Candidate Name	Centre Number	Candidate Number

OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

General Certificate of Secondary Education

SCIENCE: DOUBLE AWARD A PAPER 6 **1983/6**

SCIENCE: PHYSICS (OPTIONS A & B) PAPER 2 **1982/2**

HIGHER TIER

Tuesday **22 JUNE 2004** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Calculators may be used.
Additional materials required:
Pencil
Ruler (cm/mm)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and candidate number in the spaces at the top of this page.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.

  This means, for example, you should
  - write in clear, ordered sentences,
  - use correct spelling, punctuation and grammar,
  - use correct scientific words.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	14	
2	9	
3	7	
4	6	
5	13	
6	7	
7	14	
8	7	
9	12	
10	7	
11	4	
TOTAL	100	

This question paper consists of 24 printed pages.

Registered Charity Number: 1066969
[Turn over

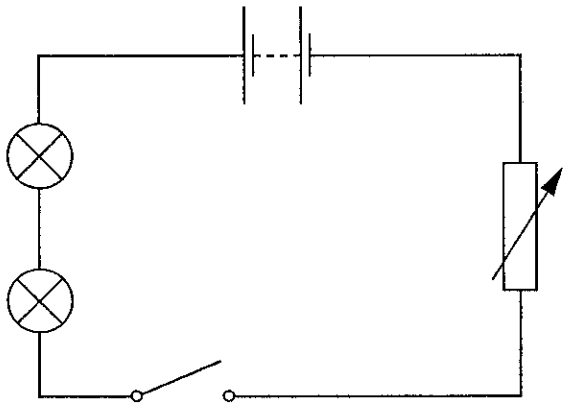
1 Tiff and Cara have built a model house for a competition.

They want to put light bulbs in the rooms.

(a) The diagram on the left shows Tiff's series circuit. One switch controls all of the bulbs. Cara wants to arrange the bulbs in parallel so that each bulb can be controlled by its own switch.

(i) Finish Cara's circuit diagram.

Tiff's circuit



Cara's circuit

[2]

(ii) There is a current in each circuit.

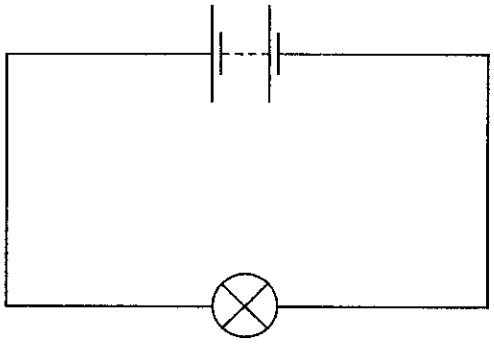
Finish the sentence by choosing the **best** words from this list.

electrons	**flow**	**force**	**heating**
neutral	**negative**	**positive**	**protons**

A current in a metal wire is due to the ..... of .....

from the ..... terminal to the ..... terminal of the battery. [3]

(b) Tiff now builds this simple circuit.



The bulb has a resistance of 6 Ω.

The current in the circuit is 2 A.

(i) Calculate the supply voltage of the circuit.

You **must** show how you work out your answer, including any equation used.

voltage = ...volts [3]

(ii) The light is left on for 20 minutes.

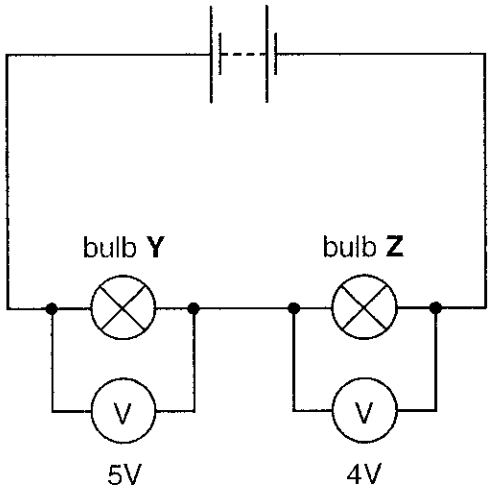
Calculate the total charge that passes through the bulb in this time.

You **must** show how you work out your answer, including any equation used.

charge = ... unit ..... [4]

[Turn over for remainder of question 1

(c) Tiff and Cara now test a new circuit containing two bulbs, **Y** and **Z**.



Cara uses two voltmeters to find the voltage (potential difference) across each bulb.

The voltage readings are shown on the diagram.

What do these readings tell you about the power outputs of the bulbs?
Explain your answer.

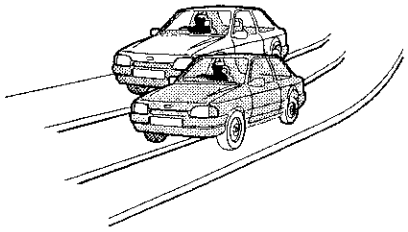
.....

.....

.....[2]

[Total: 14]

2 Sara and Jon use a transformer for their model cars.



(a) A step-down transformer is connected to the mains alternating voltage.

(i) How do the size and frequency of the **output current** compare with the **input current** for this transformer?

size .....

frequency .....[2]

(ii) Explain why the transformer will **not** work if a battery is used instead of the mains.

.....

.....[2]

(b) The transformer converts a voltage of 240 V to 12 V.
The output current is 2 A.

(i) Use this information to calculate the input current of the transformer.
You **must** show how you work out your answer, including any equation used.

input current = ...amps [3]

(ii) Suggest why the actual input current needs to be slightly larger than you have calculated.

.....

.....[2]

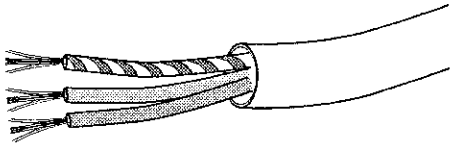
[Total: 9]

3 This question is about electrical appliances in the home.

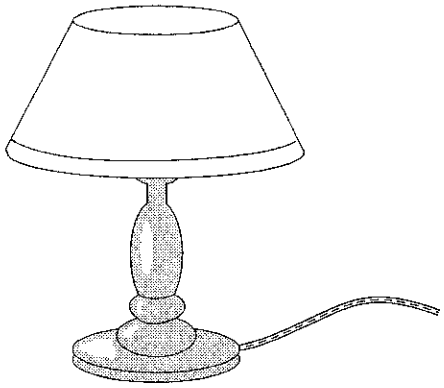
(a) Electrical appliances usually have three wires in the cable.

These wires are:

earth
live
neutral



Some correctly wired appliances, like this lamp, only have **two** wires in the cable.



(i) Which wire, earth, live or neutral, is **not** needed in the cable for this lamp?

..... [1]

(ii) Explain why the lamp is safe to use even though it has only two wires.

.....

.....

.....[2]

(b) A lawn mower contains an electric motor.
The electric motor consists of a coil which turns inside a magnet.

Explain what causes the turning effect on the coil.

.....

.....

.....[2]

(c) A **d.c.** motor needs the input current to pass through a split-ring commutator to the coil.

What effect does the split-ring commutator have on the current in the coil as it turns through one complete turn (360°)?

.....

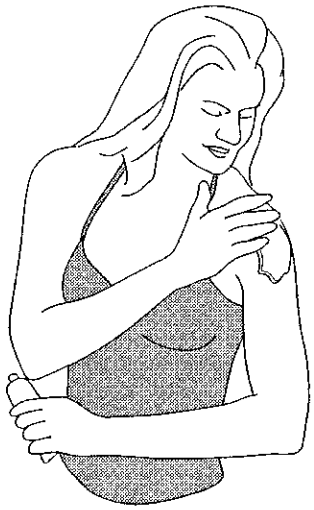
.....

.....[2]

[Total: 7]

[Turn over

4 This question is about the waves of the electromagnetic spectrum.



(a) When Daphne sunbathes, she burns easily and tends not to get a suntan.

She finds this information on the internet about skin types.

skin type number	skin type description
1	white skin that burns easily and tends not to tan
2	white skin that tans easily
3	brown skin
4	black skin

She finds another table about the risks of sunbathing. Here is part of the table.

skin type	risk of burning			
	sun index 5	sun index 6	sun index 7	sun index 8
1	high	high	very high	very high
2	medium	medium	high	high
3	low	medium	medium	medium
4	low	low	medium	medium

This is what the risks mean.

risk	
low	There is nothing to worry about.
medium	Avoid being in direct sunlight for more than 1 to 2 hours.
high	You could burn in 30 to 60 minutes. Avoid direct sunlight. Cover up **or** use a sunscreen lotion with sun protection factor (SPF) 15+.
very high	You could burn severely in 20 to 30 minutes. Keep out of direct sunlight. Cover up **and** use a sunscreen lotion SPF 15+.

(i) The sun index for the day is 7.

What is the maximum length of time Daphne could stay in the sun without risking sunburn?

maximum length of time = ...[1]

(ii) Daphne uses sunscreen with a sun protection factor (SPF) of 12.
This means she can stay in the sun twelve times longer than without sunscreen.

What is the maximum length of time Daphne should stay in the sun **with** sunscreen?
You **must** show how you work out your answer.

maximum length of time = ...[2]

(b) Daphne uses a microwave oven to cook food quickly.

Use your ideas about the properties of microwaves to explain why the food cooks quickly.

(One mark is for using correct scientific words.)

.....

.....

.....[2 + 1]

[Total: 6]

5 **(a)** The planet Uranus was discovered in 1781.

Neptune was discovered in1846 and Pluto in 1930.

Uranus appears to be pulled out of its normal orbit.

Part of this pull is caused by the other known planets.

But, there must be something else having an effect.

Some astronomers are looking for another planet beyond Pluto, which they have called **Planet X**.

(i) Suggest why **Planet X** is difficult to discover.

.....

.....

.....[2]

(ii) Suggest how astronomers might try to discover **Planet X**.

.....

.....

.....[2]

(b) Astronomers look at the light from distant galaxies to help them understand how the Universe began and how it is behaving.

They believe that
- other galaxies are moving away from us very quickly
- galaxies furthest away are moving fastest.

Explain why they believe this. Refer to the observations astronomers make and how this information is interpreted.

.....

.....

.....

.....

.....[3]

(c) A star, such as our Sun, goes through several stages in its life.
After a star forms, nuclear fusion takes place at its core.

(i) Describe what happens during nuclear fusion in our Sun and what effect this has on the Sun.

(One mark is for a clear, ordered answer.)

.....

.....

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.....

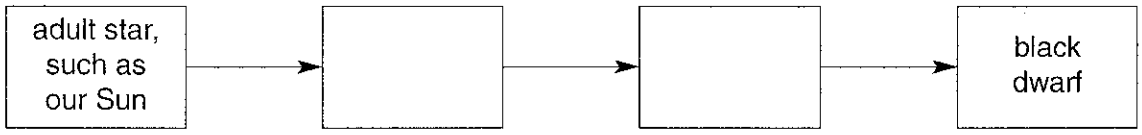
.....[3 + 1]

(ii) Our Sun is a small star.
What happens to it depends on its mass.

Towards the end of its life our Sun will

- get bigger and change colour
- then become very small
- before finally becoming a black dwarf.

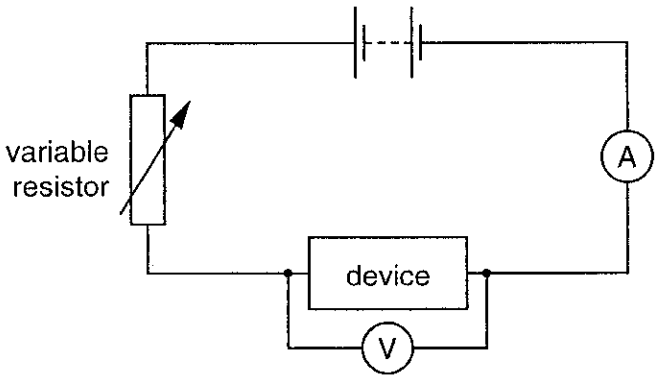
Finish the diagram by writing in the **names** of the two missing stages in the Sun's life.



[2]

[Total: 13]

6 Murray wants to find out how the current passing through a device changes with the voltage across it.

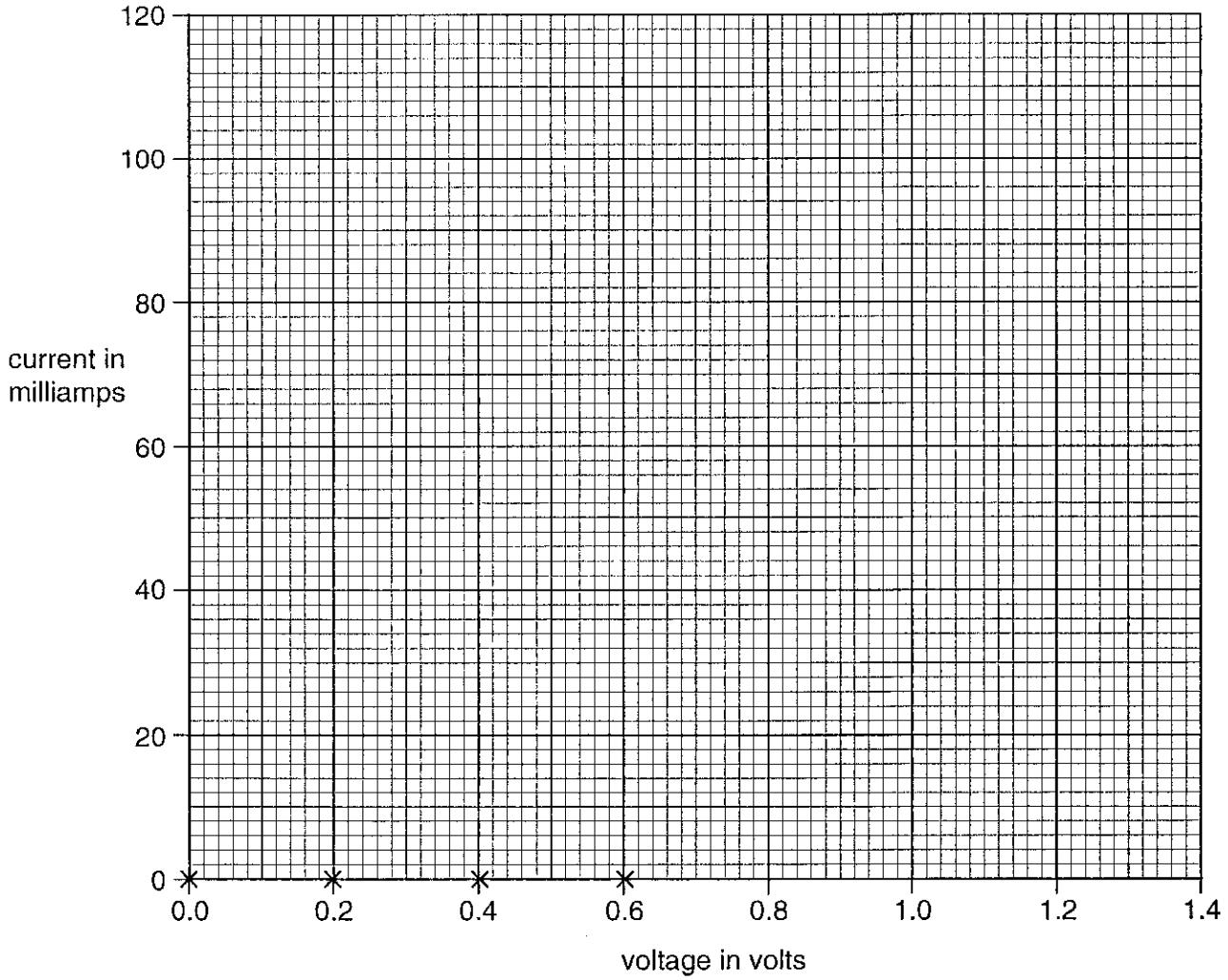


(a) Murray adjusts the variable resistor and writes down the readings shown in the table.

voltage in volts	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4
current in milliamps	0	0	0	0	16	38	66	105

(i) Plot the results on the grid. Four have been plotted for you. [1]

(ii) Finish the graph by drawing the best line through the points. [1]



(iii) Look at the graph. Describe what happens to the current and the resistance as the voltage increases from 0.6 V to 1.4 V.

(One mark is for a clear, ordered answer.)

.....

.....

.....

.....[2 + 1]

(b) Murray connects the battery the other way round.

The ammeter gives a zero reading for all settings of the variable resistor.

Suggest what the device is and give a reason for your choice.

device .....[1]

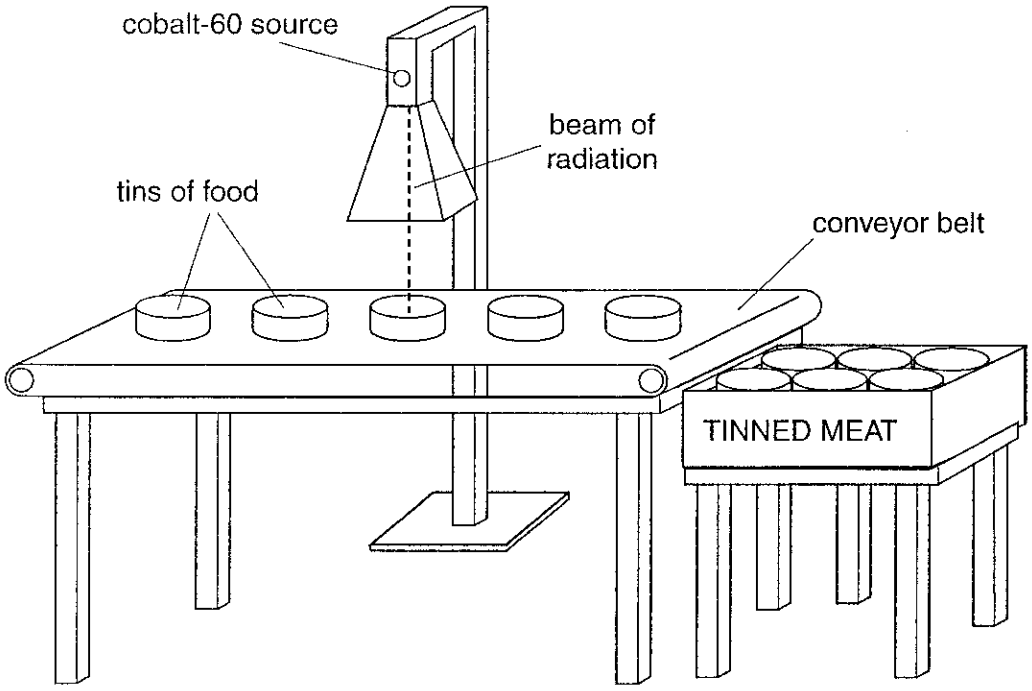
reason .....[1]

[Total: 7]

7 Cobalt-60 is a radioactive material used to irradiate food.

The process takes place in a room where the walls are made of concrete more than 3 m thick.

The food is exposed to a beam of radiation as it moves along the conveyor belt.



(a) The half-life of cobalt-60 is 5 years.

(i) Suggest why a radioactive source with a relatively long half-life is used.

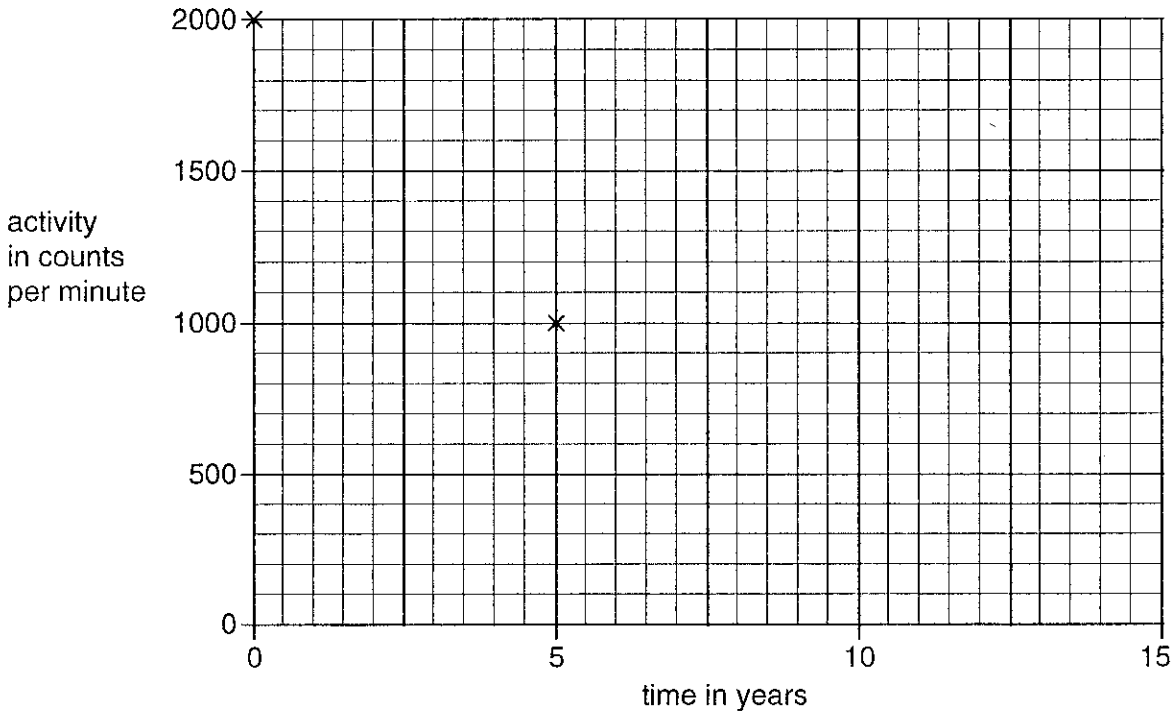
.....

.....

.....[2]

(ii) The activity of a sample of cobalt-60 is measured in the laboratory.
The Geiger counter shows a reading of 2000 counts per minute.

Use the grid to sketch a graph showing how the activity of the sample changes during the next 15 years. Two points have been plotted to help you.



[3]

[Turn over for remainder of question 7

(b) Read the following sentences carefully. Then use them to help you answer the questions.

As the population of the world increases, there is a greater need to preserve food. Food is easily contaminated by micro-organisms. It is important to find ways of treating food to stop this happening. Food can then be transported large distances and stored for long periods of time.

Food irradiation kills most micro-organisms without any noticeable change in the food. However, it is a new process that some consumers fear will 'poison' the food.

It is legal to irradiate food in 37 countries but it only actually happens in 25 countries. Irradiation is expensive and will not be used more widely until consumers are less worried about it.

The effects of irradiating food depend on the type of food and on how much radiation is used. Too much radiation and the food tastes and looks unpleasant. Only certain foods can be irradiated successfully. These include meats, seafood, fruit, vegetables, herbs and spices.

(i) What useful effect does radiation have on food?

.....[1]

(ii) Write down **three** types of food which can be irradiated.

.....[1]

(iii) Suggest why more foods are **not** being irradiated.

(One mark is for using correct spelling, punctuation and grammar.)

.....

.....

.....

.....[3 + 1]

(iv) Many people are worried that irradiated food is radioactive.

A scientist shows an audience an experiment with a Geiger counter.

She tests 10 different food samples. Five have been irradiated and five have not.

These are her results.

irradiated foods	
food sample	count rate in counts per minute
A	40
B	42
C	37
D	41
E	39

non-irradiated foods	
food sample	count rate in counts per minute
F	43
G	41
H	39
I	37
J	39

How could she use this evidence to convince her audience that the food is safe?

.....

.....

.....

.....

.....[3]

[Total: 14]

8 This question is about earthquakes.

(a) Earthquakes produce two types of waves: **P** waves and **S** waves.

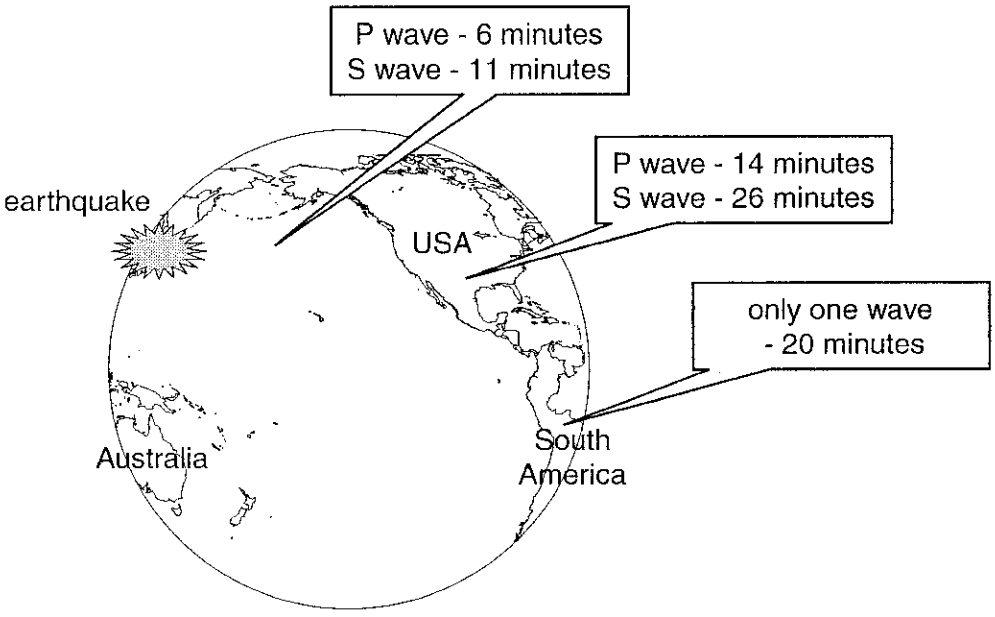
Write down one way in which **P** waves are different from **S** waves.

.....

.....[1]

(b) The diagram shows how long it takes for the earthquake waves to reach other parts of the Earth.

At some places both types of wave are detected.
At other places only one type of wave is detected.



(i) Explain why the **S** waves are detected in the USA later than the **P** waves.

.....

.....

.....[1]

(ii) Describe how the composition of the Earth's outermost layer (crust) can cause earthquakes.

.....

.....

.....[2]

(iii) Describe and explain what the evidence from earthquake waves shown in the diagram tells you about the inner structure of the Earth.
You may draw a diagram to help you answer.

.....

.....

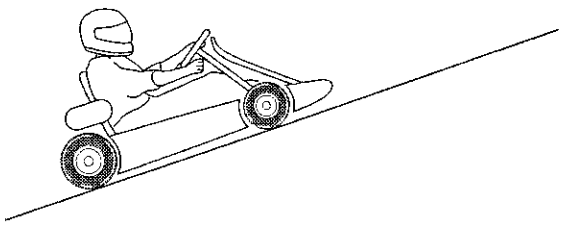
.....

.....[3]

[Total: 7]

9 This question is about forces.

Penny is driving her go-kart up a hill.



(a) (i) Add **one** arrow to this diagram to show the direction of the weight of the go-kart. [1]

(ii) The mass of Penny and her go-kart is 120 kg.

The acceleration produced is 2 m/s^2.

Calculate the force needed to give this acceleration.

You **must** show how you work out your answer, including any equation used.

force = ... newtons [3]

(iii) The actual force from the engine is greater than the force you have calculated.

Suggest **two** reasons for this.

.....

.....

.....[2]

(b) Penny's friend Niki is driving another go-kart in a race.
Over a period of 4 seconds, Niki's speed increases from 3.8 m/s to a top speed of 7.0 m/s. She maintains this speed for another 5 s to the end of the race.
Throughout all this time, Niki has the accelerator pedal pressed to the floor so that the kart cannot travel any faster.

(i) Calculate Niki's average acceleration during the 4 second period.

You **must** show how you work out your answer, including any equation used.

acceleration = ... m/s^2 [3]

(ii) In fact, the acceleration changes during this 4 second period until top speed is reached.

Use your ideas about forces to describe and explain how the acceleration changes during the race.

.....

.....

.....

.....[3]

[Total: 12]

10 David looks in the newspaper to find out what he can listen to on the radio.
He sees this information about his local radio transmitter.

194 m	206 m	247 m	261 m	275 m	290 m	330 m	1500 m
Capital	**Sunrise**	**Virgin Radio**	**LBC**	**Talk Radio**	**Country**	**Five Live**	**Radio Four**
1548 kHz	1458 kHz	1215 kHz	1152 kHz	1089 kHz	1035 kHz	909 kHz	200 kHz

(a) Use the information about Radio Four to calculate the speed of radio waves.

You **must** show how you work out your answer, including any equation used.

speed = ... unit .....[4]

(b) There is a large hill between David's home and the radio transmitter.
He cannot see the transmitter but his radio can receive radio waves from it.
The reception for Radio Four is much better than the reception for the other stations listed.

Use your ideas about waves to explain this. You may draw diagrams to help you answer.

.....

.....

.....

.....[3]

[Total: 7]

11 Ultrasound is high frequency sound above the range of human hearing.

(a) Ultrasound pulses are used to produce an image of the foetus in the mother's womb.

Use your ideas about the properties of ultrasound to explain why it can be used to do this.

.....

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.....

.....

.....[3]

(b) Describe one non-medical use of ultrasound.

.....

.....

.....[1]

[Total: 4]

END OF QUESTION PAPER