OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

A217/01

Unit 3 Modules B6 C6 P6
(Foundation Tier)

CUP/T60800

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)

Tuesday 27 January 2009
Afternoon

Duration: 40 minutes

A217701

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly 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 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, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks 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.
- This document consists of **20** pages. Any blank pages are indicated.

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

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

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

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

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

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

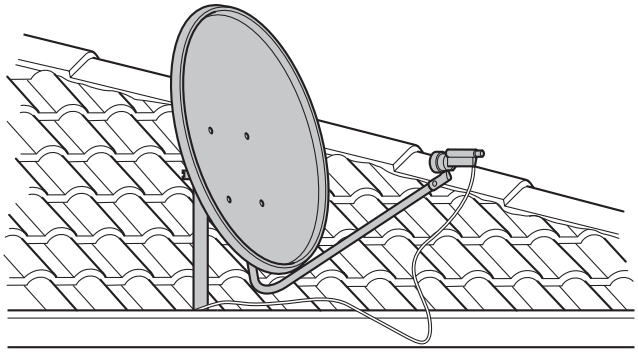
$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

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

Answer **all** the questions.

1 Microwaves carry signals from satellites to our homes through the atmosphere.



(a) Here are some other waves.

Which **one** also carries signals from satellites through the atmosphere?

Put a (ring) around the answer.

gamma **radio** **X-rays**

[1]

(b) A dish on the roof of a house guides the microwaves onto a receiver.

Complete the sentences.

Choose words from this list.

absorb **decreases** **doesn't change** **increases** **reflect** **refract**

As the microwaves travel through the atmosphere, their intensity …… .

The microwaves …… at the dish.

This process …… the intensity of the microwaves at the receiver.

[3]

(c) Other waves carry signals through optical fibres.

Which **one** of these waves carries signals through optical fibres?

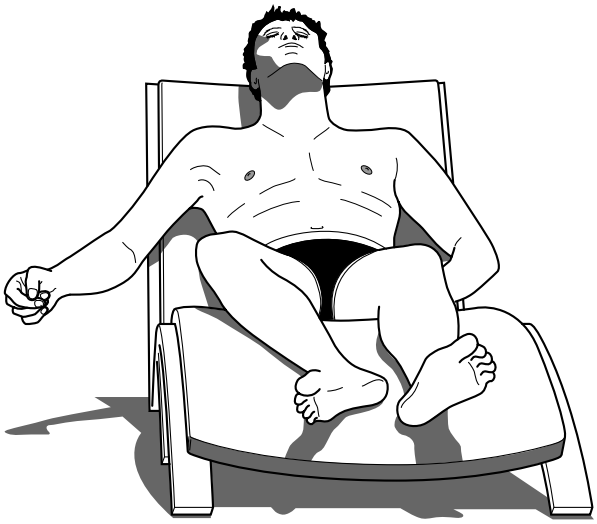
Put a (ring) around the answer.

infrared **radio** **ultraviolet** **X-rays**

[1]

[Total: 5]

2 Sam sunbathes on the beach.



(a) His skin absorbs photons of ultraviolet (UV) radiation.

Here is an incomplete diagram of the electromagnetic spectrum.

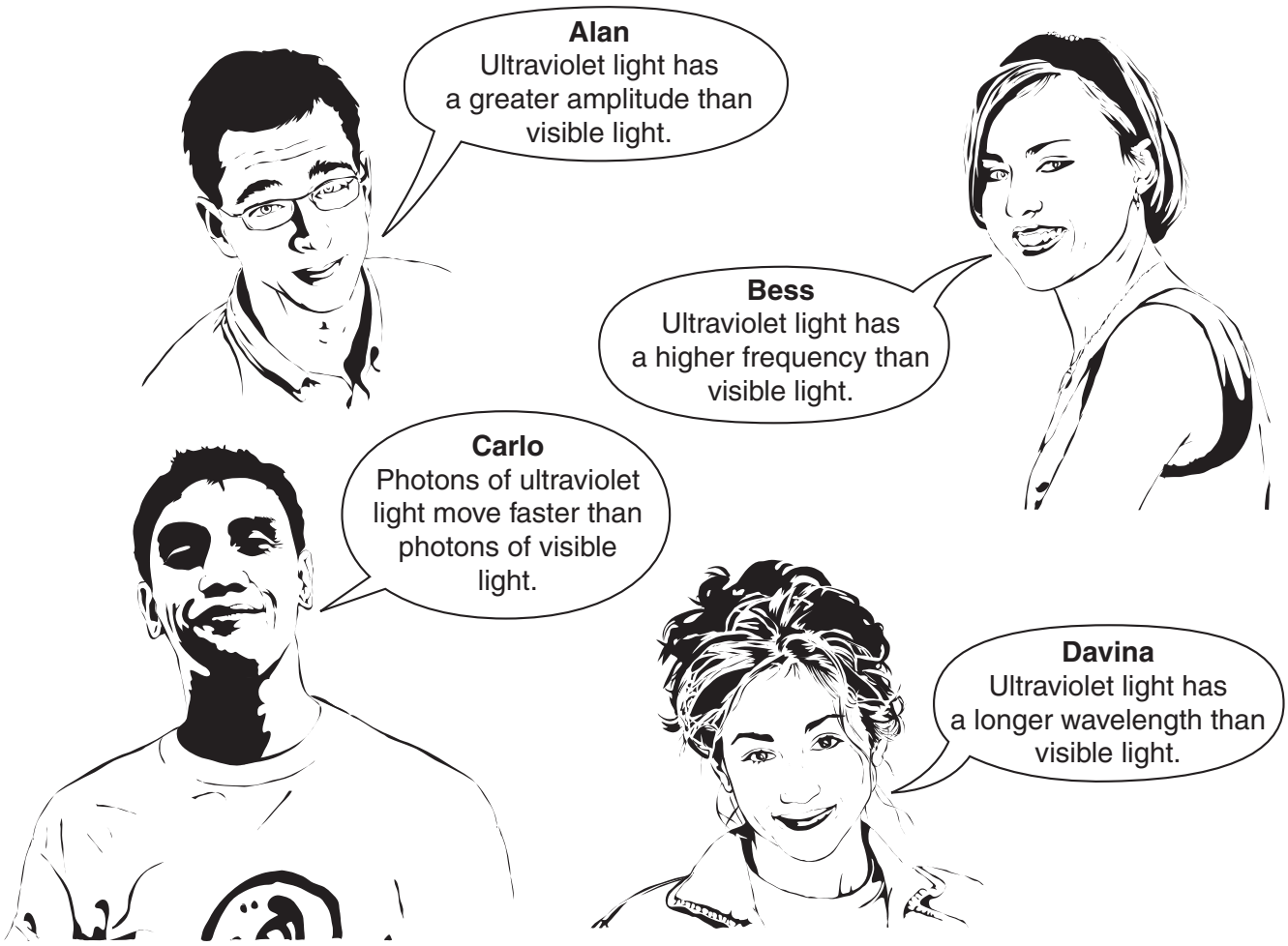
Write UV in the correct place.

	microwaves		visible		X-rays	

[1]

(b) Photons of ultraviolet light carry more energy than photons of visible light.

Sam asks his friends the reason why.



Which of his friends gives the correct reason?

answer ..... **[1]**

(c) Intensity and frequency are two different properties of sunlight.

Draw a straight line to link each **property** of sunlight to its correct **description**.

property	description
	the rate at which photons are absorbed
intensity	the number of waves emitted per second
frequency	the rate at which energy is delivered by photons
	the number of photons emitted per second

[2]

(d) Sound and UV are different types of wave.

Complete the sentences.

Choose words from this list.

Use each word **only once**.

air **empty space** **longitudinal** **transverse**

Sound is a …… wave which can't pass through …… .

UV is a …… wave. It can travel through …… .

[2]

[Total: 6]

3 Alfred looks at a compact disc (CD) in white light.

He notices that some parts of the disc appear blue. Other parts appear red.

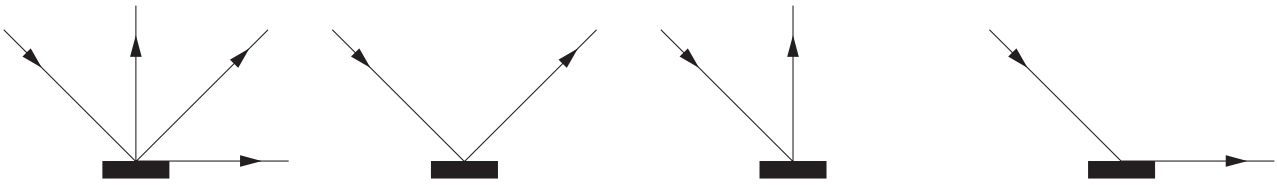
(a) Complete the sentence.

Choose a word from this list.

amplitude **intensity** **wavelength** **wave speed**

Red light has a different …… to blue light. **[1]**

(b) The CD contains billions of tiny mirrors. These reflect the white light.



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

Which **one** of the diagrams, **A**, **B**, **C** or **D**, shows light being **reflected** by a mirror?

correct diagram ..... **[1]**

(c) Complete each sentence by putting a (ring) around the correct word.

Waves of white light from different parts of the disc meet and add together.

This is called **absorption** **diffraction** **interference** **refraction**.

Waves reinforce when they arrive **in parallel** **in series** **in step** **out of step**.

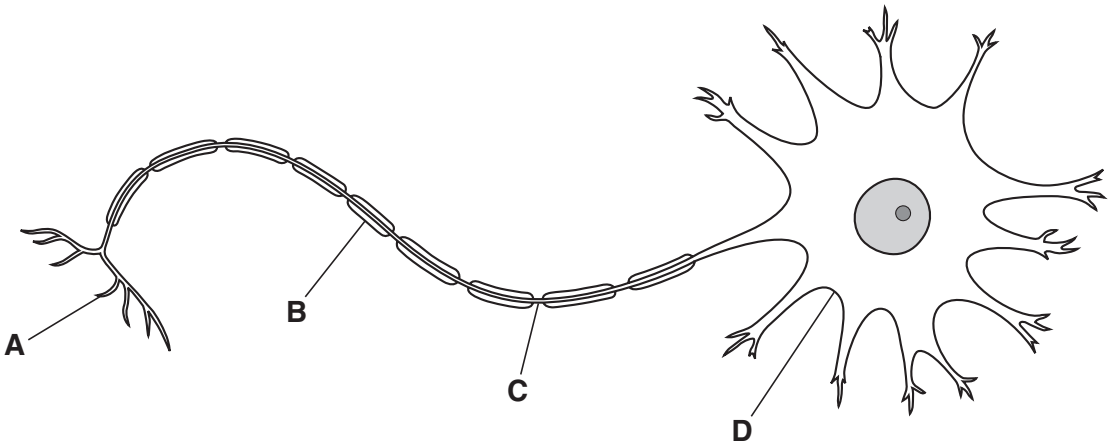
This **decreases** **doesn't change** **increases** the intensity of the wave.

[3]

[Total: 5]

4 Jo is learning about the nervous system.

(a) She looks at this diagram of a neuron.



(i) Which of the parts **A**, **B**, **C** or **D** is the axon?

answer ..... **[1]**

(ii) Which of the parts **A**, **B**, **C** or **D** is the fatty sheath?

answer ..... **[1]**

(b) How does a message travel along a neuron?

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

as a light ray ☐

as a sound wave ☐

as an electrical impulse ☐

[1]

(c) The nervous system coordinates an animal's reflex response to a stimulus.

The sentences show how Jo's eye responds to a bright light.

They are in the wrong order.

A A motor neuron carries a nerve impulse to the muscles in the iris.

B A sensory neuron carries a nerve impulse to the brain.

C Light enters the eye through the pupil.

D Muscles in the iris contract to make the pupil smaller.

Put the letters **A**, **B**, **C** and **D** in the correct order in the boxes. The first one has been done for you.

C			

[2]

(d) A reflex arc is made up of different parts.

Complete the sentences.

Use words from this list.

an effector **an impulse** **a motor** **a receptor** **a stimulus**

A change in the environment is detected by …… .

A response to the change is produced by …… .

[2]

[Total: 7]

5 A child's behaviour can be due to learning or reflex actions.

Draw a straight line from each example of **behaviour** to its **type of learning or reflex action**.

behaviour	**type of learning or reflex action**
remembering the three times table	simple reflex
a baby grasping his mother's finger	learning by experience
putting on a coat when cold	learning by repetition

[2]

[Total: 2]

6 Edward has Alzheimer's disease.

Sometimes he does not remember what day it is.

He can still remember the friends he had at school.

(a) Which of the sentences describe Edward's memory?

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

Edward's short term memory has been damaged.	☐
Edward's long term memory has been damaged.	☐
Remembering today's date is a long term memory.	☐
Remembering his school friends is a long term memory.	☐
Edward now has no memory at all.	☐

[2]

(b) Which part of the nervous system is concerned with memory?

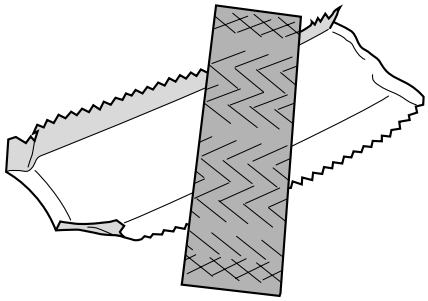
Put a tick (✓) in the correct box.

reflex arc	☐
spinal cord	☐
cerebral cortex	☐
peripheral nervous system	☐

[1]

[Total: 3]

7 Ann does an experiment with some chewing gum.



Here are the results.

what Ann does with the chewing gum	mass in g
weighs a stick of unchewed gum	8.0
weighs the same stick of gum after it has been chewed	3.0
weighs the same stick of chewed gum one week later	2.0

(a) Ann knows that a stick of gum contains several ingredients.

She knows that **pure** gum does not dissolve.

By the **end** of the experiment, what mass of ingredients had been removed?

Put a (ring) around the correct answer.

1 g **2 g** **3 g** **5 g** **6 g** **8 g**

[1]

(b) During the last week the gum got lighter.

Ann asks her friends why.

Who gives the **best** answer?

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

(c) Ann's results show that 8 g of fresh gum contains 2 g of pure gum.

What is the percentage of pure gum in a stick of fresh gum?

Put a (ring) around the correct answer.

16% **20%** **25%** **40%** **80%**

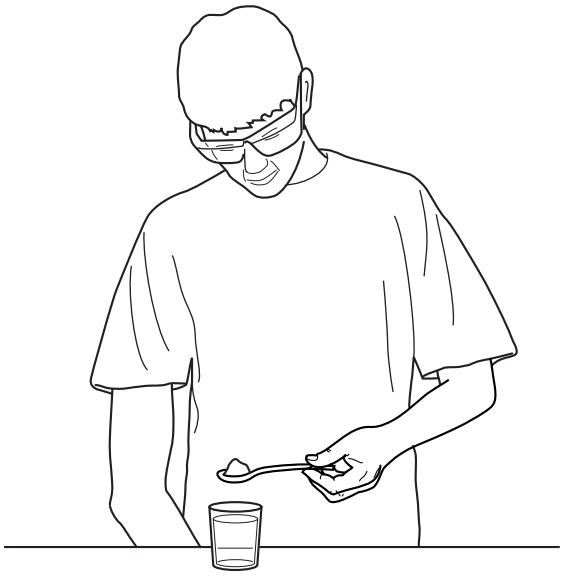
[1]

[Total: 3]

8 Tony has acid indigestion.

He knows that the sodium hydrogencarbonate, $NaHCO_3$, in his kitchen cupboard will react with acids.

He wonders if taking a spoonful will neutralise the acidity.



(a) Sodium hydrogencarbonate reacts with hydrochloric acid.

Fill in the boxes underneath the equation with the missing chemical names.

$NaHCO_3$ + HCl → H_2O + CO_2 + $NaCl$

sodium hydrogencarbonate	+	hydrochloric acid	→	water	+		+	

[2]

(b) Tony wonders how much acid reacts with a teaspoon of sodium hydrogencarbonate.

He weighs out a teaspoon full of sodium hydrogencarbonate and dissolves it in water.

He then carries out a titration.

Here are the stages of the process. They are in the wrong order.

A add indicator and stir

B stir in water to dissolve

C add acid from the burette

D swirl the flask

E weigh the solid sample

F look for a colour change

Write the correct order in the boxes. The first two have been done for you.

E	B				

[2]

(c) Tony writes down lots of readings during his titration.

A mass of conical flask

B volume of indicator added

C final reading on the burette

D initial reading on the burette

E mass of conical flask + sample

F mass of conical flask + solution

G volume of water poured into the conical flask

(i) Which **two** readings from **A** to **G** will tell him the mass of the sample that he used?

..... and ..... **[1]**

(ii) Which **two** readings from **A** to **G** will tell him the volume of acid used in the titration?

..... and ..... **[1]**

[Total: 6]

9 Chemical factories produce millions of tonnes of ammonia every year to make fertilisers.

Ammonia is a colourless gas made by the following reaction:

$$\text{nitrogen} + \text{hydrogen} + \text{iron} \longrightarrow \text{ammonia} + \text{iron}$$

(a) Complete the table to show

- any chemicals which are used up
- any chemicals which are produced
- any chemicals which act as catalysts.

chemical used up	chemical produced	catalyst

[2]

(b) When ammonia is being formed, the volume of gas decreases.

What could the engineers measure to tell how fast the ammonia is being formed?

Put a (ring) around the **best** answer.

They could measure:

change in colour

change in cloudiness

time for solid iron to disappear

change in pressure

change in surface area

[1]

(c) Engineers are trying to improve the reaction process.

Here are two possible changes in the process.

Draw one line from each **change** in the process to its **improvement**.

change	improvement
	less waste to dispose of
use a lower pressure	less acid rain is made
	vessels don't have to be as strong
re-cycle unreacted gases	less damage to the ozone layer
	less space is needed for the factory

[2]

[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.