Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
June 2007

APPLIED SCIENCE (DOUBLE AWARD) **APSC/2F**
Unit 2 Science for the Needs of Society
Foundation Tier

F

Wednesday 13 June 2007 9.00 am to 10.30 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use			
Question	Mark	Question	Mark
1		7	
2		8	
3		9	
4			
5			
6			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions in the spaces provided.

1 Environmental scientists study the composition of the Earth's atmosphere.

(a) The table shows the percentage composition of the Earth's atmosphere today.

Some data are missing.

Name of gas	Chemical formula	Percentage composition
Nitrogen		78.1
Oxygen	O_2	
	Ar	0.9
Carbon dioxide and other gases	CO_2	0.1

(i) Give the chemical formula for nitrogen.

.....

(1 mark)

(ii) Name the gas with the chemical formula Ar.

.....

(1 mark)

(iii) Calculate the percentage of oxygen in the atmosphere.

.....

.....

(2 marks)

(b) Two billion years ago the composition of the Earth's atmosphere was very different.

There was much more carbon dioxide and hardly any oxygen.

Complete the sentences by drawing a ring around the correct word in each box.

(i) Billions of years ago large amounts of carbon dioxide were released by

chimneys
plants
volcanoes

.

(1 mark)

(ii) Since then, the amount of oxygen in the atmosphere has been increased by

combustion
respiration
photosynthesis

.

(1 mark)

(iii) Today, the amount of carbon dioxide in the atmosphere is kept low by

combustion
respiration
photosynthesis

.

(1 mark)

(c) An environmental scientist was asked about global warming. This is what she said:

"The combustion of fossil fuels produces greenhouse gases and this is changing the composition of the atmosphere. Global warming will cause many problems in the future. The only solution is to burn less fossil fuel. We can do this by developing renewable energy resources."

(i) Name **one** fossil fuel.

.....

(1 mark)

(ii) Name a greenhouse gas produced by the combustion of fossil fuel.

.....

(1 mark)

(iii) Describe **one** problem that may be caused by global warming.

.....

.....

(1 mark)

(iv) Name **one** renewable energy resource.

.....

(1 mark)

11

2 Tuberculosis (TB) is an infectious disease.

Infection with TB in the UK steadily decreased in the last century.

Some of the reasons why are listed below.

- The use of streptomycin
- BCG vaccinations
- The use of radiography for early detection of the disease
- Better knowledge about how the disease is spread

Health workers are now worried that TB infection is increasing.

(a) TB is a disease caused by microorganisms.

(i) Name **one** other disease caused by microorganisms.

.....

(1 mark)

(ii) Give **one** way in which microorganisms enter the body.

.....

(1 mark)

(iii) Why do microorganisms make us feel ill when they are in the body?

.....

.....

(1 mark)

(iv) How do white blood cells protect us from infection by microorganisms?

.....

.....

(1 mark)

(b) A nurse is caring for a patient with TB.

Give **two** ways in which a nurse can protect herself and other patients from infection.

1 .....

2 .....

(2 marks)

(c) Streptomycin is a drug that kills bacteria.

(i) What name is given to this type of drug?

Draw a ring around the correct answer.

antibiotic **antidepressant** **anti-inflammatory** **antiseptic**

(1 mark)

(ii) Name **one** drug **other than** streptomycin that kills bacteria.

.....

(1 mark)

(iii) TB infection is increasing, and streptomycin does not work as well as it used to do.

Suggest why streptomycin does not work as well as it used to do.

.....

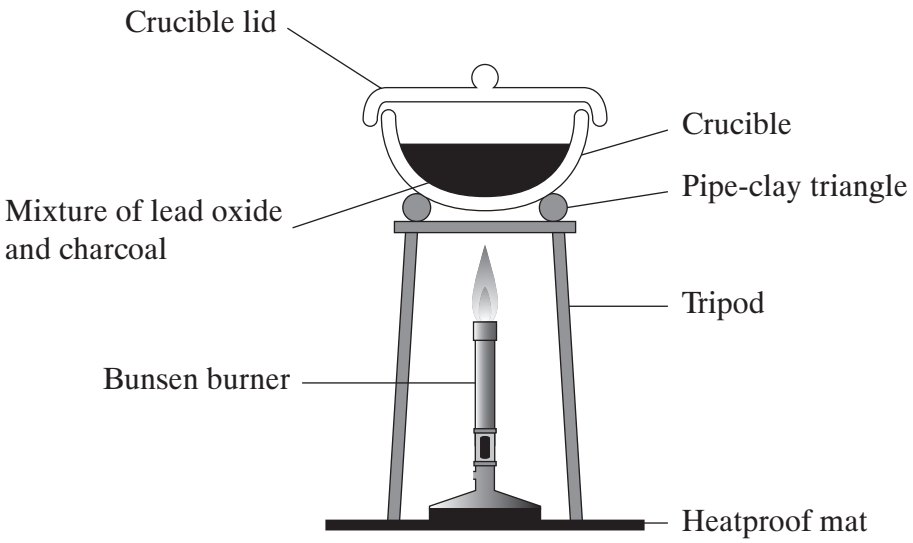
.....

(1 mark)

9

3 Lead is used in the construction industry and in the electronics industry.

Lead can be extracted from lead ore in the laboratory.



A mixture of lead ore and charcoal is heated in a crucible.

(a) The crucible is made from a ceramic material.

(i) Choose the property from the table that best explains why a ceramic material is a good choice for making the crucible.

Tick **one** box.

Brittle	
High melting point	
Low density	
Poor conductor of electricity	

(1 mark)

(ii) Crucibles may be made from other materials.

Select **one** other material that would be a good choice for making the crucible.

Tick **one** box.

Metal	
Polymer	
Wood	

(1 mark)

(b) Lead is extracted by heating a mixture of lead ore (lead oxide) and charcoal (carbon).

(i) Complete the word equation for this reaction.

Lead oxide + ... → lead + ...

(2 marks)

(ii) Name **one** other metal that can be extracted from its ore by heating with charcoal.

.....

(1 mark)

(c) Lead is used in the construction industry.

Lead flashing is used to cover gaps in a roof to make it waterproof.

Draw rings around **two** properties of lead that make it suitable for this job.

electrical conductor **heat conductor** **malleable** **shiny** **unreactive**

(2 marks)

(d) Lead alloy is used in the electronics industry.

(i) Draw a ring around the name of an alloy that is made from lead and tin.

brass **bronze** **solder** **steel**

(1 mark)

(ii) What is this alloy used for in the electronics industry?

.....

.....

(1 mark)

(iii) The alloy is a mixture containing 40% lead and 60% tin.

Calculate how much lead is needed to make 10 g of the alloy.

.....

.....

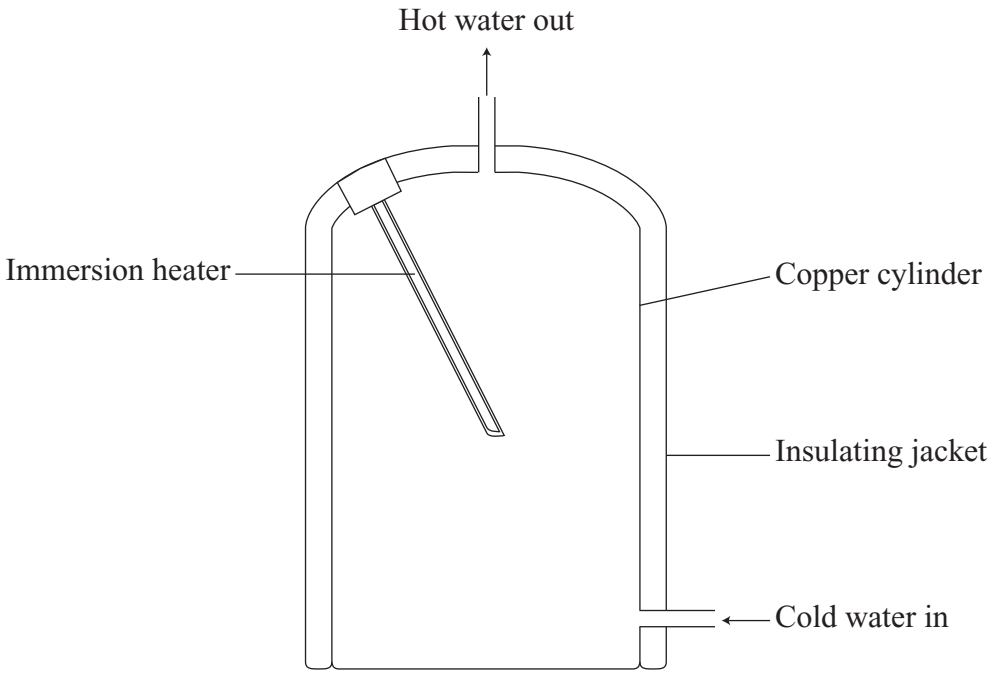
..... g of lead

(1 mark)

10

4 An electrician was asked to install a new electrical immersion heater in a hot water cylinder.

He installed an immersion heater with a power of 2700 watts (2.7 kilowatts).



(a) The electricity is supplied to the immersion heater with a potential difference of 230 volts.

Use the equation to calculate the current, in amps, flowing through the heater.

$$\text{Current (amps)} = \frac{\text{Power (watts)}}{\text{Potential difference (volts)}}$$

.....

.....

Current = ... amps

(2 marks)

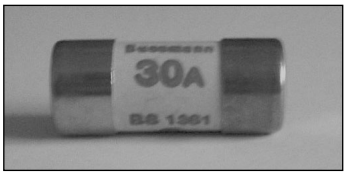
(b) The electrician chose a fuse to protect the immersion heater circuit from overheating.

(i) Tick the box next to the correct fuse.

☐

☐

☐



☐

(1 mark)

(ii) Use words from the box to explain how the fuse protects the circuit.

break	**connect**	**high**	**low**

A ..... current will flow if there is a fault.

This will ..... the fuse and cut off the electricity supply.

(2 marks)

(c) The electrician was asked about the cost of using the immersion heater.

The heater will be switched on for two hours each day.

(i) Use the equation to calculate the energy used by the immersion heater in kilowatt-hours per day.

Energy used (kilowatt-hours) = power (kilowatts) × time (hours)

.....

.....

Energy used = ... kilowatt-hours

(2 marks)

(ii) One kilowatt-hour of electricity costs 9p.

Calculate the cost of using the immersion heater each day.

.....

.....

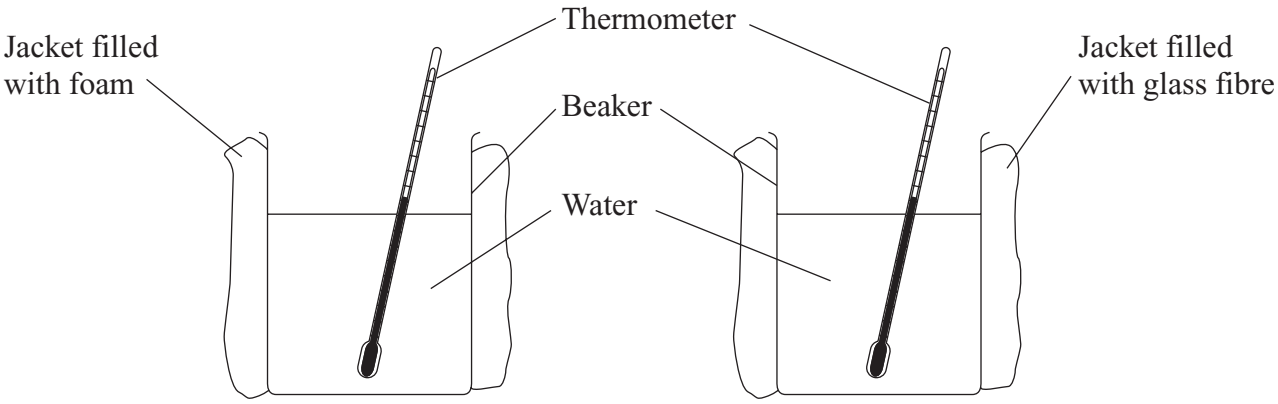
Cost = ... p

(2 marks)

(d) The hot water cylinder is fitted with an insulating jacket to reduce heat loss.

A student carried out an experiment in the laboratory to find out if a jacket filled with foam would be a better insulator than a jacket filled with glass fibre.

The apparatus for the experiment is shown below.



Describe how the student would use the apparatus to find out if foam is a better insulator than glass fibre.

.....

.....

.....

.....

.....

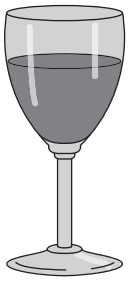
.....

(3 marks)

12

Turn over for the next question

5 Health workers know the effects of recreational drugs so that they can give good advice to their patients.



(a) Alcohol is a dangerous drug that is bought legally for recreational use.

Alcohol damages some organs in the body.

Draw a ring around **two** organs that are damaged by alcohol.

brain **heart** **liver** **lungs**

(2 marks)

(b) Smoking is linked to heart and lung disease.

(i) Name the drug in cigarette smoke.

.....

(1 mark)

(ii) Name **one** other harmful substance in cigarette smoke and explain why it is harmful.

Name .....

Explanation .....

.....

(2 marks)

(c) Barbiturates are bought illegally for recreational use.

Some harmful effects of barbiturates are given below.

- Barbiturates depress activity of the brain and central nervous system.
- They cause dependence and they have serious side effects.
- Effects of the drug include slurring of speech, sleepiness and loss of balance.

(i) Draw a ring around a legal use for this drug.

antibiotic **pain killer** **sleeping tablet**

(1 mark)

(ii) Why does a patient find it hard to stop using this drug?

.....

.....

(1 mark)

(iii) Name **one** other drug that is bought illegally for recreational use.

.....

(1 mark)

(d) Drugs can enter the bloodstream in different ways.

Name a drug and describe how it gets into the bloodstream of the person using the drug.

.....

.....

.....

.....

(2 marks)

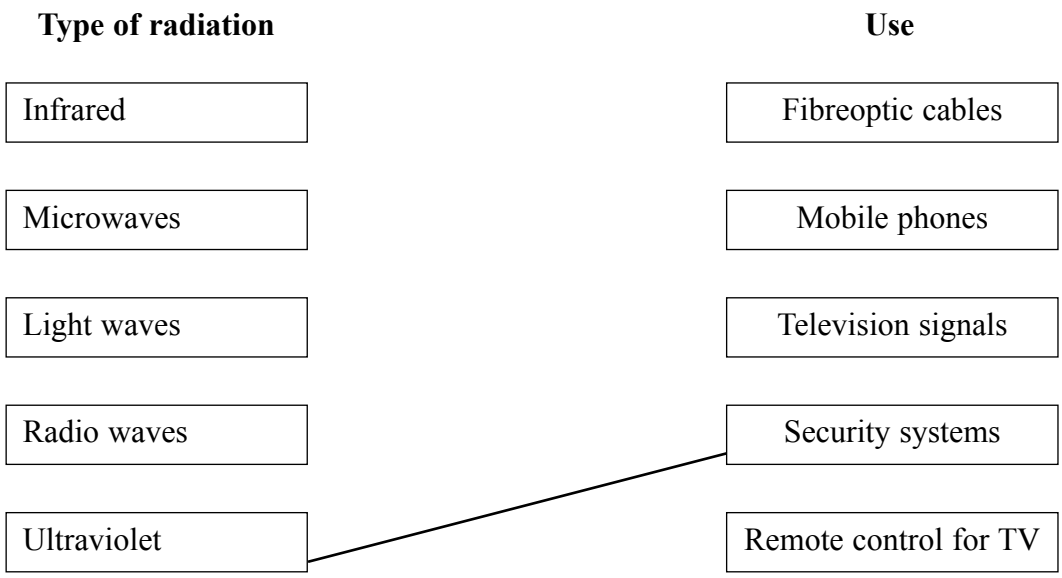
10

6 Electromagnetic radiation has many uses.

(a) Electromagnetic radiation is used in communication devices.

Draw a line from each type of electromagnetic radiation to its use.

One line has been drawn for you.



(3 marks)

(b) The use of electromagnetic radiation in communication devices depends on the frequency of the waves.

The approximate frequency of each type of radiation is given in the table.

Type of radiation	Frequency in billions of hertz (Hz)
Infrared	30 000
Microwaves	300
Light waves	300 000
Radio waves	3
Ultraviolet	3 000 000

(i) Complete the following sentences.

Electromagnetic radiation travels as ..... .

Frequency is measured in Hz, which is the number of .....

in one ..... .

(3 marks)

(ii) Write down the names of the **five** types of radiation in order of the energy of the waves.

Highest energy .....

.....

.....

.....

Lowest energy .....

(1 mark)

(c) Electromagnetic radiation is used in hospitals.

A radiotherapist is someone who works with radioactive sources.

(i) Complete the sentences using words from the box.

alpha	**beta**	**delta**	**gamma**

Radioactive sources produce ..... rays.

They also give off ..... particles and

..... particles.

(2 marks)

(ii) Radioactive sources produce ionising radiation.

Complete the sentence by drawing a ring around the correct word in the box.

It is called ionising radiation because it forms charged particles

called | atoms / ions / molecules | .

(1 mark)

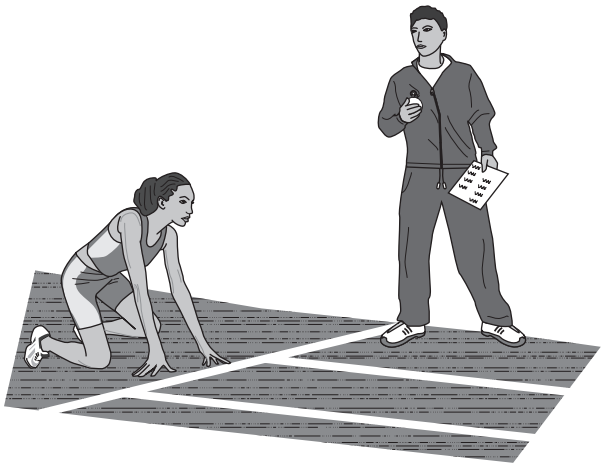
(iii) Give **one** use of ionising radiation in hospitals.

.....

(1 mark)

11

7 A sports scientist is studying the reaction times of an athlete.



He hopes to help the athlete to react quickly when the starting gun is fired.

An athlete's reaction time will depend on how quickly the following actions take place:

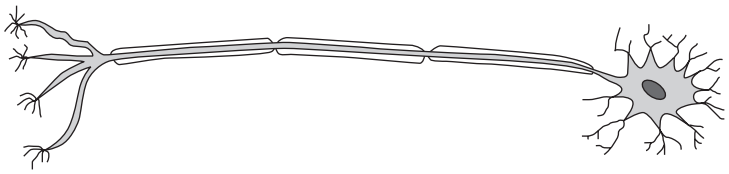
- receptor cells in the athlete's body detect a stimulus
- a message passes along neurones to the athlete's brain
- a message is sent to the athlete's leg muscles
- the athlete's leg muscles contract.

(a) Where in the athlete's body are the receptor cells that detect the stimulus when the gun is fired?

.....

(1 mark)

(b) The diagram below shows a neurone (nerve cell).



(i) Name **two** parts of a nerve cell that are also found in other animal cells.

1 .....

2 .....

(2 marks)

(ii) How does the structure of the nerve cell help it to carry out its function?

.....

.....

.....

.....

(2 marks)

(c) Muscle cells need to be supplied with energy to make them contract.

Explain how muscle cells obtain energy.

.....

.....

.....

.....

(2 marks)

(d) Adrenaline is a hormone that improves reaction times.

Adrenaline is produced in the adrenal gland.

(i) How is adrenaline transported to other parts of the body to improve reaction times?

.....

.....

(1 mark)

(ii) Name **one** other hormone that is produced in the body and name the organ that produces this hormone.

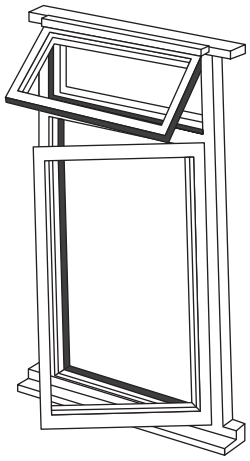
Name of hormone .....

Name of organ .....

(2 marks)

10

8 A builder was asked to recommend the materials for making the window frames for a new house.



He suggested four possible choices.

They are listed in order of cost.

The most expensive is at the top of the list.

- Hardwood frame – double glazed
- Hardwood frame – single glazed
- PVC frame – double glazed
- PVC frame – single glazed

(a) Apart from the cost, give **two** disadvantages of using a traditional material such as wood for building.

1 .....

.....

2 .....

.....

(2 marks)

(b) The sections of PVC used to make the window frames are reinforced with steel plate.

(i) Why does the PVC frame need to be reinforced with steel?

Explain your answer.

.....

.....

.....

.....

(2 marks)

(ii) Explain why this reinforced polymer could be classified as a composite.

.....

.....

(1 mark)

(c) The glass used to make the single-glazed and double-glazed units is made by heating together a mixture of materials.

Name **two** of the materials in the mixture that is heated to make glass.

1 .....

2 .....

(2 marks)

(d) The builder recommended double glazing. He said:

"Although double glazing is more expensive than single glazing, it will pay for itself by reducing fuel bills."

Explain the advice given by the builder.

.....

.....

.....

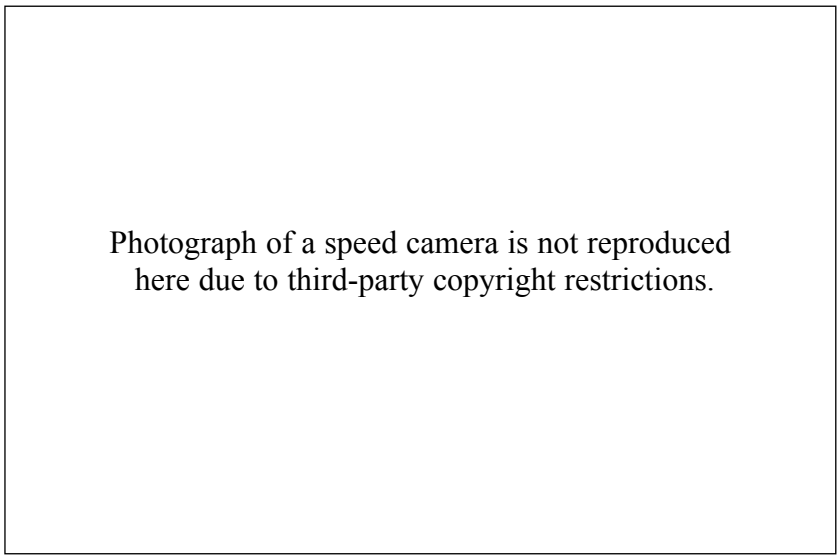
.....

(2 marks)

9

9 Speed cameras are mounted by the side of the road to detect and photograph speeding vehicles.

Some cameras are triggered by sensors in the road surface.



The camera takes two photographs, half a second apart, as the vehicle passes over markers painted on the road a fixed distance apart. When the images are compared, they show the registration marks of the vehicles and information about the speed. Speeding drivers are usually punished with a fine and with penalty points on their driving licence.

(a) How is the information from the camera used to calculate speed?

.....

.....

(1 mark)

(b) There will be fewer serious accidents if vehicles are made to travel more slowly.

There are fewer accidents because slower vehicles have a shorter stopping distance.

Give **two** other factors that affect the stopping distance of a vehicle.

1 .....

.....

2 .....

.....

(2 marks)

(c) Inexperienced drivers and drunken driving cause accidents on the roads.

Describe how we try to reduce the number of accidents caused by these problems.

Inexperienced drivers .....

.....

Drunken driving .....

.....

(2 marks)

(d) A road traffic engineer was asked by the residents of a busy street to check the speed of vehicles passing their homes. The residents were worried that some of the vehicles were going faster than the speed limit of 30 miles per hour (13.4 metres per second).

The engineer recorded the time taken for the vehicles to pass between two posts that he positioned 50 metres apart.

The results of some of his measurements are recorded in the table below.

Vehicle	Time taken in seconds	Calculated speed in m/s
Blue Vauxhall	4.1	12
Red BMW	3.3	

Use a calculation to show whether the red BMW was going faster than the speed limit of 13.4 metres per second.

Show your working.

.....

.....

..... m/s

(2 marks)

(e) The engineer noticed that the frequency of the sound waves from the vehicles changed as they moved away from him.

Describe the change in the frequency of the sound waves.

.....

.....

(1 mark)

8

END OF QUESTIONS

There are no questions printed on this page

There are no questions printed on this page

There are no questions printed on this page

ACKNOWLEDGEMENT OF PUBLISHERS AND COPYRIGHT-HOLDERS

Question 9 Photograph © EMPICS.