

2004 Physics

Intermediate 1

Finalised Marking Instructions

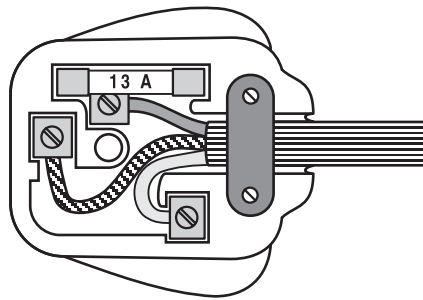
Marks

1. The unit of frequency is the
- A decibel
 - B metre per second
 - C hertz
 - D metre
 - E watt.

Answer C

1

2. The diagram shows a flex connected correctly to a plug.



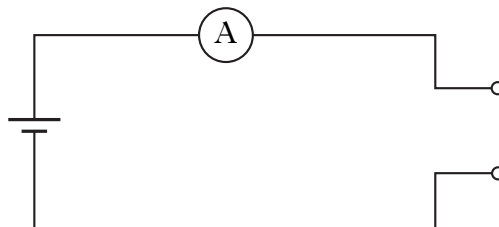
Which row in the table shows two parts which are there for safety reasons?

A	live wire	fuse
B	live wire	neutral wire
C	neutral wire	fuse
D	earth wire	fuse
E	earth wire	live wire

Answer D

1

3. The following circuit is a continuity tester.



A continuity tester is used to detect

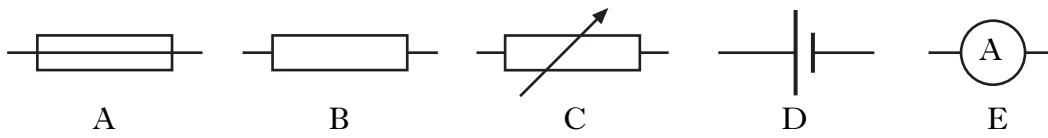
- A radio signals
- B light levels
- C sound levels
- D open circuits
- E temperature changes.

Answer D

1

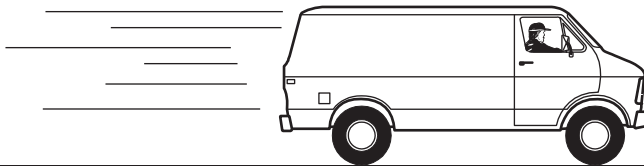
Marks

4. Which of the circuit symbols below represents a fuse?



Answer 1

5. A van travels along a straight level road.
The forces on the van are balanced.



The van is

- A accelerating to the right
- B accelerating to the left
- C travelling with constant speed
- D decelerating
- E stopping.

Answer 1

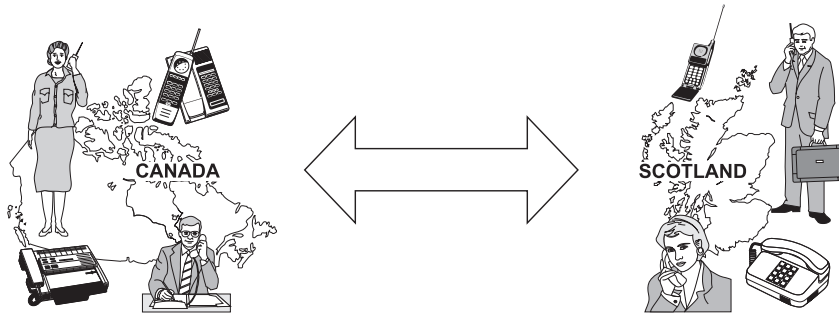
6. In a bright room an LDR has a resistance of 400 ohms.
In a darker room the resistance of this LDR could be

- A 20 ohms
- B 200 ohms
- C 300 ohms
- D 400 ohms
- E 4000 ohms.

Answer 1

Marks

7. Telephone calls between Scotland and Canada use three methods to carry signals across the Atlantic.



- (a) Here is a list of four different types of signal.

sound light electrical radio

- (i) Complete the sentence below by choosing words from the list.

Three methods used to send telephone signals across the Atlantic are:

- | | | |
|---|-----------------------|----------------------------|
| 1 | electrical (1) | signals in metal wires; |
| 2 | light (1) | signals in optical fibres; |
| 3 | radio (1) | signals in air. |

3

- (ii) Which of the three methods has the slowest signals?

light in optical fibres

1

- (iii) Which of the **four** types of signal can be used for satellite communications?

radio signals

1

- (b) (i) State **one** advantage of a mobile phone.

can use outside OR no wires OR use almost anywhere

1

- (ii) State **one** disadvantage of a mobile phone.

some blank areas OR battery can go flat OR money may run out

1

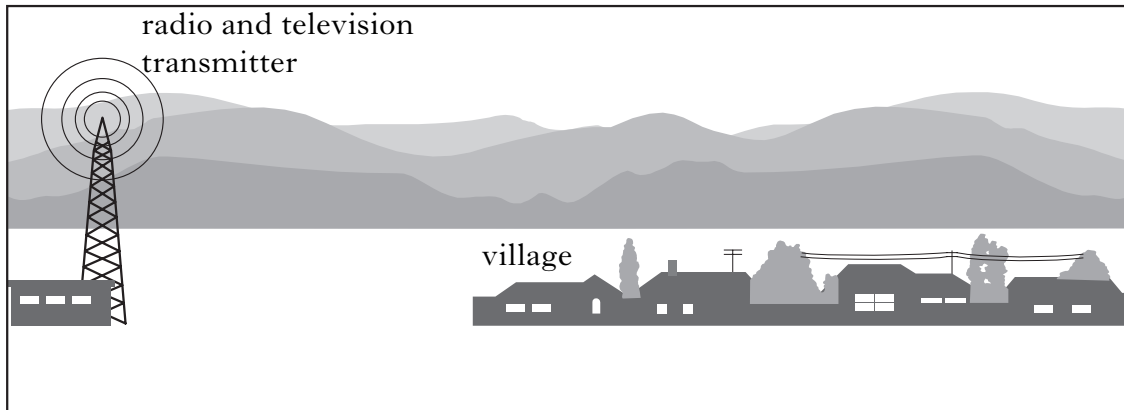
- (c) State the purpose of a **fax** machine.

transmission by telephone of written or drawn material

1

Marks

8. A transmitter sends radio and television signals to the houses in a village.



- (a) Which has the greater frequency, television signals or radio signals?

television (signals)

1

- (b) (i) State the function of the tube in a television.

converts electrical energy into light energy OR converts vision signal into light

1

- (ii) A strong magnifying glass is used to examine a white part of a picture on a television screen.

What colours are seen on the white part of the screen?

red, green and blue

1

- (c) A television has security markings on it which are invisible in ordinary light.

- (i) What type of radiation is used to make these markings visible?

ultraviolet OR U.V.

1

- (ii) The markings are made visible because they fluoresce.

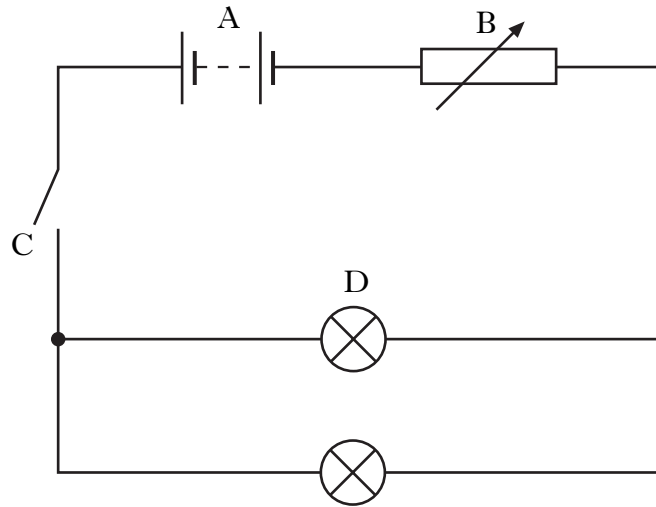
Explain what the word *fluoresce* means.

glow under ultraviolet light

1

Marks

9. (a) The following circuit is set up.



Name components A, B, C and D.

A **battery OR cells (½)**

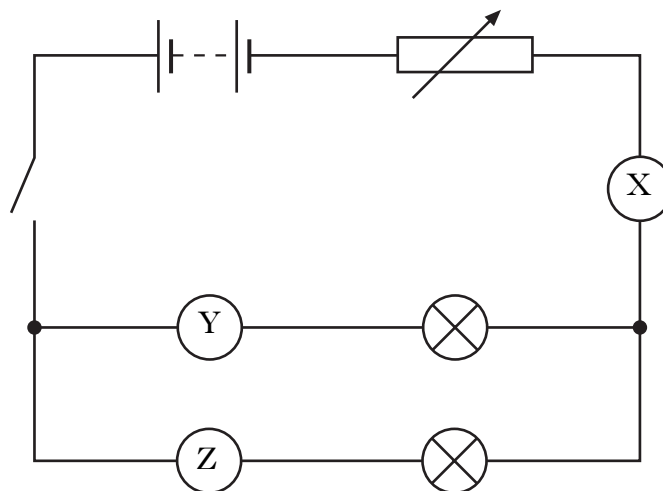
B **rheostat OR variable resistor (½)**

C **switch (½)**

D **bulb OR lamp (½)**

2

(b) Three identical meters X, Y and Z are inserted in the circuit as shown. This allows currents to be measured in different parts of the circuit.



(i) Name the type of meter used to measure current.

ammeter

1

Marks

9. (b) (continued)

- (ii) The reading on meter X is 2.4 amperes and the reading on meter Y is 1.8 amperes.

Calculate the reading on meter Z.

$$\begin{aligned}\text{reading on Z} &= 2.4 - 1.8 \\ &= 0.6 \text{ amperes (1)}\end{aligned}$$

Note: $\frac{1}{2}$ unit deduction

1

- (iii) Component B is adjusted so that the lamps become dimmer.
What effect does this have on the meter readings?
You **must** explain your answer.

readings lower (1)
current less (1)
OR resistance more

2

[Turn over

Marks

10. The rating plate on a fan heater is shown below.

Model No.	2004
Power	1380 watts
Voltage	230 volts
a.c.	50 hertz

- (a) Calculate the current when the fan heater is on.

$$\text{current} = \frac{\text{power}}{\text{voltage}} \left(\frac{1}{2}\right) = \frac{1380}{230} \left(\frac{1}{2}\right) = 6 \text{ amperes} \left(\frac{1}{2}\right) \left(\frac{1}{2}\right)$$

2

- (b) The heating element is removed from the fan heater.

The element is connected to an ammeter, voltmeter and power supply so that its resistance can be measured.

The following readings are obtained.

Ammeter reading = 0.6 ampere

Voltmeter reading = 12 volts

- (i) Calculate the resistance of the heating element.

$$\text{resistance} = \frac{\text{voltage}}{\text{current}} \left(\frac{1}{2}\right) = \frac{12}{0.6} \left(\frac{1}{2}\right) = 20 \text{ ohms} \left(\frac{1}{2}\right) \left(\frac{1}{2}\right)$$

2

- (ii) Name a meter that can be used to measure resistance directly.

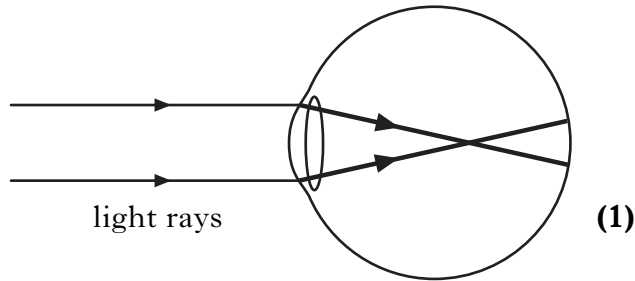
ohmmeter

1

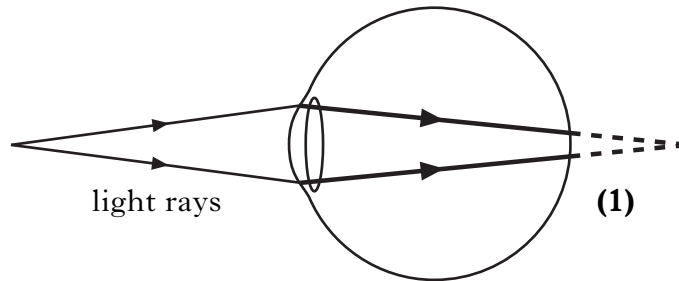
Marks

11. An optician tests the sight of two customers. One customer is short sighted and the other is long sighted.

(a) Complete the diagrams below to show the paths of the light rays after they have passed through the lens in each eye.



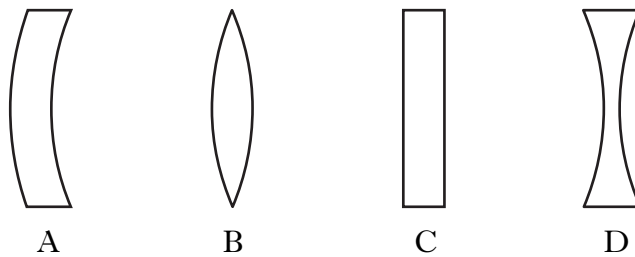
Eye of customer with short sight



Eye of customer with long sight

2

(b) The optician uses different lenses to correct long and short sight. From the following shapes, choose a suitable lens for each customer.



Lens for short sighted customer

D

Lens for long sighted customer

B

2

Marks

12. (a) Gamma radiation is used in medicine and industry.

(i) Give **one** use of gamma radiation in medicine.

**gamma camera OR detection or treatment of cancer
OR sterilise instruments etc**

1

(ii) Give **one** use of gamma radiation in industry.

tracer to monitor liquid flow OR testing welds etc

1

(b) Great care must be taken when using a source of gamma radiation.

(i) Explain why gamma radiation is dangerous to people.

**gamma kills or damages living cells OR can cause
cancer**

1

(ii) A technician uses tongs when removing a source of gamma radiation from a lead-lined box.

(A) Why is it safer for the technician to use tongs?

**tongs increase distance from the source OR avoid
contact with skin**

1

(B) Why is the box lined with lead?

lead acts as shielding OR lead absorbs gamma

1

(c) Gamma radiation sources used in medicine are replaced regularly. Explain why this replacement is necessary.

strength of the gamma source decreases with time

1

Marks

13. During a thunderstorm the lightning is seen before the thunder is heard.

(a) (i) Why does this happen?

light travels faster than sound OR sound travels slower than light

1

(ii) A girl sees lightning strike a tall building 1600 metres away.

She hears the thunder 5 seconds later.

Use these figures to calculate the speed of sound in air.

$$\text{speed} = \frac{\text{distance}}{\text{time}} \text{ (1/2)} = \frac{1600}{5} \text{ (1/2)}$$

$$= 320 \text{ metres per second (1/2)(1/2)}$$

Note: do not accept mps as unit

2

(b) An astronaut watches the same thunderstorm from a space station.

Explain why the astronaut can see the lightning but cannot hear the thunder.

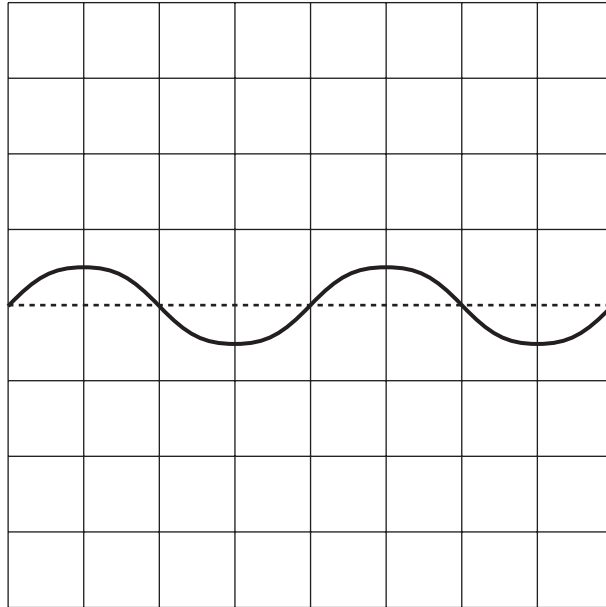
light travels through vacuum or space to astronaut (1)
sound cannot travel through vacuum or space (1)

2

Marks

14. (a) A student uses an oscilloscope to measure the voltage across the input of an amplifier.

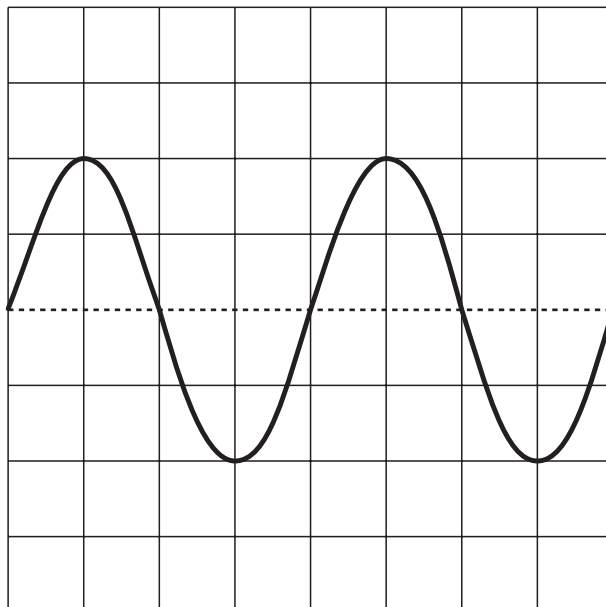
The oscilloscope trace for the input voltage is shown on the grid below.



input voltage trace

Without altering the oscilloscope controls the student then measures the output voltage.

On the grid below, draw a possible oscilloscope trace for the output voltage.



output voltage trace

same frequency (1)
bigger amplitude (1)

2

Marks

14. (continued)

- (b) For another setting of the amplifier, the input voltage is 0.3 volt and the output voltage is 3 volts.

Calculate the voltage gain of the amplifier.

$$\text{voltage gain} = \frac{\text{output voltage}}{\text{input voltage}} \left(\frac{1}{2}\right) = \frac{3}{0.3} \left(\frac{1}{2}\right) = 10 \quad (1)$$

(Note: deduct (1/2) mark if any unit given)

2

- (c) Personal stereos can play compact discs or tape cassettes.

State **two** advantages of a compact disc compared to a tape cassette.

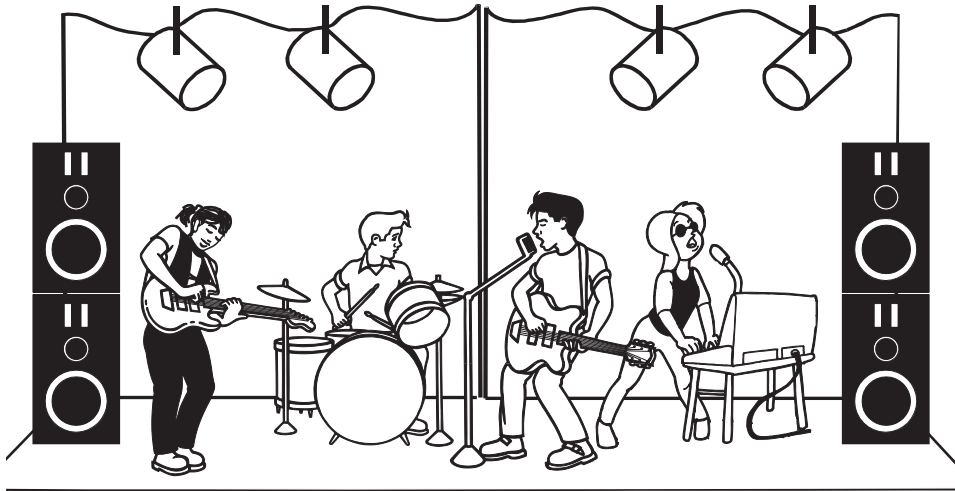
quantity of data
quality of sound
robustness
track selection
use with computer **any two (1) (1)**

2

[Turn over

Marks

15. A band is playing on a stage.



(a) One guitarist is playing a note of frequency 440 hertz.

(i) State the frequency of the note one octave lower than 440 hertz.

220 hertz **(½) unit deduction**

1

(ii) The guitarist alters the frequency of a note by changing the length of a string.

In the passage below, circle one word in each box to make the statement correct.

The the length of the string, the

the frequency of the note.

1

The longer the length of the string, the lower the frequency of the note.

OR

The shorter the length of the string, the higher the frequency of the note.

Marks

15. (continued)

- (b) Musical instruments can produce notes with a wide range of frequencies. State the lowest and highest frequencies of the normal range of human hearing.

The lowest frequency is

20 hertz (1)

The highest frequency is

20 000 hertz (1)

2

(Note: (1/2) unit deduction in each case for missing or wrong unit)

- (c) Sound levels are often very high at concerts.

- (i) State the unit of sound level.

decibel OR dB

1

- (ii) Staff near the front of the stage wear ear protectors. Explain why the staff wear these protectors.

excessive noise damages hearing
OR protectors absorb most of sound energy

1

Marks

16. (a) At an athletics meeting the pole-vault event is in progress.



- (i) A pole-vaulter has a mass of 60 kilograms.
Calculate the weight of the pole-vaulter.

$$\text{weight} = 10 \times \text{mass} \left(\frac{1}{2}\right) = 10 \times 60 \left(\frac{1}{2}\right) = 600 \text{ newtons} \left(\frac{1}{2}\right) \left(\frac{1}{2}\right)$$

2

- (ii) The pole-vaulter clears the bar and falls towards the mat.
Are the forces acting on the pole-vaulter balanced during the fall?
You **must** explain your answer.

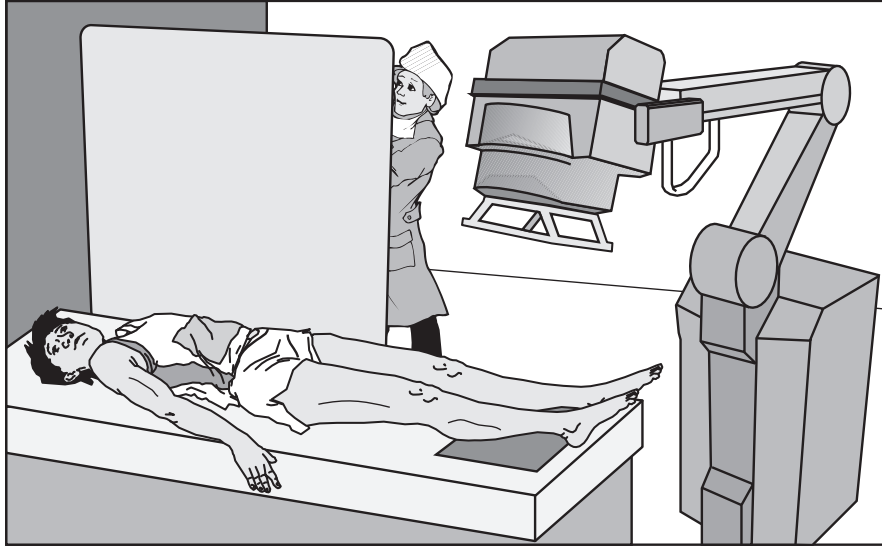
not balanced (1)
pole-vaulter speeds up OR accelerates OR movement
changes while falling OR correct analysis of the forces (1)

2

Marks

16. (continued)

- (b) At the same meeting, another pole-vaulter lands badly and injures an ankle. An X-ray is taken of the injured ankle.



- (i) Explain why the X-ray is taken.

to find out if a bone is broken in the ankle

1

- (ii) Why does the radiographer stand behind a screen when the X-ray is taken?

**to give protection to radiographer from dangerous X-rays
OR avoid overexposure to dangerous X-rays over time**

1

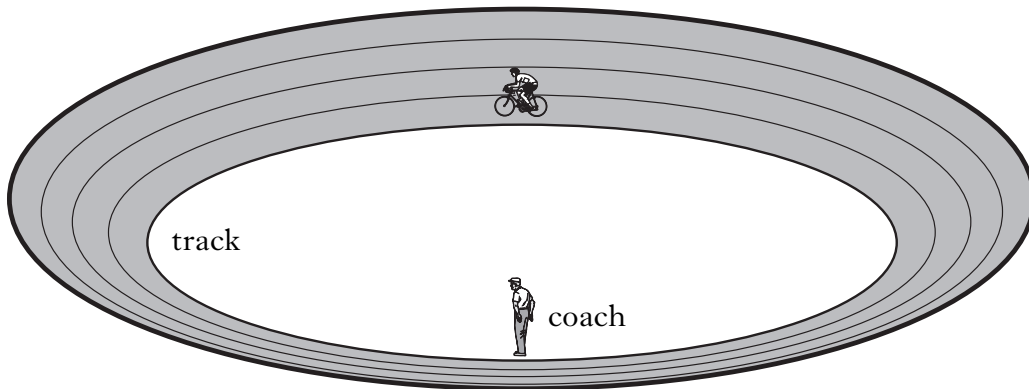
- (iii) It is found that the pole-vaulter has suffered only muscle damage. State **one** form of radiation used to treat muscle damage.

**ultrasound OR infrared OR microwaves
OR heat**

1

Marks

17. (a) A cyclist is training on a track. When the cyclist pedals, the bicycle moves forwards because the tyres do not slip.



- (i) Name the force that prevents the bicycle tyres from slipping.

friction

1

- (ii) State **one** change that would make the force between the tyres and the track decrease.

wet surface OR worn tyres OR oil OR ice

1

- (b) The cyclist's average speed for one lap of the track is to be calculated.

- (i) List the measurements needed to calculate the cyclist's average speed for one lap.

distance gone (1)

time taken (1)

2

- (ii) Name pieces of equipment that the coach could use to make these measurements.

measuring tape OR trundle wheel OR metre stick (½)

stopwatch (½)

1

Marks

17. (continued)

(c) The cyclist starts from rest and takes 4 seconds to complete the first 50 metres of the track.

(i) Calculate the average speed of the cyclist over this distance.

$$\text{average speed} = \frac{\text{distance}}{\text{time}} \text{ (}\frac{1}{2}\text{)} = \frac{50}{4} \text{ (}\frac{1}{2}\text{)}$$

$$= 12.5 \text{ metres per second (}\frac{1}{2}\text{) (}\frac{1}{2}\text{)}$$

Note: do not accept mps as unit

2

(ii) The cyclist's average speed for a complete lap is greater than the average speed for the first 50 metres.

Explain how this is possible.

faster (1) later in the lap (1)

OR slower (1) earlier in the lap (1)

2

(iii) State **two** ways in which the cyclist could increase the average speed for one lap.

pedal harder

crouch position

flying start

streamlining of named items

any two (1) (1)

2

Marks

18. A car has sensors which are part of its safety systems.

(a) One sensor activates a frost warning when the outside temperature is below freezing.

Here is a list of electronic devices.

Thermistor LED Switch Motor LDR Buzzer

(i) Name one device **from the list** which can be used as a temperature sensor.

thermistor

1

(ii) Name one device **from the list** which can be used to give a warning.

buzzer OR LED

1

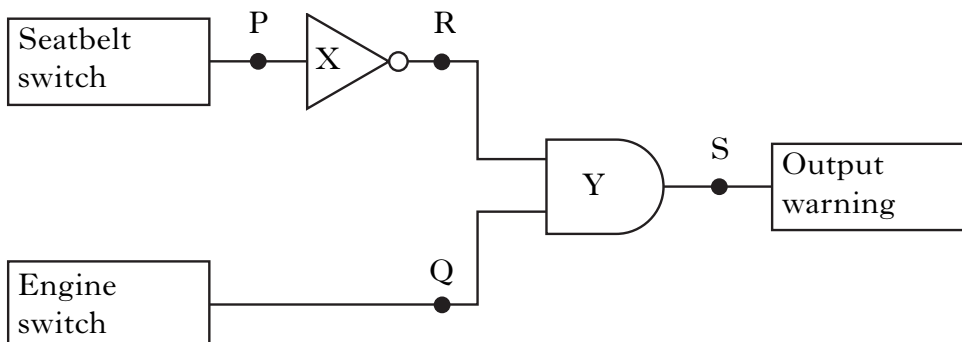
(iii) State the useful energy change for the device you have named in (a) (ii).

electrical to sound OR electrical to light

1

(b) In the same car, a warning is given when the driver's seatbelt is not fastened and the engine is running.

A diagram of the warning circuit is shown below.



(i) Name the logic gates shown in the diagram.

The name of logic gate X is **NOT gate OR inverter**

The name of logic gate Y is **AND gate**

2

