



RECOGNISING ACHIEVEMENT

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A217/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 3 Modules B6 C6 P6 (Higher Tier)

FRIDAY 20 JUNE 2008

Morning

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 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	4	
2	5	
3	5	
4	4	
5	7	
6	3	
7	4	
8	2	
9	1	
10	3	
11	4	
TOTAL	42	

This document consists of 19 printed pages and 1 blank page.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

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

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

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

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

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

Electric Circuits

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

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

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

$$\text{power} = \text{potential difference} \times \text{current}$$

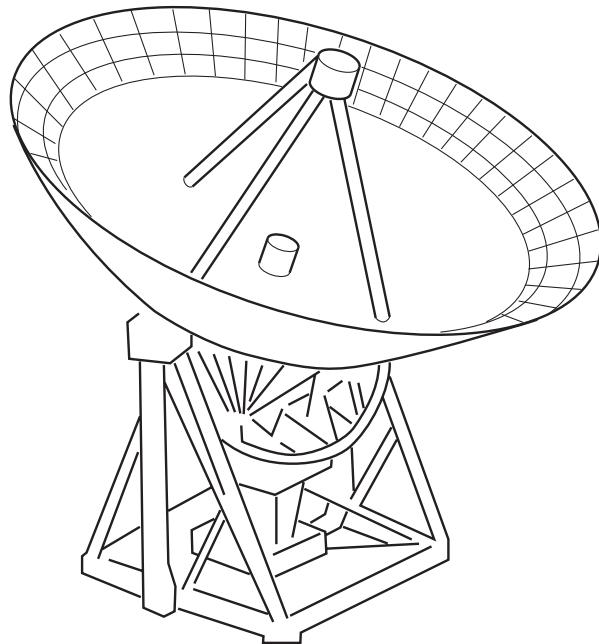
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

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

Answer **all** the questions.

1 Large metal dishes receive radio waves from satellites in space.



(a) Here are some reasons why radio waves are used to communicate with satellites in space.

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

Radio waves are ...

... not absorbed by the atmosphere.

... able to travel through empty space.

... safer than other electromagnetic waves.

... the fastest of the electromagnetic waves.

... more powerful than other electromagnetic waves.

[2]

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

speed direction induction

amplitude frequency modulation

Information is put into radio waves by altering their or

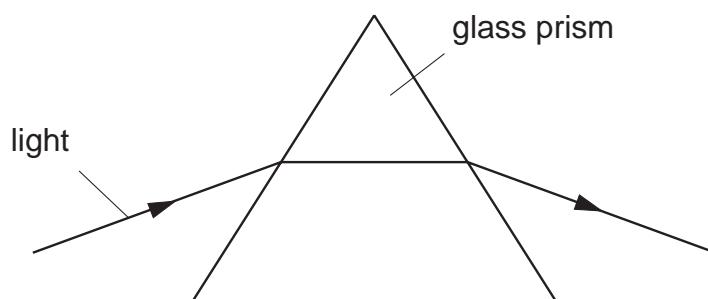
This process is called

[2]

[Total: 4]

[Turn over

2 This diagram shows a beam of light passing through a glass prism.



(a) What does the diagram show?

Put a (ring) around the correct answer.

diffraction

interference

reflection

refraction

[1]

(b) The light changes direction as it enters the glass.

Complete the sentences. Choose words from this list.

Each word may be used once, more than once or not at all.

decreases

increases

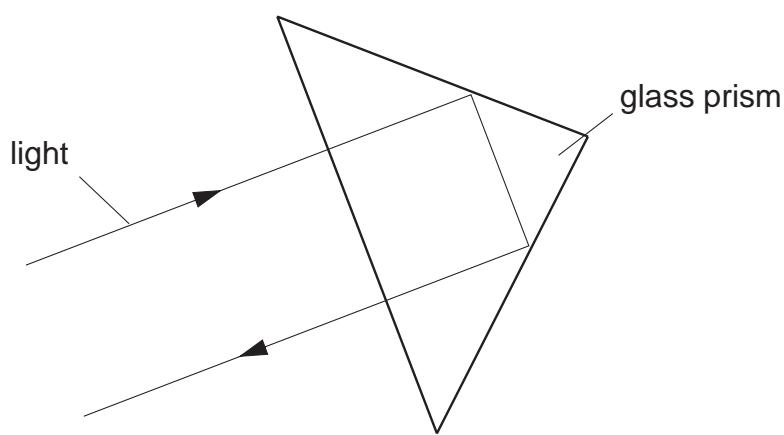
doesn't change

The speed of the light as it passes from air to glass.

The frequency of the light, so the wavelength

[3]

(c) A different glass prism is used, changing the path followed by the beam of light.



The light is totally internally reflected twice before it leaves the glass again.

Put a tick (✓) in the box next to the correct reason for this.

The light is reflected because ...

... the angle of reflection is exactly 45°.

... the angle of reflection is less than 90°.

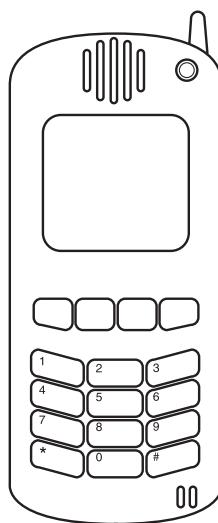
... the angle of refraction would be less than 90°.

... the angle of refraction would be greater than 90°.

[1]

[Total: 5]

3 A mobile phone transmits sounds as digital signals, using radio waves.



(a) The sentences describe the process of transmitting sounds with digital signals. They are in the wrong order.

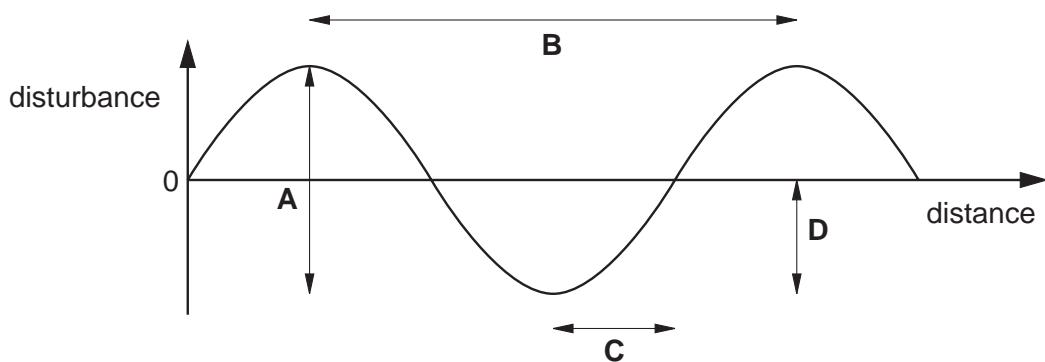
- A The signal is cleaned up at the receiver.
- B The sound wave is converted into a digital code.
- C The signal is decoded to produce a copy of the sound wave.
- D The code controls the amplitude of radio waves from the phone.

Fill in the boxes to show the correct order. The last one has been done for you.

			C
--	--	--	---

[2]

(b) Here is a disturbance-distance graph for a radio wave.



Which distance, **A**, **B**, **C** or **D**, is the amplitude of the wave?

answer [1]

(c) Why is digital transmission of sound with radio waves of higher quality than analogue transmission?

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

A digital signal can usually be separated from noise in a radio signal.

An analogue signal has the same frequency as the original sound.

A radio signal decreases in amplitude as it travels.

Radio signals pick up noise as they pass from transmitter to receiver.

The radio signal has to be amplified at the receiver before it is decoded.

[2]

[Total: 5]

4 Like many animals, pond snails use their nervous system to detect and respond to changes in their environment.



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(a) Complete the following sentences. They compare pond snails and humans.

Choose words from this list.

complex involuntary unhelpful reflexes tropisms

Pond snails use simple to find food.

Humans respond better than snails to a new situation because their behaviour is

Both humans and snails respond to bright light. This response is

[2]

(b) The pond snail's nervous system contains both receptors and effectors.

Which cells are effectors, which are receptors, and which are neither?

Put a tick (✓) in the correct box for each type of cell.

type of cell	effectors	receptors	neither effectors nor receptors
muscle cells			
egg cells			
slime-secreting cells			
light-sensitive cells			

[2]

[Total: 4]

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Question 5 starts on page 10.

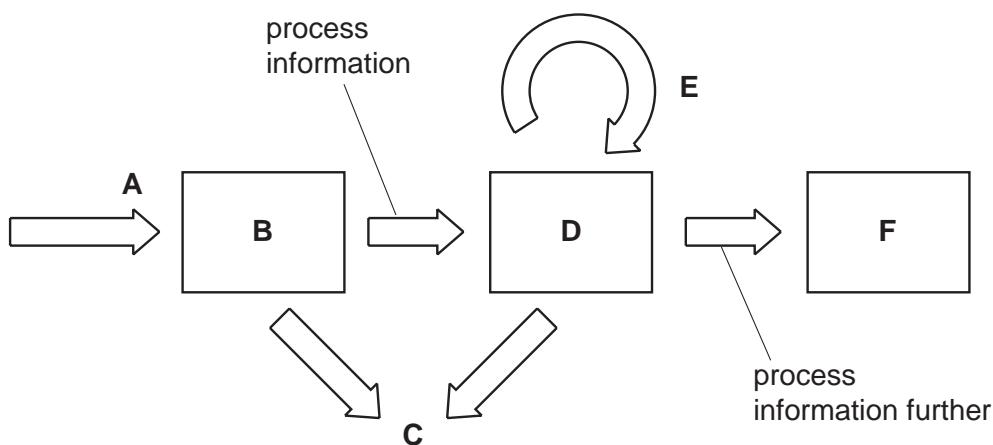
PLEASE DO NOT WRITE ON THIS PAGE

10

5 Humans can store and retrieve information. This is called memory.

(a) Scientists have created models for memory.

The diagram shows one example, the **multi-store model**.



There are several stages in this process.

Write the correct letter, **A**, **B**, **C**, **D**, **E** or **F**, in the box next to each stage.

stage in the model	letter
environmental stimuli are received	
information is lost	
long term memory	
sensory memory store	
information is rehearsed	
short term memory	

[2]

(b) Remembering information is an important part of our lives.

Finish the sentences. Choose words from this list.

Each word may only be used once.

memory pattern repetition shape smell

We are more likely to remember information if it has a

It also helps if the information is associated with a stimulus, such as

Memory is reinforced when there is of the information.

[3]

(c) Where do we process memories?

Put a **ring** around the correct answer.

cerebral cortex

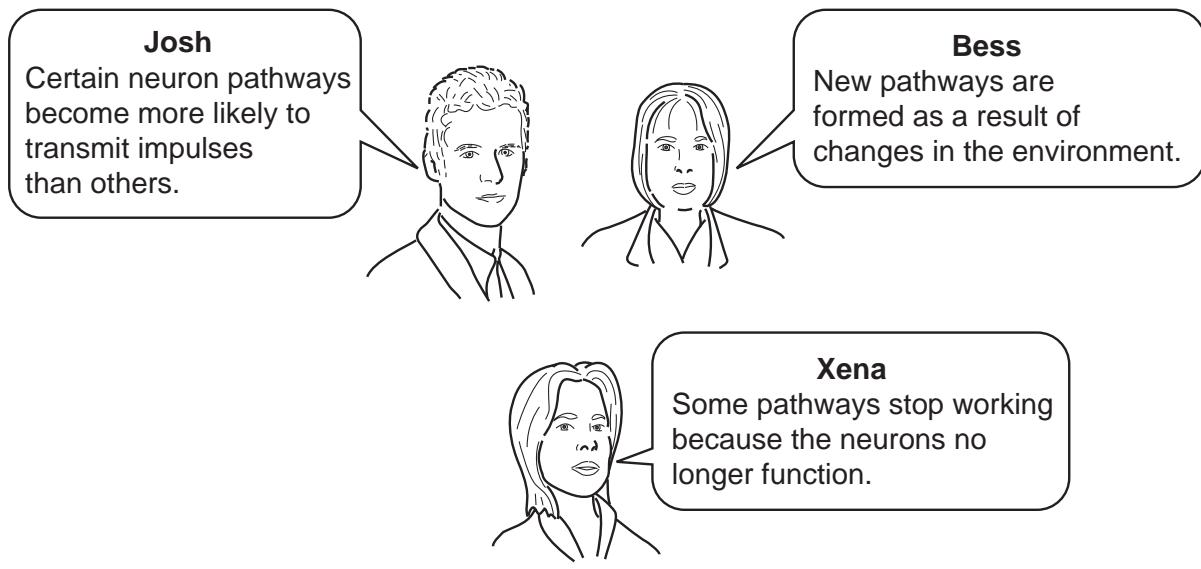
hypothalamus

pituitary gland

spinal cord

[1]

(d) Three people were asked to describe the way in which neuron pathways operate to retain memory.



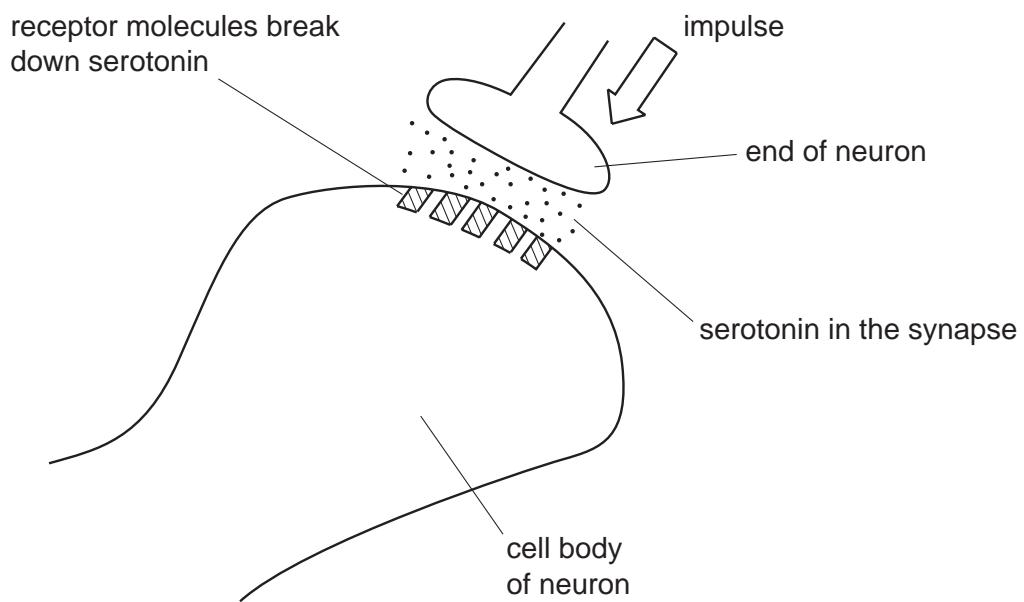
Who gave the **wrong** description of the retention of memory?

answer

[1]

[Total: 7]

6 Neurons use chemical and electrical methods for transmitting impulses.



(a) The diagram shows a synapse between two neurons.

Here are some statements about synapses.

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

Synapses weaken the strength of impulses.

Synapses slow down transmission of impulses.

A synapse closes up when each impulse arrives.

Synapses only allow impulses to travel in one direction.

Increasing the gap in a synapse speeds up the transmission of impulses.

[2]

13

(b) Serotonin is a chemical found in some brain synapses.
Serotonin is broken down by receptor molecules.
The drug Ecstasy blocks the action of the receptor molecules, resulting in a feeling of well-being.

Here are some possible explanations for this effect.

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

The level of ...

... serotonin falls.

... Ecstasy increases.

... serotonin increases.

... Ecstasy stays the same.

... serotonin stays the same.

[1]

[Total: 3]

7 Baking powder contains small grains of a solid acid and a solid alkali. When you put baking powder into water it starts to fizz slightly.

(a) Which **solid acid** could be used to make baking powder?

Put a **ring** around the correct answer.

ethanoic acid

hydrogen chloride

nitric acid

sulfuric acid

tartaric acid

[1]

(b) Baking powder doesn't react until water is added.

Angela discusses reasons for this with her friends.



Who gives the correct reason why the reaction only happens when water is added?

answer [1]

15

(c) Which particles are produced when an acid dissolves in water?

Put a (ring) around the correct answer.

H₂ H H⁺ OH⁻

[1]

(d) When acids react with metals they give off a gas.

Put a (ring) around the formula of this gas.

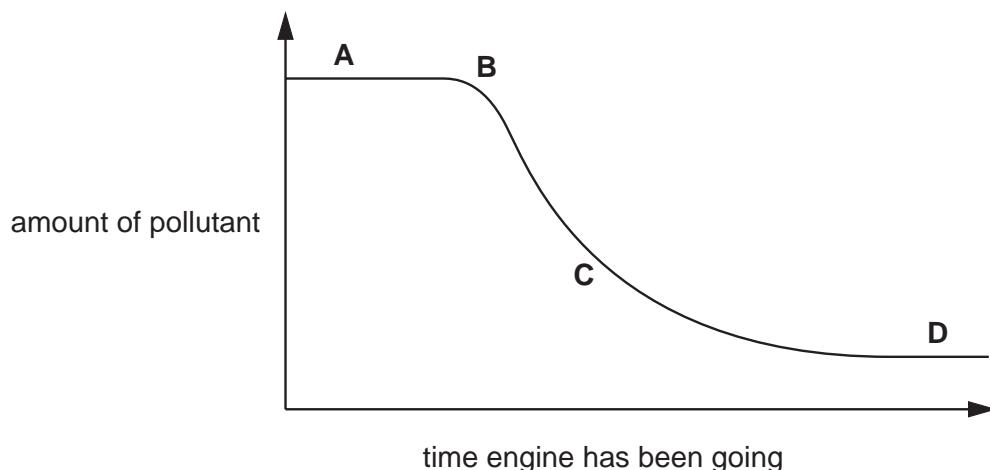
H₂ CO₂ O₂ N₂

[1]

[Total: 4]

8 The catalytic converter on a car normally converts most of the pollutants into harmless gases.

The operation of the catalyst depends on its temperature.



The graph shows the amount of pollutant that comes from a car exhaust. Four points have been labelled **A**, **B**, **C** and **D**.

(a) When is the catalyst operating at its optimum temperature?

Put a **(ring)** around the correct letter.

A B C D

[1]

(b) Here are some statements about a catalyst.

Draw **one** straight line from the correct **statement about the catalyst** to the correct **amount of pollutant**.

statement about the catalyst
(choose one)

It increases the rate of reaction.

amount of pollutant
(choose one)

The same amount of pollutant is converted to harmless gases.

It doesn't affect the rate of reaction.

More pollutant is converted to harmless gases.

It decreases the rate of reaction.

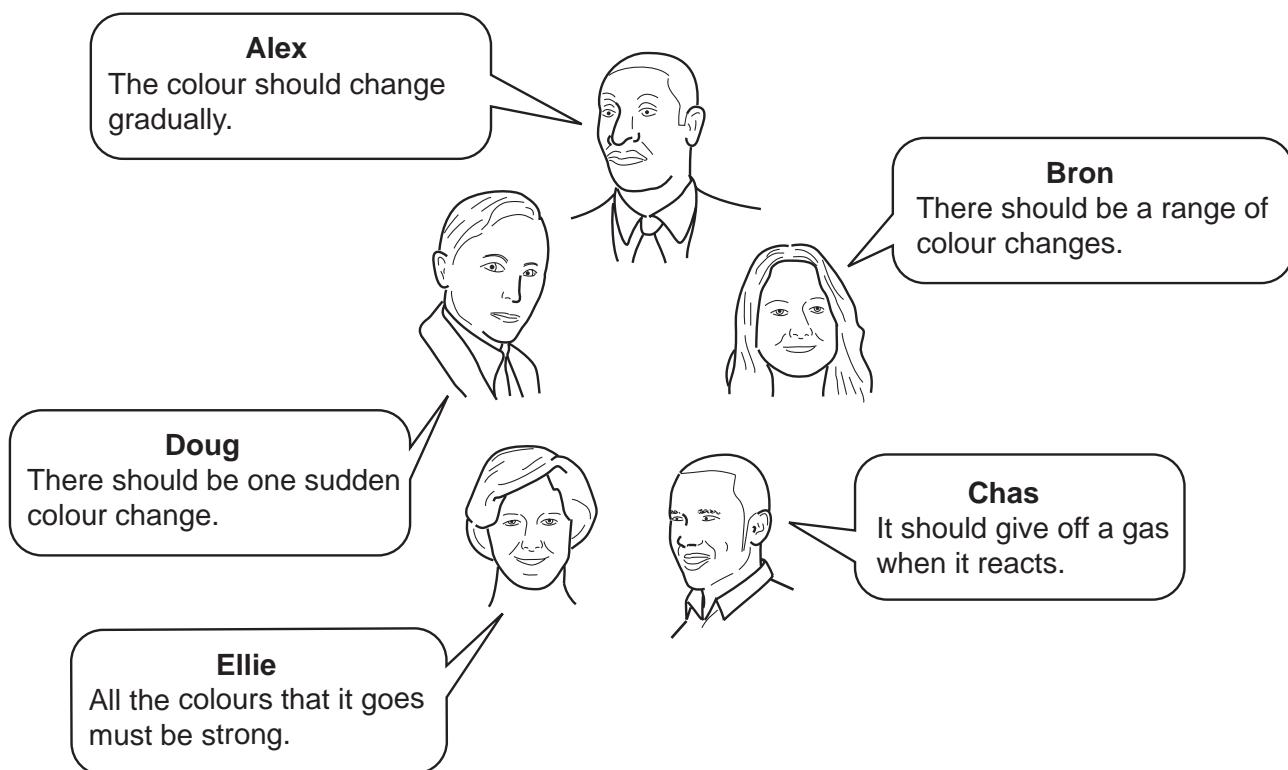
Less pollutant is converted to harmless gases.

[1]

[Total: 2]

9 Mary needs to choose an indicator for an acid-alkali titration.

She asks some friends for advice about the indicator.



Who gives the **best** advice?

answer [1]

[Total: 1]

10 Here are the equations for the reactions between some solutions of acids and alkalis.

(a) Which of these equations is **not** balanced?

A $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 B $\text{H}_2\text{SO}_4 + \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
 C $2\text{HCl} + \text{Mg(OH)}_2 \rightarrow \text{MgCl}_2 + 2\text{H}_2\text{O}$
 D $\text{H}_2\text{SO}_4 + \text{Mg(OH)}_2 \rightarrow \text{MgSO}_4 + 2\text{H}_2\text{O}$

answer [1]

(b) Arthur writes an equation to show what happens when **any** acid neutralises **any** base.

A $\text{H}^- + \text{OH}^+ \rightarrow \text{H}_2\text{O}$
 B $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
 C $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 D $2\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$

Which of **A**, **B**, **C** or **D** is the correct equation?

answer [1]

(c) Arthur reacts solid lumps of calcium carbonate with hydrochloric acid. The lumps disappear into the liquid and a gas is given off.

Add state symbols to the equation for this reaction. Two have been done for you.



[1]

[Total: 3]

11 You can use relative atomic masses to work out reacting masses in an equation.

(a) Jane knows that the relative atomic mass of carbon is 12.

What does this tell her?

- A A carbon atom has 12 protons.
- B A carbon atom has 12 neutrons.
- C A carbon atom has 12 electrons.
- D A carbon atom has 12 times the mass of a hydrogen atom.

answer [1]

(b) Relative atomic masses can be used to work out amounts of reacting chemicals.

Here are some relative atomic masses: C = 12, O = 16, Fe = 56.

Fill in the boxes for this reaction. The first one has been done for you.



[3]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0
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 aluminum 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
85 Rb rubidium 37	88 Sr strontium 38	91 Y yttrium 39	93 Nb niobium 40	96 Mo molybdenum 41	101 Ru ruthenium 42	103 Rh rhodium 43	106 Pd palladium 45
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	190 Os osmium 75	192 Ir iridium 77
[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	[268] Mt meitnerium 109
[227] Rg roentgenium 111	[271] Ds darmstadtium 110	[271] 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