Add 50 cm^3 of water and stir to dissolve.
 3. Add a few drops of universal indicator solution.
 4. Add 5 cm^3 of hydrochloric acid and stir.
 5. Continue adding 5 cm^3 of acid until the indicator turns green (pH7).
 6. Record the volume of acid needed to neutralise the tablet.

The student used a measuring cylinder to measure the volume of acid.



- (a) Which measuring cylinder (**X**, **Y** or **Z**) would be most suitable to measure the volume of acid in steps 4 and 5? Explain your choice. [2 marks]

- (b) The bar chart below shows the volume of acid that neutralised each tablet.



- (i) State the range of the volume of hydrochloric acid used in this investigation. [1 mark]

_____ cm³

The student decided to change his method and retest tablets **C** and **D**.

In step 4 he added 10 cm^3 of acid and then in step 5 he added 1 cm^3 at a time, until the indicator turned green.

(ii) Explain fully how this will improve his investigation.
[2 marks]

The diagram below gives some of the colours of universal indicator with the corresponding pH value.

yellow	light green	green	dark green	turquoise	pale blue
5	6	7	8	9	10

(iii) Using the information above, explain why universal indicator is **not** the best method to find pH7.
[1 mark]

When the student retested tablets **C** and **D** he found that tablet **C** needed 13 cm^3 of acid to neutralise it and tablet **D** needed 14 cm^3 .

(iv) Using this information and the bar chart, put the tablets **A**, **B**, **C** and **D** in order of effectiveness. Put the most effective first. [2 marks]

Sodium hydrogencarbonate is one of the chemicals in indigestion tablets.

(c) When this reacts with acid, carbon dioxide is produced. Describe the test for carbon dioxide. [2 marks]

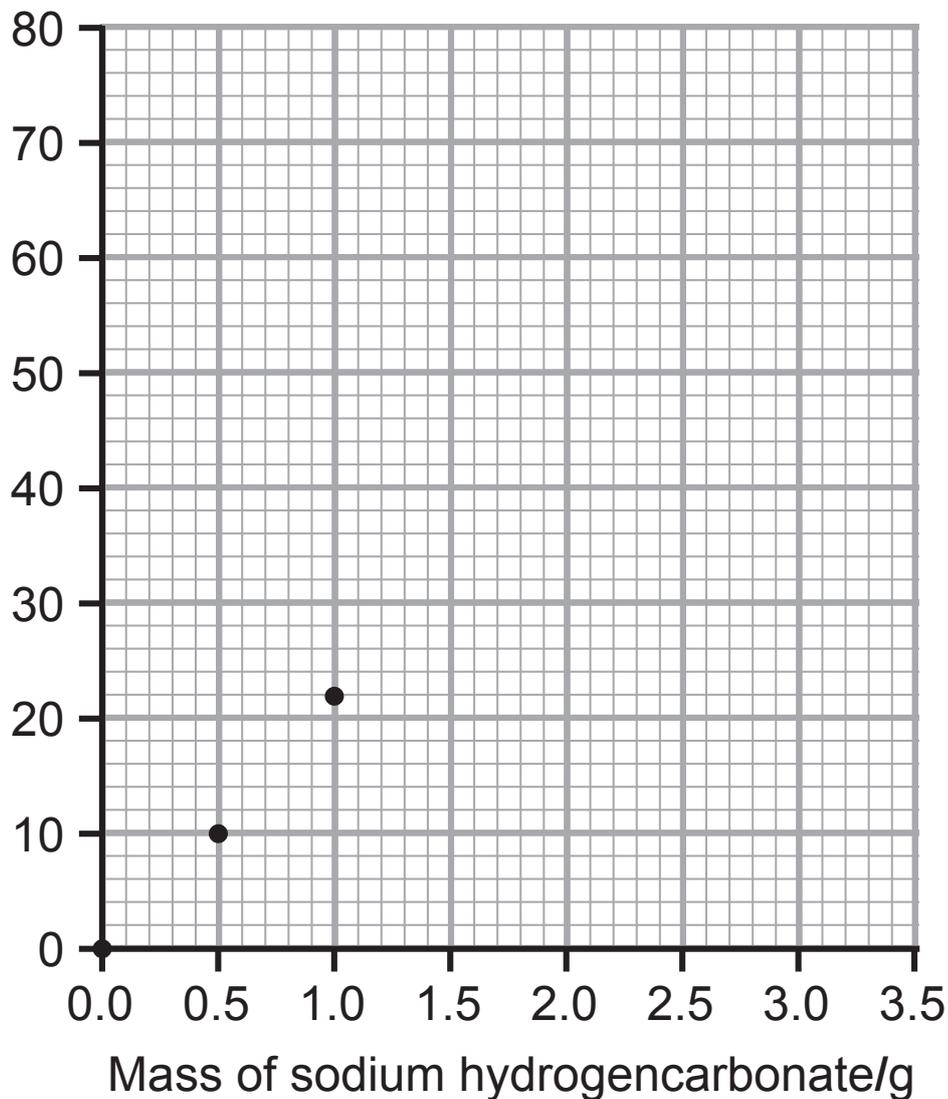
- (d) The table below shows how much acid different amounts of sodium hydrogencarbonate will neutralise.

Mass of sodium hydrogencarbonate/g	Volume of acid/ cm ³
0.0	0
0.5	10
1.0	22
1.5	30
2.0	40
2.5	50
3.0	61
3.5	72

- (i) On the grid opposite, add a suitable label to the y-axis. [1 mark]

- (ii) On the grid opposite plot and draw a line graph for these results. The first three points have been plotted for you. [3 marks]

- (iii) State the trend shown by these results. [1 mark]



This graph can be represented by the equation:

$$y = mx + c$$

(iv) What is the value for **c** on this graph? [1 mark]

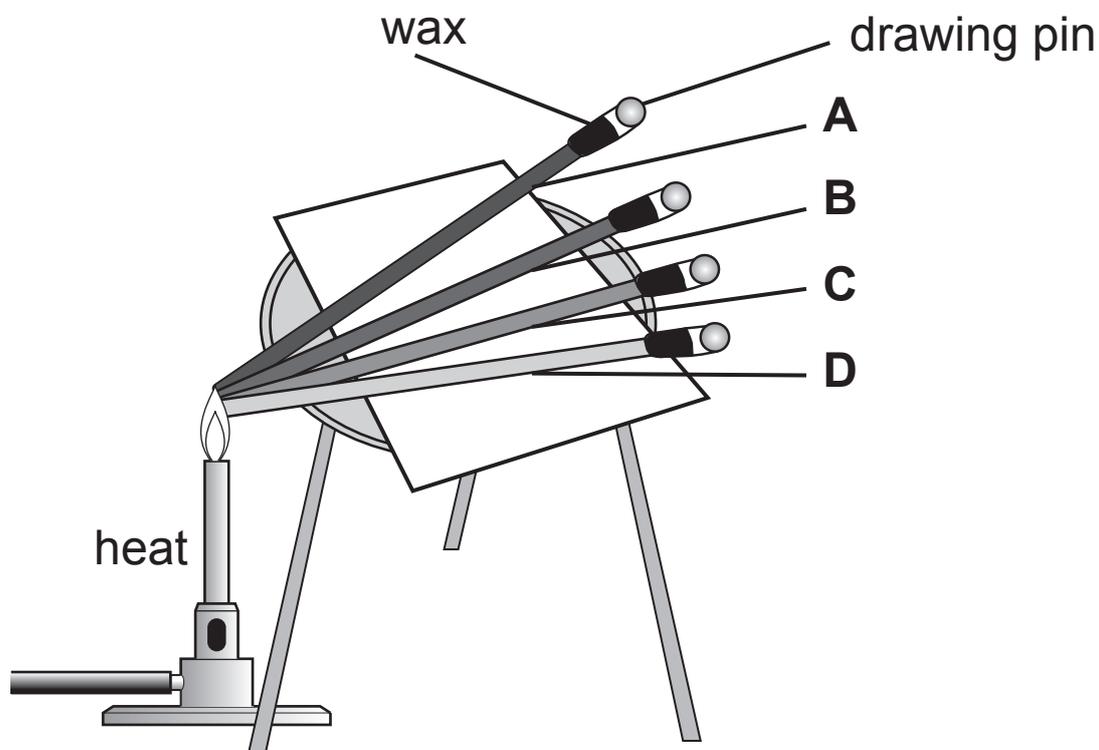
_____ cm^3

(v) Did this investigation produce any anomalous results? [1 mark]

Explain your answer.

Section C – Physics

- 6 (a) A student wanted to investigate four metals to find out which was the best conductor of heat. He used the apparatus shown below.



The metals were heated using a Bunsen burner and the student timed how long it took for the drawing pins to fall off.

- (i) Give **one** variable that was kept the same to make this a fair test. [1 mark]

(ii) What type of variable is **time** in this investigation?
[1 mark]

Circle the correct answer.

dependent

control

independent

(b) The investigation was carried out three times and an average calculated.

The results are shown below.

	Time to fall/s			
Metal	1	2	3	Average
A	5.7	5.9	5.8	5.8
B	8.2	8.3	8.0	
C	14.9	14.1	14.5	14.5
D	10.7	20.1	10.5	10.6

(i) Why did the student carry out the investigation three times for each metal? [1 mark]

(ii) Calculate the average time for metal **B**, giving your answer to **one** decimal place. [3 marks]

(Show your working out.)

_____ s

(iii) The student thought **one** of the times recorded was an anomaly.

Circle the anomalous result in the table above.

[1 mark]

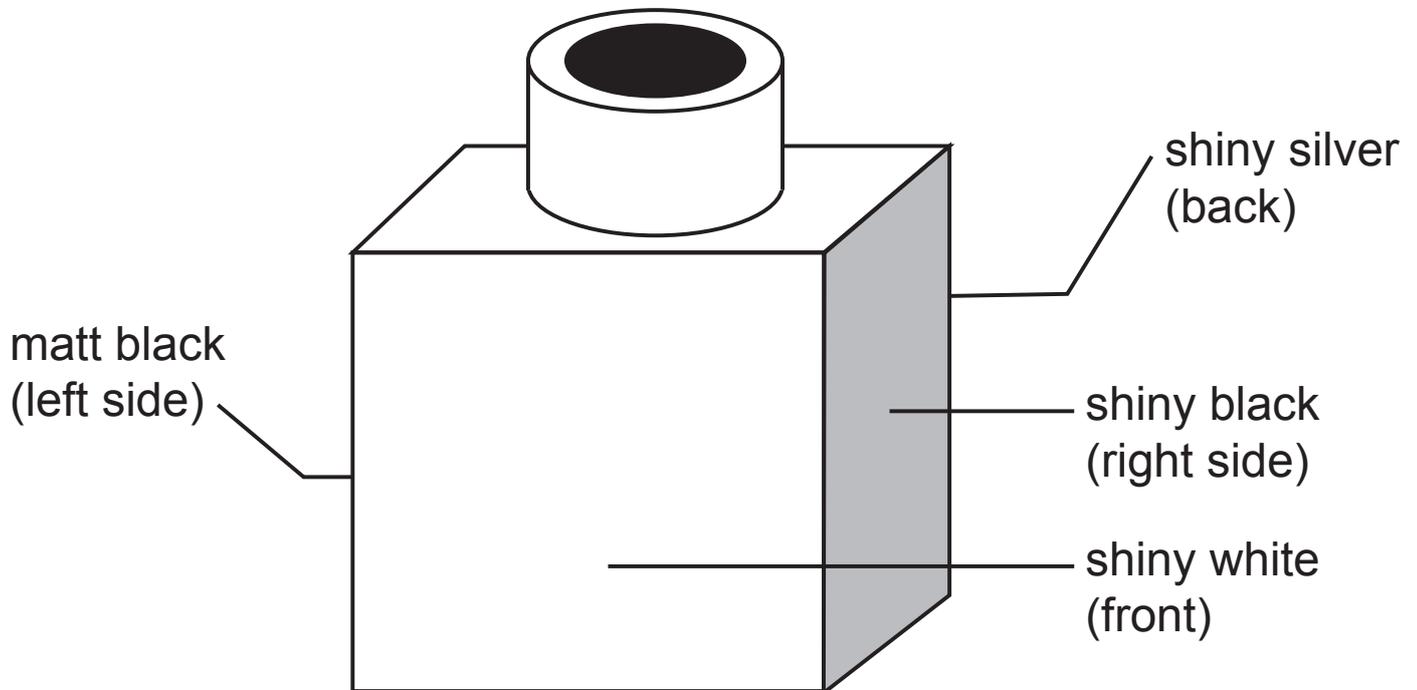
(iv) Look at the student's table of results and state how he dealt with the anomalous result. [1 mark]

(v) Of the metals tested, copper was the best conductor. Suggest which metal (**A**, **B**, **C** or **D**) was copper.

[1 mark]

(vi) Which **type** of graph would be best to display this data? [1 mark]

(c) Shown below is a Leslie's cube. When filled with boiling water it can be used to demonstrate the effect of colour on the radiation of heat. It has four sides made from the same metal but with different coloured surfaces.



One student suggested they could measure the heat radiated from a surface by **touching** each side of the cube.

(i) Apart from the danger of injury, explain why this will **not** indicate the amount of heat radiated. [1 mark]

Another student suggested putting his hand 5 cm from each side in turn and feeling which radiated the most heat.

His teacher said it would be more accurate if he used a heat sensor instead of his hand.

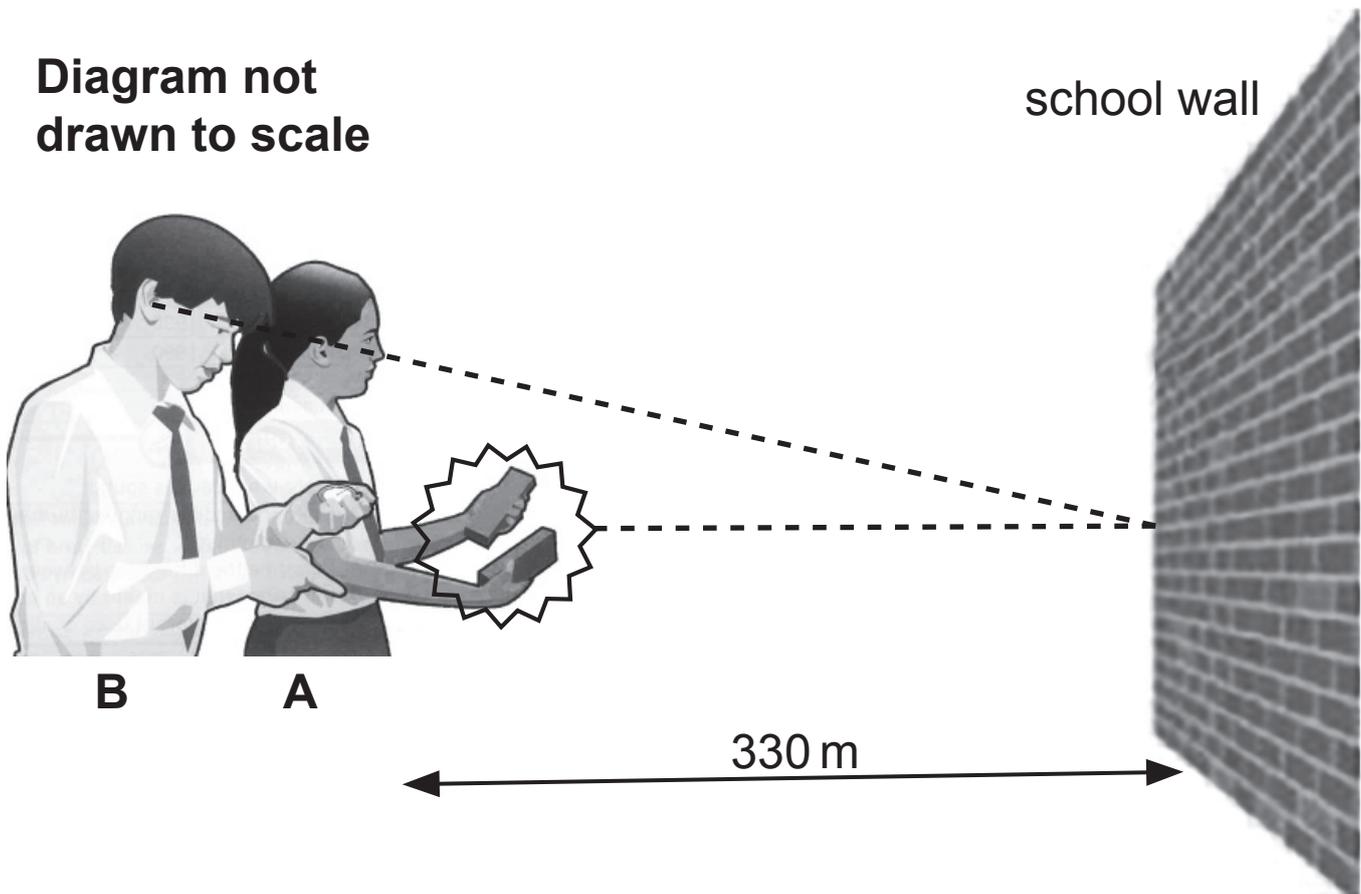
The results from the heat sensor are shown below.

Surface colour	Temperature/°C
Shiny white	49.8
Shiny silver	27.3
Shiny black	68.3
Matt black	68.8

- (ii) Use these results to explain fully why the student placing his hand 5 cm from the cube would **not** be an accurate way of finding the best radiator of heat.
[2 marks]

- 7 The diagram below shows two students **A** and **B** experimenting to find the speed of sound using the echo method.

Diagram not drawn to scale



The return time for the echo is measured by student **B**.

(a) When should he:

(i) start the stopwatch? [1 mark]

(ii) stop the stopwatch? [1 mark]

(b) Slow reactions are a possible source of error in this experiment.

Student **B** takes 0.1 s to react when starting the stopwatch and 0.1 s when stopping the stopwatch.

What effect, if any, will this have on the time he measured for the echo to return? [1 mark]

Choose from:

no effect

longer time

shorter time

(c) Which formula will be used to calculate the speed of sound? [1 mark]

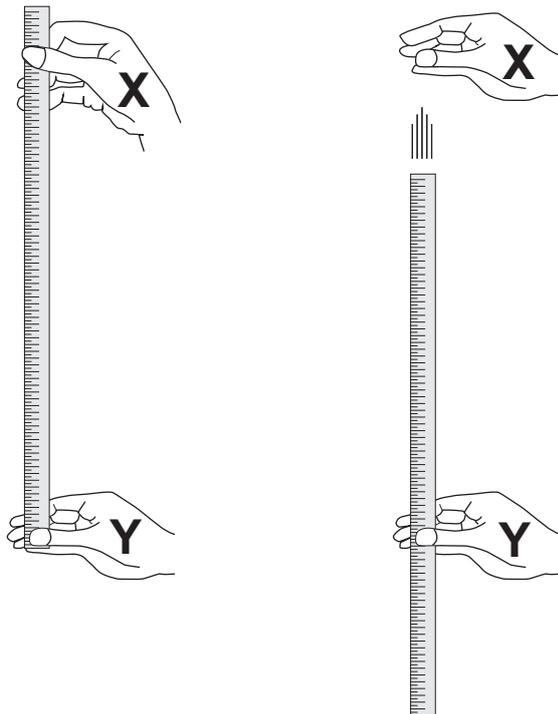
Circle the correct answer.

speed = distance × time

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

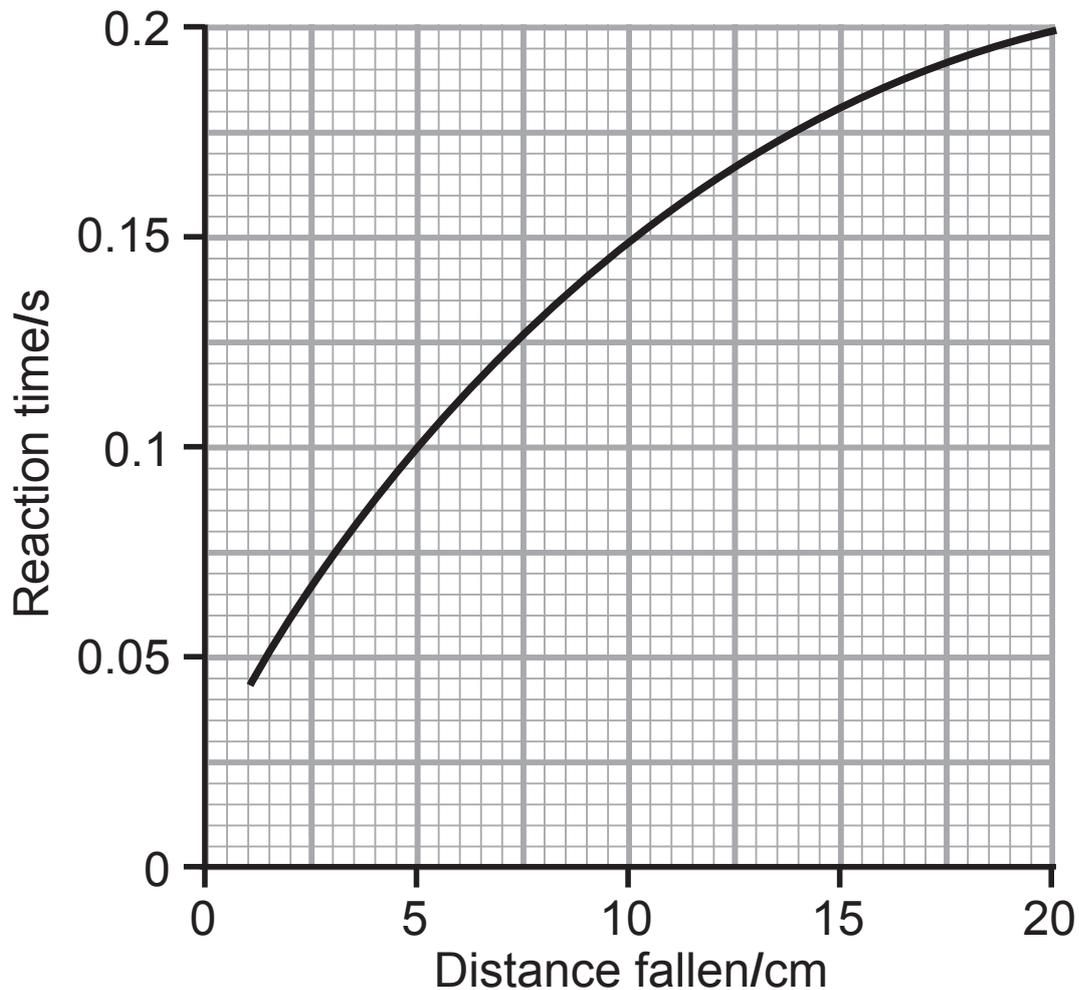
speed = $\frac{\text{distance}}{\text{time}}$

8 The diagram below shows two students **X** and **Y** using a ruler to test their reactions.



(a) The reactions of which student (**X** or **Y**) are being tested? [1 mark]
Explain your answer.

The graph below shows the relationship between the distance fallen by the ruler and reaction times.



(b) Student **X** caught the ruler at a distance of 5 cm and student **Y** at 10 cm.

(i) Use the graph to compare the reaction times of student **X** and student **Y**. [2 marks]

Each student was a different gender, **X** was a girl and **Y** was a boy.

(ii) Why is it **not** possible to conclude from this investigation that girls have faster reactions than boys? [1 mark]

(iii) Describe fully how this investigation needs to be changed to be able to conclude if reaction time depends on gender. [2 marks]

This is the end of the question paper

SOURCESQ1(a) . . . © *Martin Shields / Science Photo Library*Q5 © *prill / Thinkstock*Q6(a) . . . Source: *Principal Examiner*Q7 Source: *CCEA*Q8 Source: *Principal Examiner*

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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Examiner Number

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New
Specification

SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble
Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any
kind. No other type of data booklet or information
sheet is authorised for use in the examinations

gcse examinations

chemistry

For first teaching from September 2017

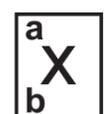
THE PERIODIC TABLE OF ELEMENTS

Group

																		0
																		4
																		He Helium
																		2
1	2											3	4	5	6	7		
7	9											11	12	14	16	19	20	
Li Lithium	Be Beryllium											B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon	
3	4											5	6	7	8	9	10	
23	24											27	28	31	32	35.5	40	
Na Sodium	Mg Magnesium											Al Aluminium	Si Silicon	P Phosphorus	S Sulfur	Cl Chlorine	Ar Argon	
11	12											13	14	15	16	17	18	
39	40	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84	
K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium	Br Bromine	Kr Krypton	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
85	88	89	91	93	96	98	101	103	106	108	112	115	119	122	128	127	131	
Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium	I Iodine	Xe Xenon	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
133	137	139	178	181	184	186	190	192	195	197	201	204	207	209	210	210	222	
Cs Caesium	Ba Barium	La * Lanthanum	Hf Hafnium	Ta Tantalum	W Tungsten	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	Hg Mercury	Tl Thallium	Pb Lead	Bi Bismuth	Po Polonium	At Astatine	Rn Radon	
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
223	226	227	261	262	266	264	277	268	271	272	285							
Fr Francium	Ra Radium	Ac † Actinium	Rf Rutherfordium	Db Dubnium	Sg Seaborgium	Bh Bohrium	Hs Hassium	Mt Meitnerium	Ds Darmstadtium	Rg Roentgenium	Cn Copernicium							
87	88	89	104	105	106	107	108	109	110	111	112							

* 58 – 71 Lanthanum series

† 90 – 103 Actinium series



a = relative atomic mass (approx)

x = atomic symbol

b = atomic number

140	141	144	145	150	152	157	159	162	165	167	169	173	175
Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium
58	59	60	61	62	63	64	65	66	67	68	69	70	71
232	231	238	237	242	243	247	245	251	254	253	256	254	257
Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium
90	91	92	93	94	95	96	97	98	99	100	101	102	103