

Monday 14 January 2013 – Morning

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A151/01 Modules B4 C4 P4 (Foundation 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

MODIFIED LANGUAGE



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 (-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

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

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

Sustainable energy

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

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

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

Explaining motion

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

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

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

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

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

Electric circuits

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

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

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

Radioactive materials

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

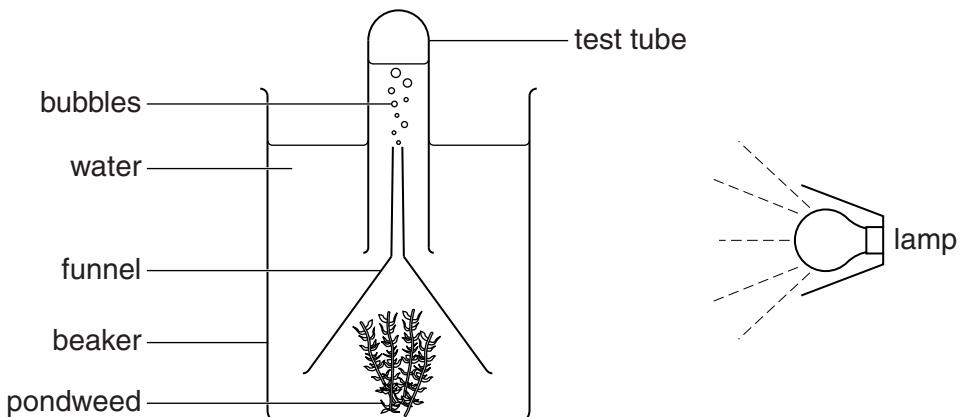
BLANK PAGE

Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

- 1 Anette does an experiment with pondweed.



The pondweed is photosynthesising.

- (a) What is the name of the gas produced by photosynthesis?

..... [1]

- (b) Anette changes the distance of the lamp from the pondweed.

At each distance she counts the number of bubbles of gas collected in 5 minutes.

She does the experiment three times at each distance.

Here are her results.

Distance from lamp to pondweed in cm	Number of bubbles produced in 5 minutes			
	Experiment 1	Experiment 2	Experiment 3	Average
10	21	21	18	
15	14	15	16	15
20	11	14	11	12
25	10	8	12	10

- (i) Suggest why there was variation in the results at 10 cm from the lamp.

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

- (ii) Calculate the average (mean) number of bubbles collected when the lamp is at a distance of 10 cm.

average = [1]

- (iii) What conclusion about photosynthesis can Anette make from these data?

.....

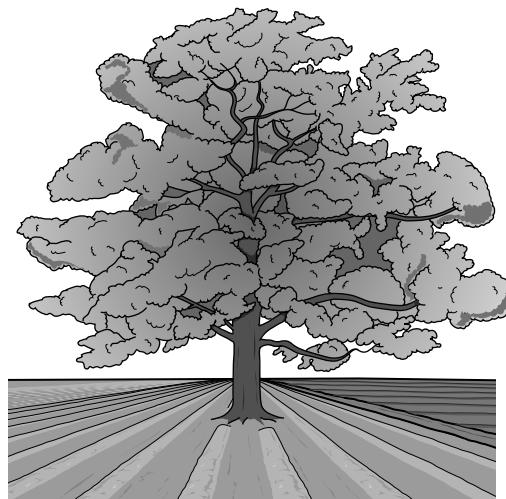
.....

..... [1]

Question 1 continues on page 6

- (c) Anette wants to investigate the effect of **shade** on plants growing in a field.

The field contains a large tree.



She thinks that at different distances from the tree, the number of plants growing will not be the same.

She plans an investigation to test this idea.

- (i) What items of equipment should she use to collect data for this investigation?

Put **rings** around the **two** correct answers.

lamp

light meter

pH meter

quadrat

stop watch

[1]

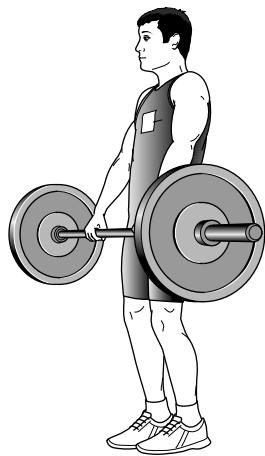
- (ii) Suggest what she would expect to find, and explain your answer.

.....
.....
.....
.....

[2]

[Total: 7]

- 2** Nathan is weightlifting.



The four statements describe what happens.

- His muscles respire **aerobically** as he stands before lifting the weights.
 - He can stand for a long time.
 - His muscles respire **anaerobically** when he lifts the weights.
 - He can not hold the weights for a long time.

Use your knowledge of the differences between **aerobic** and **anaerobic** respiration to explain these statements.



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

[6]

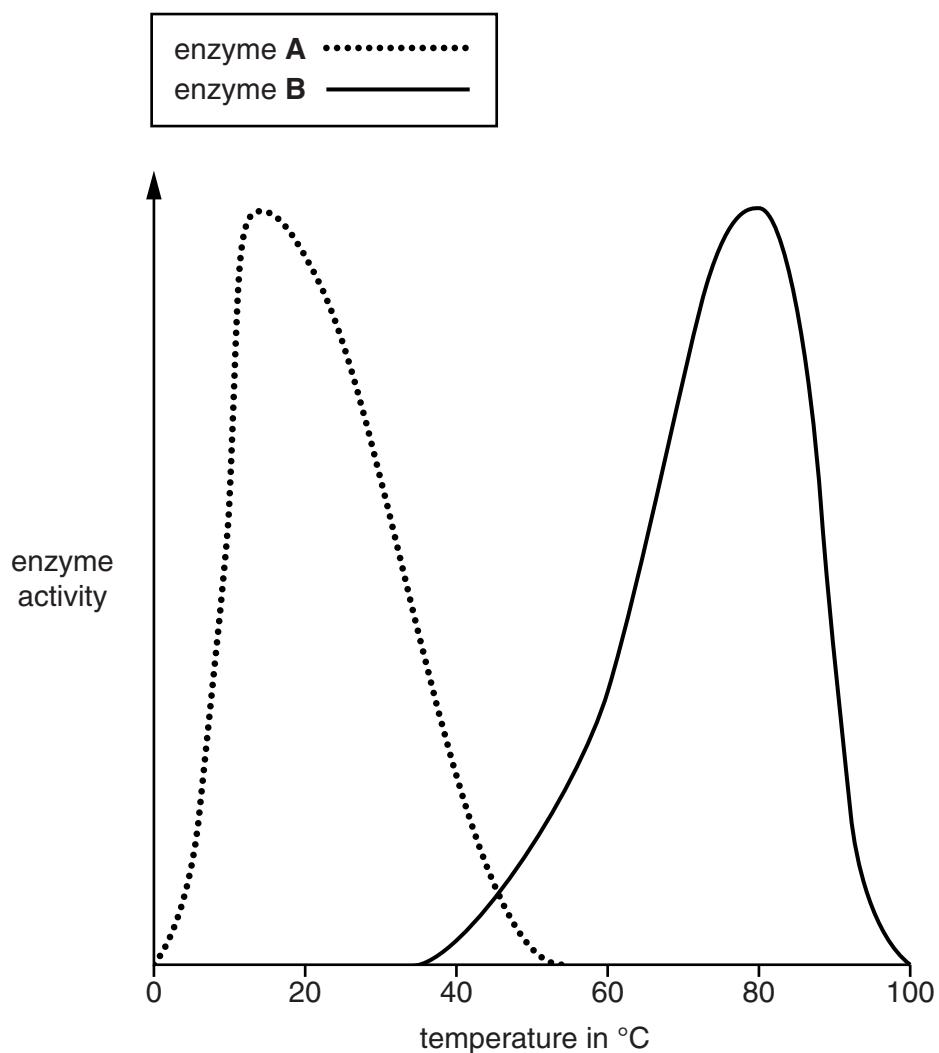
- [6]

[Total: 6]

- 3 Corinne does an experiment using two different enzymes, **A** and **B**.

She records the activity of each enzyme at different temperatures.

She plots her results on a graph.



- (a) Both enzymes work on the same chemical.

One of the enzymes is from a bacterium that lives in hot springs at 80 °C.

The other enzyme is from a bacterium that lives in the sea at 14 °C.

Corinne concludes that enzyme **A** comes from the bacterium that lives in the sea.

Explain why Corinne's conclusion is correct.

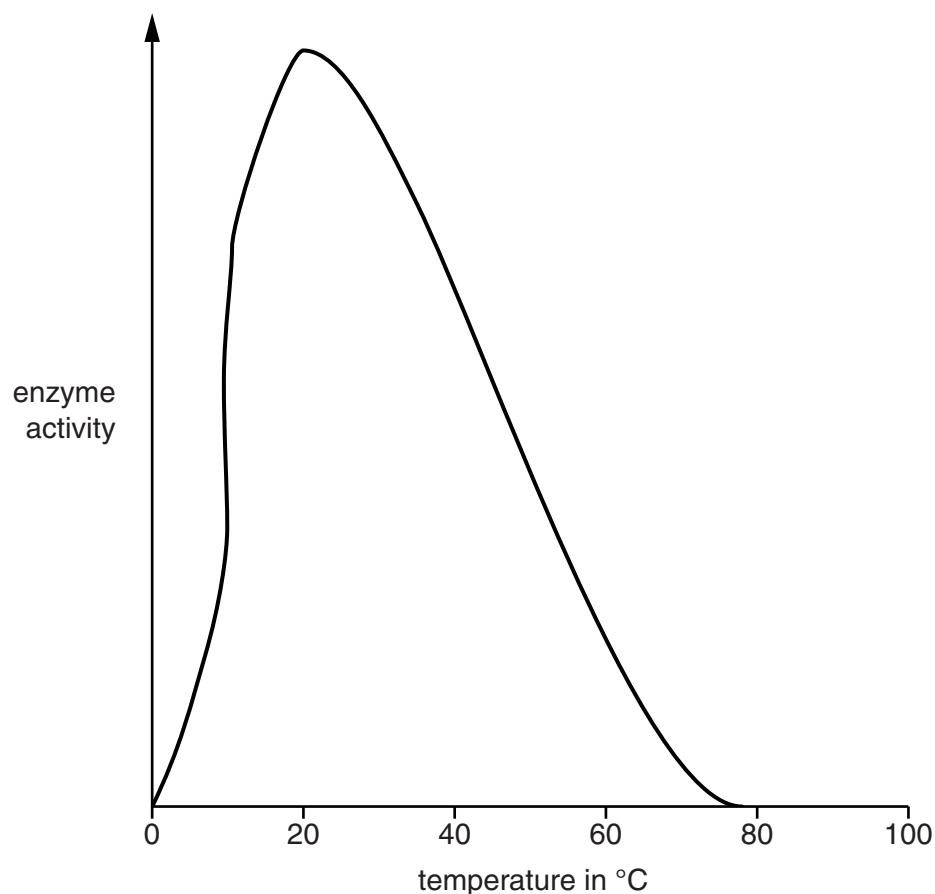
.....
.....
.....
.....

[2]

- (b) Corinne does the same experiment with a different enzyme, **C**.

This enzyme works on the same chemical as enzymes **A** and **B**.

She plots her results on a graph.



She finds that enzyme **C** works best at 20°C.

She heats a fresh sample of the enzyme to 100°C and then cools it back to 20°C.

She then uses this enzyme in an experiment.

Suggest and explain what the result of the experiment would be.

.....
.....
.....
.....

[2]

[Total: 4]

- 4 Ryan investigates osmosis in pieces of raw potato.

He cuts six cylinders of potato, each with the same shape and mass.

He places each cylinder of potato in a sugar solution.

Each solution contains the same sugar, but at a different concentration.

After 2 hours, he records the mass of each potato cylinder and calculates its percentage (%) change in mass.

Here are his results.

Concentration of sugar solution in g/dm ³	Percentage (%) change in mass of potato cylinder
0	+7
20	+3
40	+1
60	-1
80	-4
100	-6

- (a) Put a **ring** around the correct choice to complete each sentence.

The membrane of the potato cells is **not / partially / completely** permeable.

The concentration of the cell contents is between **0 and 20 / 40 and 60 / 80 and 100** g/dm³.

In osmosis, the overall movement of water is from one solution to

a more concentrated / an equally concentrated / a less concentrated solution.

[2]

- (b) Ryan suggests ways to get a better estimate of the concentration of the cell contents.

Put a tick (**✓**) in the box next to Ryan's best suggestion.

Record the change in mass in g instead of percentage change.

Repeat the experiment using different sizes of potato cylinder.

Repeat the experiment with concentrations greater than 100 g/dm³ of sugar.

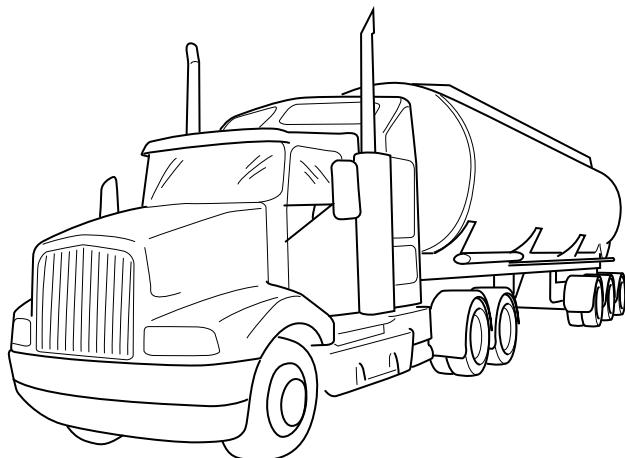
Repeat each concentration and calculate the average percentage change in mass.

Soak the potato in pure water before the experiment.

[1]

[Total: 3]

- 5 The chemical industry uses large amounts of chlorine. Some of this chlorine is transported across the country.



- (a) The lorry has this hazard symbol on the side.



What does the symbol mean?

Put a (ring) around the correct answer.

corrosive

explosive

flammable

toxic

[1]

- (b) Chlorine is made up of molecules.

Which diagram shows a molecule of chlorine?

Put a (ring) around the correct answer.



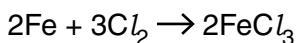
[1]

- (c) The chlorine is carried in a steel tank.

Steel is mainly iron.

The chlorine does not react with the tank unless there is a very hot fire.

At high temperatures, iron reacts with chlorine gas to make small crystals.



- (i) Write a word equation for this reaction.

..... [2]

- (ii) Put a tick (\checkmark) in the correct box to show if each substance is a solid, a liquid or a gas at room temperature and pressure.

	Solid	Liquid	Gas
Cl_2			
Fe			
FeCl_3			

[2]

- (d) Here is some information about one atom of chlorine.

Complete the table.

atomic (proton) number	17
relative mass	35
number of electrons	

[1]

[Total: 7]

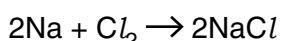
- 6 Sodium and potassium are both Group 1 metals.
Sodium is a reactive metal.

- (a) Sodium reacts with chlorine to make sodium chloride.
The formula for sodium chloride is NaCl .

Look up the symbol for potassium in the Periodic Table and write the formula for potassium chloride.

..... [1]

- (b) The equation for the reaction between sodium and chlorine is



How many atoms of sodium react with one molecule of chlorine?

..... [1]

- (c) The electronic configuration of sodium is 2.8.1

What do the numbers 2.8.1 tell you?

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

- (d) Melted sodium chloride conducts electricity.
Use ideas about particles to explain why.

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

[Total: 7]

- 7 X, Y and Z are three elements in the Periodic Table.

Element	X	Y	Z
atomic (proton) number	less than 12	12	more than 12
melting point in °C	1278	649	839
density in g/cm ³	1.85	1.74	1.54
reaction with water	no reaction	slow	rapid
formula of chloride	$XC{l_2}$	YCl_2	ZCl_2
formula of oxide	XO	YO	ZO
melting point of oxide in °C	2550	2852	2554

Jo thinks that X, Y and Z are in the same Group.

Ann thinks that they are not.

Who is right?

Use evidence from the table to support your answer.



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

[6]

[Total: 6]

- 8 Tom investigates the effect of different road surfaces on how quickly a car can stop.



The same car is tested on three different road surfaces.

The brakes are applied when the car is going at 15 m/s.

Tom measures the time between applying the brakes and the car stopping completely.

Here are his results.

Road surface	Time in seconds for the car to stop from 15 m/s			
	First try	Second try	Third try	mean
GripMore	1.9	2.1	2.0	2.0
SlideLess	1.7	2.0	2.3	2.0
StopSure	2.4	2.6	2.2	2.4

- (a) Tom does three time measurements for each road surface.

He never gets the same result for the same road surface.

Suggest why.

..... [1]

- (b) Tom decides that StopSure is the worst surface.

Give **two** reasons why he can't be sure which of GripMore or SlideLess is the best.

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

- (c) Suggest **two** things Tom could do to help him to decide which is the best surface.

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

[Total: 5]

- 9** Jim lights a firework rocket and stands well back.



The rocket emits a lot of hot gas in a downwards direction.

Use ideas of forces to explain how this makes the rocket move upwards.



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

[6]

- [6]

[Total: 6]

- 10 Here is some data for three different electric cars.

Name of car	Top speed in m/s	Accelerating time in s	Total mass in kg
CitiStroll	25	10	200
EasyShop	15	5	400
GoFar	20	4	600

The **accelerating time** is how long it takes for each car to reach its top speed from a standing start.

- (a) The manufacturers of GoFar claim that their car has the greatest acceleration.
Are they right? Give reasons for your answer.
Use calculations in your answer.

.....
.....
.....
.....

[2]

- (b) Calculate the kinetic energy of a GoFar car at its top speed.

$$\text{kinetic energy} = \dots\dots\dots\dots\dots \text{J} [1]$$

- (c) Here are some statements about cars as they accelerate.
Put ticks (\checkmark) in the boxes next to the **two** correct statements.

The driving force does work on the car.

The kinetic energy of the car remains constant.

The weight of the car decreases as it speeds up.

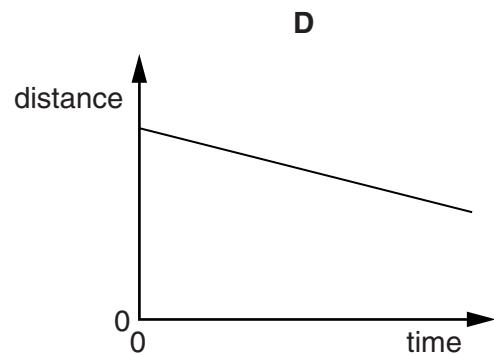
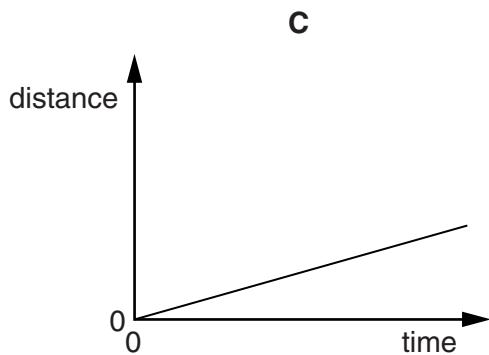
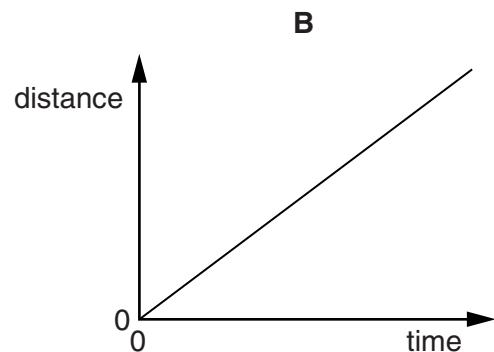
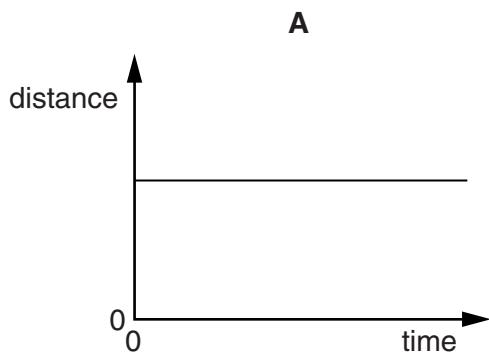
The driving force is greater than the counter force.

The reaction from the ground decreases the momentum.

[2]

[Total: 5]

- 11 Here are distance-time graphs for four different bicycles **A**, **B**, **C** and **D**.



(a) Which bicycle is not moving?

answer [1]

(b) Which bicycle has the greatest speed?

answer [1]

[Total: 2]

12 Sally climbs the stairs at a steady speed.

Put a **(ring)** around the correct choice to complete each sentence.

As Sally climbs, her legs push **up / down** on each step.

The reaction force from each step pushes **up / down** on Sally.

As she goes up the stairs at a steady speed, she increases her
gravitational potential energy / kinetic energy / momentum.

[2]

[Total: 2]

END OF QUESTION PAPER



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of the Elements

1	2	3	4	5	6	7	0
Li lithium 3	Be beryllium 4	Na sodium 11	Mg magnesium 12	Ca calcium 20	Sc scandium 21	Ti titanium 22	V vanadium 23
K potassium 19	Rb rubidium 37	Sr strontium 38	Y yttrium 39	Nb niobium 41	Mo molybdenum 42	Tc technetium 43	Ru ruthenium 44
Cs caesium 55	Ba barium 56	L [*] lanthanum 57	Hf hafnium 72	Ta tantalum 73	W tungsten 74	Re rhenium 75	Os osmium 76
[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				
1 H hydrogen 1	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminum 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16
17 Cl chlorine 17	18 Ar argon 18	19 F fluorine 9	20 Ne neon 10	21 Ne neon 10	22 Ar argon 18	23 Kr krypton 36	24 Xe xenon 54
25 Br bromine 35	26 As arsenic 33	27 Ge germanium 32	28 Se selenium 34	29 Te tellurium 52	30 Sb antimony 51	31 I iodine 53	32 At astatine 85
33 Ga gallium 31	34 Ge germanium 32	35 Sn tin 50	36 Ge germanium 32	37 Sb antimony 51	38 Te tellurium 52	39 I iodine 53	40 Kr krypton 36
41 Zn zinc 30	42 Cd cadmium 48	43 In indium 49	44 Cd cadmium 48	45 Pd palladium 46	46 Ag silver 47	47 In indium 49	48 Ge germanium 32
49 Rh rhodium 45	50 Ru ruthenium 44	51 Ir iridium 77	52 Os osmium 76	53 Pt platinum 78	54 Au gold 79	55 Hg mercury 80	56 Bi bismuth 83
57 Co cobalt 27	58 Ni nickel 28	59 Cu copper 29	60 Zn zinc 30	61 Ge germanium 32	62 Sb antimony 51	63 Te tellurium 52	64 Po polonium 84
65 Fe iron 26	66 Mn manganese 25	67 Cr chromium 24	68 V vanadium 23	69 Nb niobium 41	70 Ga gallium 31	71 Sn tin 50	72 Br bromine 35
73 Ge germanium 32	74 Ge germanium 32	75 As arsenic 33	76 Ge germanium 32	77 In indium 49	78 Ge germanium 32	79 Te tellurium 52	80 Br bromine 35
81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86	87 Kr krypton 36	88 Xe xenon 54
89 Fr francium 87	90 Ra radium 88	91 Sr strontium 38	92 Y yttrium 39	93 Nb niobium 41	94 Tc technetium 43	95 Ru ruthenium 44	96 Mo molybdenum 42
97 Cs caesium 55	98 Ba barium 56	99 La [*] lanthanum 57	100 Hf hafnium 72	101 Ta tantalum 73	102 W tungsten 74	103 Re rhenium 75	104 Os osmium 76
105 Fr francium 87	106 Sc scandium 21	107 Ti titanium 22	108 V vanadium 23	109 Nb niobium 41	110 Cr chromium 24	111 Mn manganese 25	112 Fe iron 26
113 Fr francium 87	114 Ra radium 88	115 Ac [*] actinium 89	116 Rf rutherfordium 104	117 Db dubnium 105	118 Sg seaborgium 106	119 Bh bohrium 107	120 Mt meitnerium 109
121 Fr francium 87	122 Ra radium 88	123 Ac [*] actinium 89	124 Rf rutherfordium 104	125 Db dubnium 105	126 Sg seaborgium 106	127 Bh bohrium 107	128 Mt meitnerium 109
129 Fr francium 87	130 Ra radium 88	131 Ac [*] actinium 89	132 Rf rutherfordium 104	133 Db dubnium 105	134 Sg seaborgium 106	135 Bh bohrium 107	136 Mt meitnerium 109
137 Fr francium 87	138 Ra radium 88	139 Ac [*] actinium 89	140 Rf rutherfordium 104	141 Db dubnium 105	142 Sg seaborgium 106	143 Bh bohrium 107	144 Mt meitnerium 109
145 Fr francium 87	146 Ra radium 88	147 Ac [*] actinium 89	148 Rf rutherfordium 104	149 Db dubnium 105	150 Sg seaborgium 106	151 Bh bohrium 107	152 Mt meitnerium 109
153 Fr francium 87	154 Ra radium 88	155 Ac [*] actinium 89	156 Rf rutherfordium 104	157 Db dubnium 105	158 Sg seaborgium 106	159 Bh bohrium 107	160 Mt meitnerium 109
161 Fr francium 87	162 Ra radium 88	163 Ac [*] actinium 89	164 Rf rutherfordium 104	165 Db dubnium 105	166 Sg seaborgium 106	167 Bh bohrium 107	168 Mt meitnerium 109
169 Fr francium 87	170 Ra radium 88	171 Ac [*] actinium 89	172 Rf rutherfordium 104	173 Db dubnium 105	174 Sg seaborgium 106	175 Bh bohrium 107	176 Mt meitnerium 109
177 Fr francium 87	178 Ra radium 88	179 Ac [*] actinium 89	180 Rf rutherfordium 104	181 Db dubnium 105	182 Sg seaborgium 106	183 Bh bohrium 107	184 Mt meitnerium 109
185 Fr francium 87	186 Ra radium 88	187 Ac [*] actinium 89	188 Rf rutherfordium 104	189 Db dubnium 105	190 Sg seaborgium 106	191 Bh bohrium 107	192 Mt meitnerium 109
193 Fr francium 87	194 Ra radium 88	195 Ac [*] actinium 89	196 Rf rutherfordium 104	197 Db dubnium 105	198 Sg seaborgium 106	199 Bh bohrium 107	200 Mt meitnerium 109
199 Fr francium 87	200 Ra radium 88	201 Ac [*] actinium 89	202 Rf rutherfordium 104	203 Db dubnium 105	204 Sg seaborgium 106	205 Bh bohrium 107	206 Mt meitnerium 109
207 Fr francium 87	208 Ra radium 88	209 Ac [*] actinium 89	210 Rf rutherfordium 104	211 Db dubnium 105	212 Sg seaborgium 106	213 Bh bohrium 107	214 Mt meitnerium 109
215 Fr francium 87	216 Ra radium 88	217 Ac [*] actinium 89	218 Rf rutherfordium 104	219 Db dubnium 105	220 Sg seaborgium 106	221 Bh bohrium 107	222 Mt meitnerium 109
223 Fr francium 87	224 Ra radium 88	225 Ac [*] actinium 89	226 Rf rutherfordium 104	227 Db dubnium 105	228 Sg seaborgium 106	229 Bh bohrium 107	230 Mt meitnerium 109
231 Fr francium 87	232 Ra radium 88	233 Ac [*] actinium 89	234 Rf rutherfordium 104	235 Db dubnium 105	236 Sg seaborgium 106	237 Bh bohrium 107	238 Mt meitnerium 109
239 Fr francium 87	240 Ra radium 88	241 Ac [*] actinium 89	242 Rf rutherfordium 104	243 Db dubnium 105	244 Sg seaborgium 106	245 Bh bohrium 107	246 Mt meitnerium 109
247 Fr francium 87	248 Ra radium 88	249 Ac [*] actinium 89	250 Rf rutherfordium 104	251 Db dubnium 105	252 Sg seaborgium 106	253 Bh bohrium 107	254 Mt meitnerium 109
255 Fr francium 87	256 Ra radium 88	257 Ac [*] actinium 89	258 Rf rutherfordium 104	259 Db dubnium 105	260 Sg seaborgium 106	261 Bh bohrium 107	262 Mt meitnerium 109
263 Fr francium 87	264 Ra radium 88	265 Ac [*] actinium 89	266 Rf rutherfordium 104	267 Db dubnium 105	268 Sg seaborgium 106	269 Bh bohrium 107	270 Mt meitnerium 109
271 Fr francium 87	272 Ra radium 88	273 Ac [*] actinium 89	274 Rf rutherfordium 104	275 Db dubnium 105	276 Sg seaborgium 106	277 Bh bohrium 107	278 Mt meitnerium 109
279 Fr francium 87	280 Ra radium 88	281 Ac [*] actinium 89	282 Rf rutherfordium 104	283 Db dubnium 105	284 Sg seaborgium 106	285 Bh bohrium 107	286 Mt meitnerium 109
287 Fr francium 87	288 Ra radium 88	289 Ac [*] actinium 89	290 Rf rutherfordium 104	291 Db dubnium 105	292 Sg seaborgium 106	293 Bh bohrium 107	294 Mt meitnerium 109
295 Fr francium 87	296 Ra radium 88	297 Ac [*] actinium 89	298 Rf rutherfordium 104	299 Db dubnium 105	300 Sg seaborgium 106	301 Bh bohrium 107	302 Mt meitnerium 109
303 Fr francium 87	304 Ra radium 88	305 Ac [*] actinium 89	306 Rf rutherfordium 104	307 Db dubnium 105	308 Sg seaborgium 106	309 Bh bohrium 107	310 Mt meitnerium 109
311 Fr francium 87	312 Ra radium 88	313 Ac [*] actinium 89	314 Rf rutherfordium 104	315 Db dubnium 105	316 Sg seaborgium 106	317 Bh bohrium 107	318 Mt meitnerium 109
319 Fr francium 87	320 Ra radium 88	321 Ac [*] actinium 89	322 Rf rutherfordium 104	323 Db dubnium 105	324 Sg seaborgium 106	325 Bh bohrium 107	326 Mt meitnerium 109
327 Fr francium 87	328 Ra radium 88	329 Ac [*] actinium 89	330 Rf rutherfordium 104	331 Db dubnium 105	332 Sg seaborgium 106	333 Bh bohrium 107	334 Mt meitnerium 109
335 Fr francium 87	336 Ra radium 88	337 Ac [*] actinium 89	338 Rf rutherfordium 104	339 Db dubnium 105	340 Sg seaborgium 106	341 Bh bohrium 107	342 Mt meitnerium 109
345 Fr francium 87	346 Ra radium 88	347 Ac [*] actinium 89	348 Rf rutherfordium 104	349 Db dubnium 105	350 Sg seaborgium 106	351 Bh bohrium 107	352 Mt meitnerium 109
355 Fr francium 87	356 Ra radium 88	357 Ac [*] actinium 89	358 Rf rutherfordium 104	359 Db dubnium 105	360 Sg seaborgium 106	361 Bh bohrium 107	362 Mt meitnerium 109
365 Fr francium 87	366 Ra radium 88	367 Ac [*] actinium 89	368 Rf rutherfordium 104	369 Db dubnium 105	370 Sg seaborgium 106	371 Bh bohrium 107	372 Mt meitnerium 109
375 Fr francium 87	376 Ra radium 88	377 Ac [*] actinium 89	378 Rf rutherfordium 104	379 Db dubnium 105	380 Sg seaborgium 106	381 Bh bohrium 107	382 Mt meitnerium 109
385 Fr francium 87	386 Ra radium 88	387 Ac [*] actinium 89	388 Rf rutherfordium 104	389 Db dubnium 105	390 Sg seaborgium 106	391 Bh bohrium 107	392 Mt meitnerium 109
395 Fr francium 87	396 Ra radium 88	397 Ac [*] actinium 89	398 Rf rutherfordium 104	399 Db dubnium 105	400 Sg seaborgium 106	401 Bh bohrium 107	402 Mt meitnerium 109
405 Fr francium 87	406 Ra radium 88	407 Ac [*] actinium 89	408 Rf rutherfordium 104	409 Db dubnium 105	410 Sg seaborgium 106	411 Bh bohrium 107	412 Mt meitnerium 109
415 Fr francium 87	416 Ra radium 88	417 Ac [*] actinium 89	418 Rf rutherfordium 104	419 Db dubnium 105	420 Sg seaborgium 106	421 Bh bohrium 107	422 Mt meitnerium 109
425 Fr francium 87	426 Ra radium 88	427 Ac [*] actinium 89	428 Rf rutherfordium 104	429 Db dubnium 105	430 Sg seaborgium 106	431 Bh bohrium 107	432 Mt meitnerium 109
435 Fr francium 87	436 Ra radium 88	437 Ac [*] actinium 89	438 Rf rutherfordium 104	439 Db dubnium 105	440 Sg seaborgium 106	441 Bh bohrium 107	442 Mt meitnerium 109
445 Fr francium 87	446 Ra radium 88	447 Ac [*] actinium 89	448 Rf rutherfordium 104	449 Db dubnium 105	450 Sg seaborgium 106	451 Bh bohrium 107	452 Mt meitnerium 109
455 Fr francium 87	456 Ra radium 88	457 Ac [*] actinium 89	458 Rf rutherfordium 104	459 Db dubnium 105	460 Sg seaborgium 106	461 Bh bohrium 107	462 Mt meitnerium 109
465 Fr francium 87	466 Ra radium 88	467 Ac [*] actinium 89	468 Rf rutherfordium 104	469 Db dubnium 105	470 Sg seaborgium 106	471 Bh bohrium 107	472 Mt meitnerium 109
475 Fr francium 87	476 Ra radium 88	477 Ac [*] actinium 89	478 Rf rutherfordium 104	479 Db dubnium 105	480 Sg seaborgium 106	481 Bh bohrium 107	482 Mt meitnerium 109
485 Fr francium 87	486 Ra radium 88	487 Ac [*] actinium 89	488 Rf rutherfordium 104	489 Db dubnium 105	490 Sg seaborgium 106	491 Bh bohrium 107	492 Mt meitnerium 109
495 Fr francium 87	496 Ra radium 88	497 Ac [*] actinium 89	498 Rf rutherfordium 104	499 Db dubnium 105	500 Sg seaborgium 106	501 Bh bohrium 107	502 Mt meitnerium 109
505 Fr francium 87	506 Ra radium 88	507 Ac [*] actinium 89	508 Rf rutherfordium 104	509 Db dubnium 105	510 Sg seaborgium 106	511 Bh bohrium 107	512 Mt meitnerium 109
515 Fr francium 87	516 Ra radium 88	517 Ac [*] actinium 89	518 Rf rutherfordium 104	519 Db dubnium 105	520 Sg seaborgium 106	521 Bh bohrium 107	522 Mt meitnerium 109
525 Fr francium 87	526 Ra radium 88	527 Ac [*] actinium 89	528 Rf rutherfordium 104	529 Db dubnium 105	530 Sg seaborgium 106	531 Bh bohrium 107	532 Mt meitnerium 109
535 Fr francium 87	536 Ra radium 88	537 Ac [*] actinium 89	538 Rf rutherfordium 104	539 Db dubnium 105	540 Sg seaborgium 106	541 Bh bohrium 107	542 Mt meitnerium 109
545 Fr francium 87	546 Ra radium 88	547 Ac [*] actinium 89	548 Rf rutherfordium 104	549 Db dubnium 105	550 Sg seaborgium 106	551 Bh bohrium 107	552 Mt meitnerium 109
555 Fr francium 87	556 Ra radium 88	557 Ac [*] actinium 89	558 Rf rutherfordium 104	559 Db dubnium 105	560 Sg seaborgium 106	561 Bh bohrium 107	562 Mt meitnerium 109
565 Fr francium 87	566 Ra radium 88	567 Ac [*] actinium 89	568 Rf rutherfordium 104	569 Db dubnium 105	570 Sg seaborgium 106	571 Bh bohrium 107	572 Mt meitnerium 109
575 Fr francium 87	576 Ra radium 88	577 Ac [*] actinium 89	578 Rf rutherfordium 104	579 Db dubnium 105			

* 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.