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A216/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 2 Modules B5 C5 P5 (Higher Tier)

WEDNESDAY 18 JUNE 2008

Afternoon
Time: 40 minutes

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

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

CUP/T44370

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 blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- 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	4	
4	4	
5	7	
6	3	
7	4	
8	5	
9	5	
TOTAL	42	

This document consists of **18** printed pages and **2** blank pages.

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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 × time for which it acts

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

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

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Question 1 starts on page 4

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Answer **all** the questions.

1 This baby girl has just been born.

She is part of the human life cycle.

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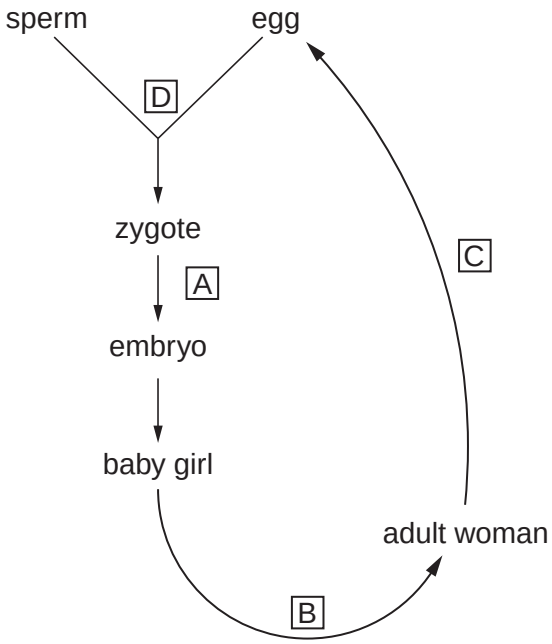

(a) At which stage, **A**, **B**, **C** or **D**, in the cycle does meiosis take place?

answer …… [1]

(b) The chromosome number in most human body cells is 46.

Put a ring around the number of chromosomes in human cells produced by meiosis.

2 **23** **46** **92** [1]

(c) Mitosis also takes place in the human life cycle.

What happens to the chromosome number when body cells divide by mitosis?

Put a ring around the correct answer.

doubles **halves** **quarters** **stays the same** [1]

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(d) One of the stages in the human life cycle is the formation of a zygote.

Put ticks (✓) in the boxes to show if the statements about the zygote are **true** or **false**.

The zygote contains …	**true**	**false**
… a unique combination of chromosomes.		
… a set of chromosomes from each parent.		
… only chromosomes from the mother.		
… twice the number of chromosomes found in the sperm.		
… half the number of chromosomes found in the egg.		

[2]

[Total: 5]

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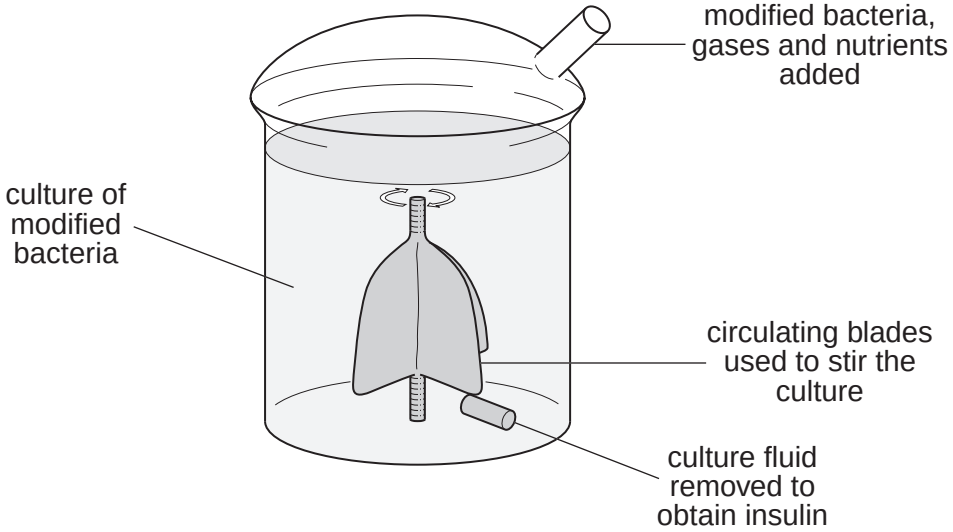
2 This question is about **genetic engineering**.

Bacteria have been modified by scientists so that they produce insulin.

These bacteria are grown in fermenters.



(a) Complete the following sentences.

Choose words from the list.

amino acids	**bases**	**fatty acids**	**proteins**	**sugars**

Bacteria that have not been modified cannot produce insulin. This is because their DNA does not have the correct sequence of …… .

Human DNA is added to the bacteria so that they make insulin by putting the …… in the correct order. [2]

(b) Most human cells cannot produce insulin.

What is the reason for this?

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

Human cells must remain unspecialised to produce insulin. ☐

Different cells in the body contain different genes. ☐

Some genes are not active in different human cells. ☐

All cells in the body contain the same genes. ☐ [1]

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(c) It is now possible to create **human** tissue cultures using embryonic stem cells.

The cultures can be used to make insulin commercially.

This technique is successful for a number of reasons.

Put ticks (✓) in the boxes to show if each reason is **true** or **false**.

reason	true	false
Embryonic stem cells are unspecialised.		
Embryonic stem cells grow rapidly.		
Some of the genes in the embryonic stem cells are switched on by the process.		
Genes coding for the production of insulin are added to the embryonic stem cells.		

[2]

[Total: 5]

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3 Peter is studying the growth of plants.

(a) He examines the tissues inside a plant shoot and finds the **meristem**.

What is the function of the meristem?

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

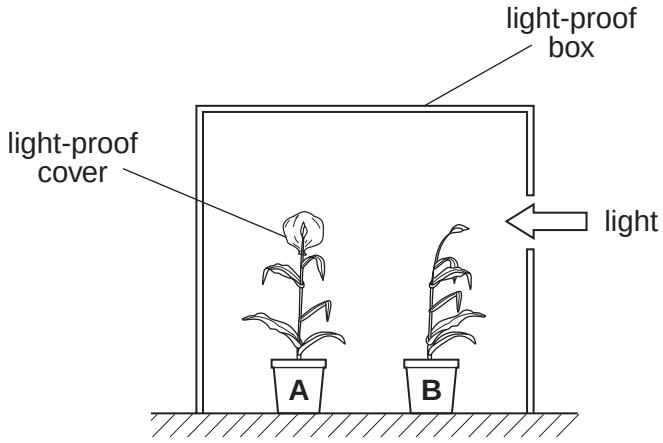
production of cells	☐
site of photosynthesis	☐
storage of food	☐
transport of water	☐

[1]

(b) He then does an experiment to show the link between **auxin** and shoot growth.

He puts two young plants in a box for 3 days.

Look at the diagram.



Auxin is produced at the tip of the plant shoots.

What is the distribution of auxin in the shoots at the end of the experiment?

Put a tick (✓) in the correct box for shoots **A** and **B**.

shoot	more auxin in the side nearest the light	more auxin in the side away from the light	auxin in equal amounts on both sides
A			
B			

[2]

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(c) Peter takes a cutting from another plant and dips the cut surface in rooting powder containing auxins.

Complete the sentences.

Choose words from the list.

enzyme	**fertiliser**	**hormone**
inactive	**specialised**	**unspecialised**

Auxins are a type of plant …… .

Auxins can change …… cells into xylem and phloem cells. [1]

[Total: 4]

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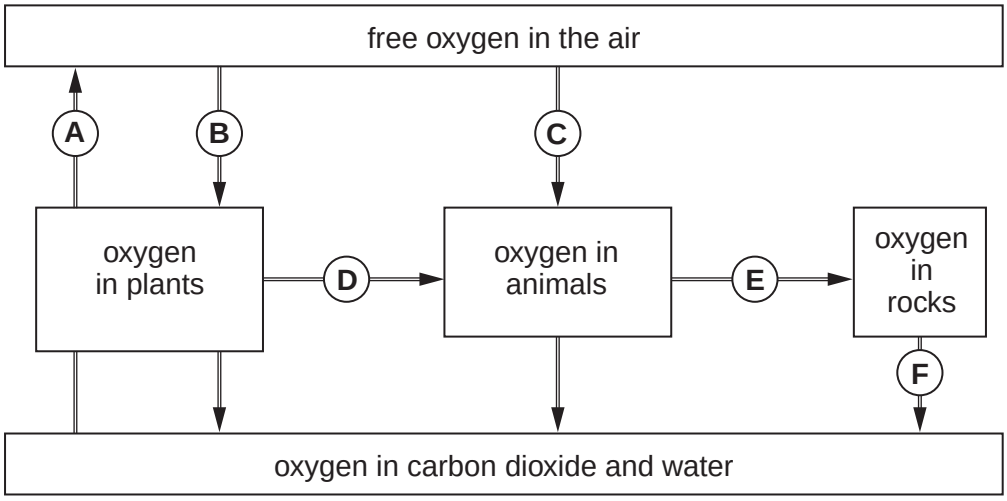
4 Tony draws a diagram of an oxygen cycle.



(a) Most of these stages take place fairly quickly.

Which stage, **A**, **B**, **C**, **D**, **E** or **F**, is most likely to keep the oxygen out of the air for millions of years?

answer ..... [1]

(b) Give the letter for **one** stage which removes oxygen from the air. .....

Give the letter for **one** stage which puts oxygen into the air. ..... [1]

(c) Oxygen gas is removed from the air when carbon burns to form carbon dioxide, CO_2.

How much carbon dioxide is formed when 12 g of carbon burns?

(relative atomic mass: C = 12, O = 16)

Put a (ring) around the correct answer.

28 g **32 g** **44 g** **56 g**

[1]

(d) Another substance which removes oxygen gas from the air is methane, CH_4.

Put numbers in the boxes to balance the equation for this reaction.

$$CH_4 + \square\ O_2 \rightarrow \square\ H_2O + CO_2$$

[1]

[Total: 4]

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5 We dig millions of tonnes of rock from the surface of the Earth.

(a) What is this part of the Earth called?

Put a ring around the correct answer.

atmosphere **biosphere** **hydrosphere**

lithosphere **troposphere** [1]

(b) Sometimes compounds from this rock are melted and then electrolysed to produce a metal.

Put a ring around each of the **two** of these substances which, when melted, can be electrolysed to produce metals.

aluminium oxide **carbohydrate** **DNA**

protein **silicon dioxide** **sodium chloride** [2]

(c) Other compounds can be heated with carbon to extract the metal.

Put ticks (✓) in the **two** correct boxes to show what happens in this reaction.

The metal compound is oxidised.	☐
The metal compound is reduced.	☐
The carbon is oxidised.	☐
The carbon is reduced.	☐

[1]

(d) What can you say about the metals which can be extracted in this way?

Choose the **best** answer from **A**, **B**, **C** or **D**.

A They are totally unreactive.

B They are less reactive than carbon.

C They are just as reactive as carbon.

D They are more reactive than carbon.

answer ..... [1]

(e) Which metals can be extracted by heating their ore with carbon?

Put a ring around each correct answer.

aluminium **copper** **sodium** **zinc** [1]

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(f) Several reactions take place when iron is extracted from its ore.

Put numbers in the boxes to balance the equation for this reaction.

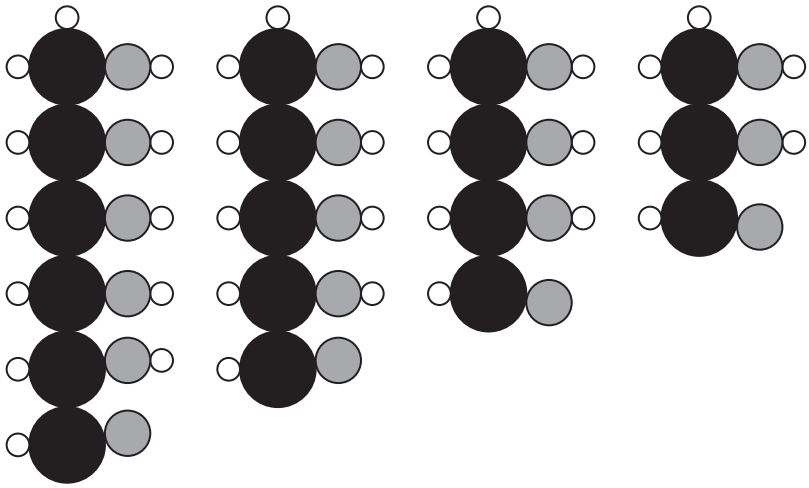
Fe_3O_4 + ☐ C → ☐ Fe + ☐ CO_2

[1]

[Total: 7]

6 There are different types of sugar.

Here are diagrams of four of them.



A **B** **C** **D**

(a) Which sugar, **A**, **B**, **C** or **D**, has the formula $C_4H_8O_4$?

answer …… [1]

(b) Sometimes we use the letter 'n' for a number in a formula.

Put a (ring) around each formula which applies to **all** these sugars.

$(CH_2O)_n$ **$C_nH_{2n}O_n$** **C_nH_2O** **$C_5H_nO_5$** **$C_6H_{12}O_n$**

[2]

[Total: 3]

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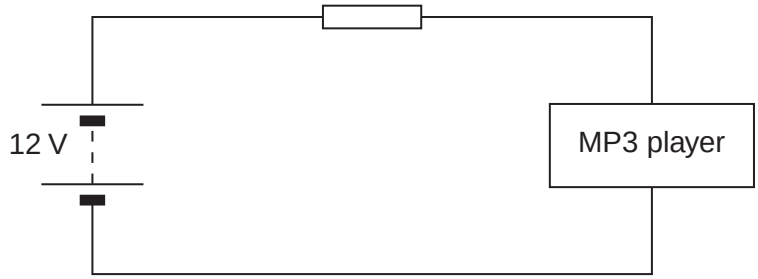
7 Jo likes to listen to her MP3 player in the car.

She uses this circuit to connect her MP3 player to the 12 V car battery.



(a) When the MP3 player is switched on, the potential difference across it is 1.5 V and the current in it is 0.05 A.

What is the power of her MP3 player?

Put a (ring) around the correct answer.

0.033 W **0.075 W** **30 W** [1]

(b) Complete the sentences. Choose words from the list.

charge **power** **resistance** **temperature** **voltage**

The resistor resists the flow of …… through the MP3 player.

This results in an increase in …… for the resistor. [2]

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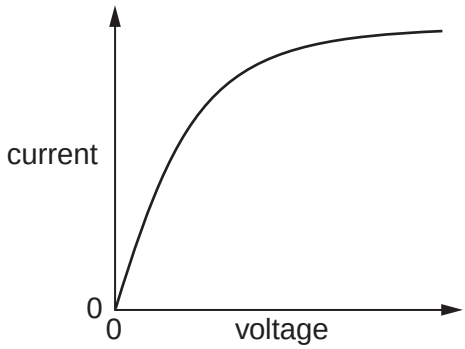
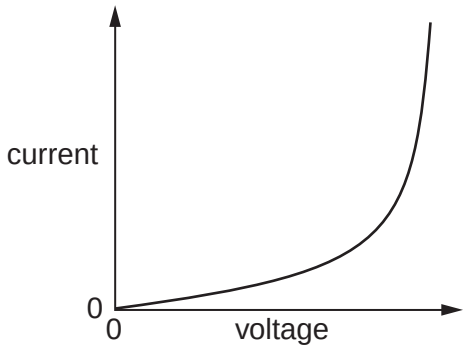
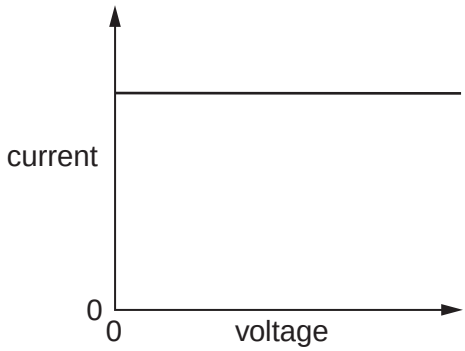
(c) Which of these graphs, **A**, **B**, **C** or **D**, shows how the current in the resistor depends on the voltage across it?



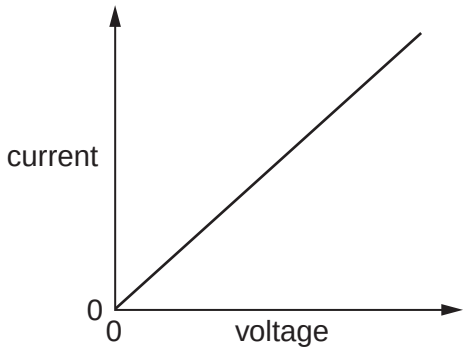
A



B



C



D

answer …… [1]

[Total: 4]

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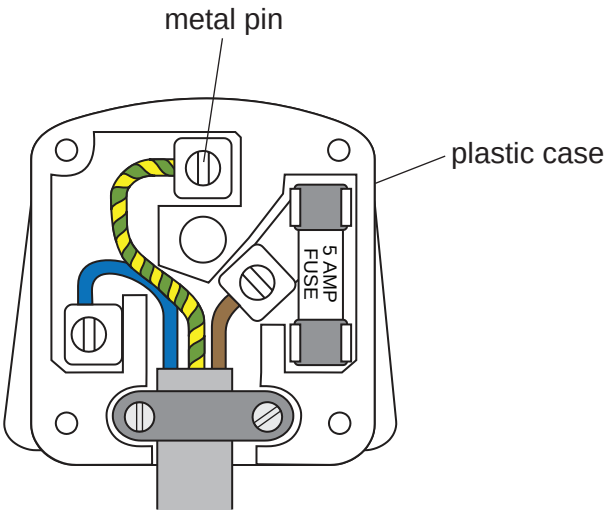
8 Julie investigates the mains plug on her computer.



(a) The fuse contains a piece of wire which melts when the current is greater than 5 A.

Put a tick (✓) in the box next to the correct explanation of this heating effect.

The heating effect of the fuse wire is caused by ...

... emission of moving electrons by stationary atoms. ☐

... absorption of moving electrons by stationary atoms. ☐

... collisions between moving electrons and stationary atoms. ☐

[1]

(b) Julie calculates the **maximum power** she can draw from a mains socket using the plug.

Which of these is the correct calculation?

Put a (ring) around the correct answer.

$\frac{230}{5}$ $\quad$ 230×5 $\quad$ $\frac{5}{230}$ $\quad$ $\frac{50}{5}$ $\quad$ 50×5

[1]

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(c) Complete the sentences.

Choose words from the list.

atoms	**conductors**	**current**	**electrons**
insulators	**ions**	**resistance**	**voltage**

The metal pins on the plug are …… .

This is because they contain free …… .

They have a low …… . [3]

[Total: 5]

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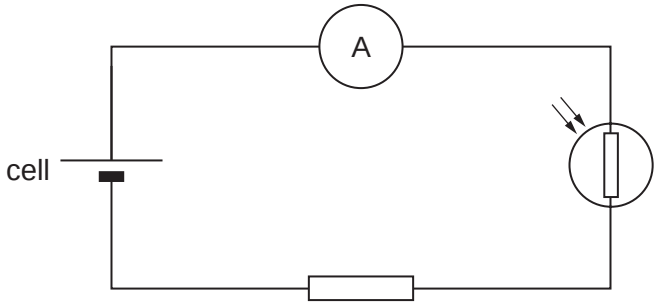
9 Daniel builds this circuit. It contains an LDR.



(a) Daniel needs to measure the potential difference across the LDR.

To do this he adds a meter to the circuit.

Draw on the circuit diagram to show the meter connected correctly. [1]

(b) Daniel increases the amount of light on the LDR.

The sentences explain how this affects the ammeter reading.

They are **not** in the correct order.

A The current in the circuit increases.

B The resistance of the LDR decreases.

C There are more free electrons in the LDR.

Fill in the boxes to show the correct order.

[2]

(c) The voltage across the cell is **1.5 V**.

When the voltage across the LDR is 0.5 V, what is the voltage across the resistor?

Put a (ring) around the correct answer.

0 V **0.5 V** **1.0 V** **1.5 V** **2.0 V** [1]

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(d) Daniel replaces the cell with two cells in parallel.

Complete the sentence.

Choose from this list.

bigger than **smaller than** **the same as**

The current in the circuit is now …… it was for just one cell.

[1]

[Total: 5]

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.

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