Year 10 Physics

Mock Test

Time Allowed: 1 Hour 30 Minutes

Total Marks: 100

27 June 2026

Calculator Allowed

Full Name of Student: ……

1.

This question is about parts of the electromagnetic spectrum.

gamma rays	x-rays		visible light	infrared waves	microwaves	radio waves

(a) Name the missing part of this spectrum.

(1)

.....

(b) Which part of this spectrum has the shortest wavelength?

(1)

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(c) Explain how the frequency of electromagnetic waves in free space differs with increasing wavelength.

(2)

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(d) Microwaves are used to heat food.

State another part of the spectrum that is used to heat food.

(1)

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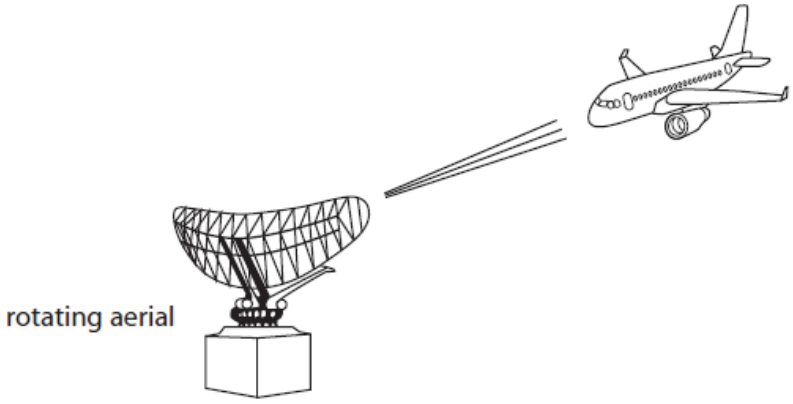
(e) Microwaves are used at airports to detect aeroplanes.

A microwave beam is emitted from a large rotating aerial and reflected back off the metal surface of the aeroplane.



(i) Explain how microwaves are used to find the distance to an aeroplane.

(3)

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(ii) Suggest why it is important for the aerial to rotate through a full circle every two seconds.

(1)

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[Total for Question 1 = 9 marks]

2.

Tritium is an isotope of hydrogen that decays by emitting beta particles.

It is used in some luminous signs.

(a) (i) The symbol for tritium is $^{3}_{1}H$.

Determine the number of protons and the number of neutrons in a single atom of tritium.

(2)

number of protons .....

number of neutrons .....

(ii) Describe three differences between an alpha particle and a beta particle.

(3)

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(iii) Suggest why tritium cannot emit alpha particles.

(1)

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(b) Tritium is used in this luminous sign.

In this sign

- the letters are made up of glass tubes containing tritium gas
- the inside of each tube is coated with a phosphor
- the phosphor emits light when beta particles hit it

Suggest why this sign is safe to use even though beta particles are ionising and can be dangerous.

(2)

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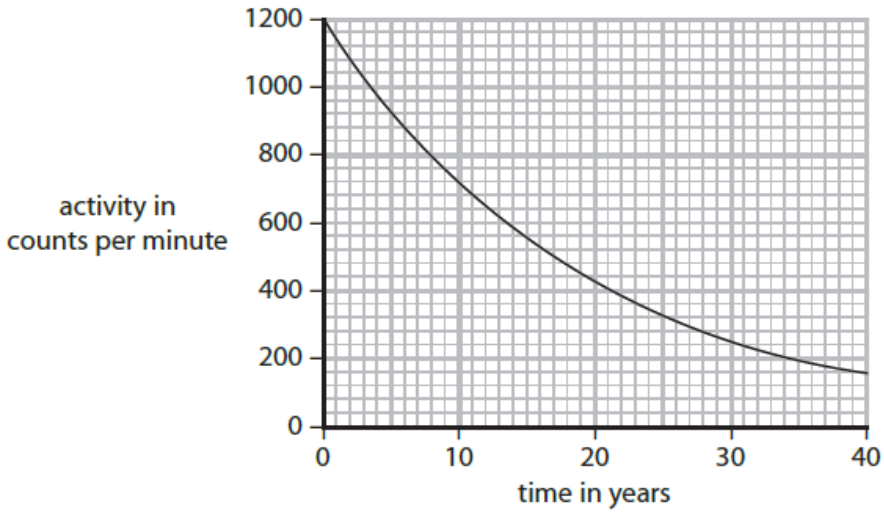
(c) The graph shows how the activity of tritium in this luminous sign varies with time.



(i) Explain what is meant by the term **half-life**.

(2)

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(ii) Use the graph to estimate the half-life of tritium.

Show your working.

(2)

half-life = ... years

(d) The manufacturer of this luminous sign claims that the sign will work for more than 20 years.

The minimum activity required for the tubes to emit sufficient light is 400 counts per minute.

Evaluate the manufacturer's claim.

(2)

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[Total for Question 2 = 14 marks]

3.

Velocity is a vector quantity.

It can be calculated by using equations or by drawing scale diagrams.

(a) Describe the difference between scalar and vector quantities.

.....

.....

[2]

(b) The diagram shows a car accelerating.

The car accelerates at $0.6\,m/s^2$ for 10 s.

The car has a final velocity of 11 m/s.

Calculate the starting velocity.

.....

.....

.....

answer ..... m/s **[2]**

[Total for Question 3 = 4 marks]

4.

A student investigates the motion of a toy car as it moves freely down a slope.

The student wants to find the link between the starting height of the car and the speed of the car at the bottom of the slope.

(a) (i) State the independent variable in this investigation.

(1)

.....

(ii) Suggest a link between the starting height of the car and its speed at the bottom of the slope.

(1)

.....

.....

(b) Describe how the student should measure the starting height of the car.

(2)

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.....

(c) The student describes how she will find the speed of the car at the bottom of the slope.

I will start the timer when the car begins to move.
I will stop the timer when the car reaches the bottom.

I will find the speed at the bottom by dividing the distance moved by the time taken.

(i) Explain why the student will **not** be able to calculate the correct speed using this method.

(2)

(ii) Describe how the student should take the measurements needed to find the speed of the car at the bottom of the slope.

You should name any additional equipment needed.

(3)

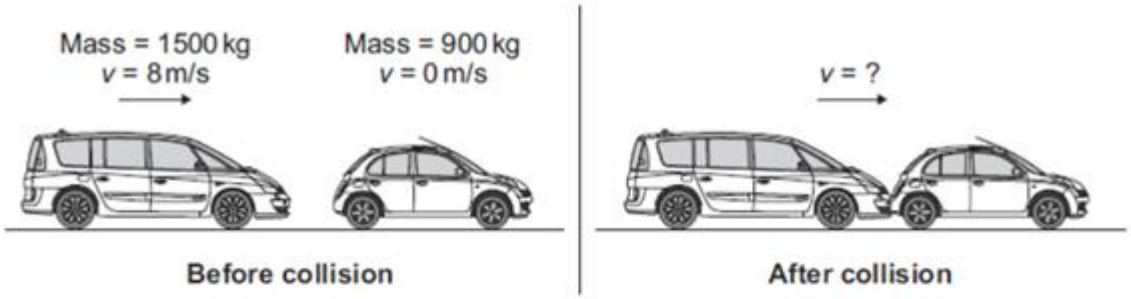
[Total for Question 4 = 9 marks]

5.

A car moving along a horizontal road collided with a stationary car in front of it, causing the two cars to join together.

Figure 5 shows both cars, just before and just after the collision.

Figure 5



(i) The momentum of the two cars was conserved.

What is meant by the statement 'momentum is conserved'?

[1 mark]

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(ii) Calculate the velocity of the two joined cars immediately after the collision.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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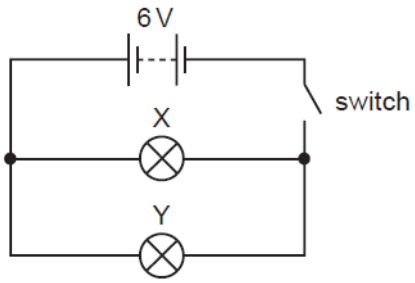
Velocity = ... m/s

[Total for Question 5 = 4 marks]

6.

(a)

In the circuit below, X and Y are identical 6 V lamps.



What happens when the switch is closed?

A X lights more brightly than Y.

B Y lights more brightly than X.

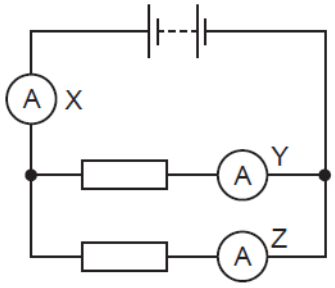
C X and Y light with equal brightness.

D Neither X nor Y light.

(1)

(b)

The diagram shows a circuit with three ammeters, X, Y and Z.



Which set of readings is possible?

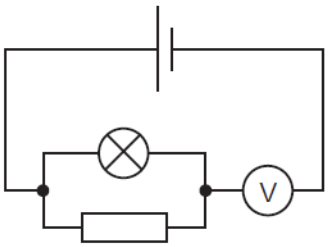
	X	Y	Z
A	2 A	3 A	5 A
B	3 A	2 A	5 A
C	3 A	3 A	3 A
D	5 A	2 A	3 A

(1)

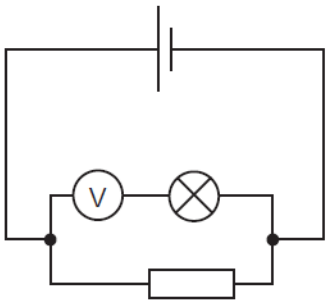
(c)

In which circuit does the voltmeter read the potential difference across the lamp?

A



B



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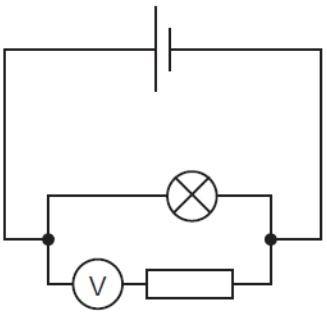
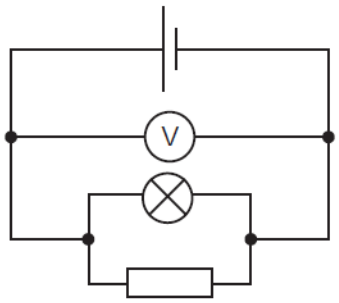


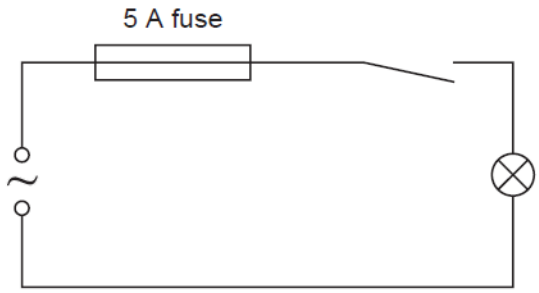
D



(1)

(d)

A student makes the circuit shown.



The fuse has blown and stopped the current.

What could have caused this?

A The current rating of the fuse was too high.

B The current was too large.

C The lamp was loose.

D The voltage was too small.

(1)

[Total for Question 6 = 4 marks]

7.

A note was played on an electric keyboard.

The frequency of the note was 440 Hz.

(a) (i) What does a frequency of 440 Hz mean?

[1 mark]

.....

.....

(a) (ii) The sound waves produced by the keyboard travel at a speed of 340 m/s.

Calculate the wavelength of the note.

Use the correct equation from the Physics Equations Sheet.

Give your answer to **three** significant figures.

[1 mark]

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.....

.....

Wavelength = ... metres

(b) **Figure 3** shows a microphone connected to a cathode ray oscilloscope (CRO) being used to detect the note produced by the keyboard.

Figure 3

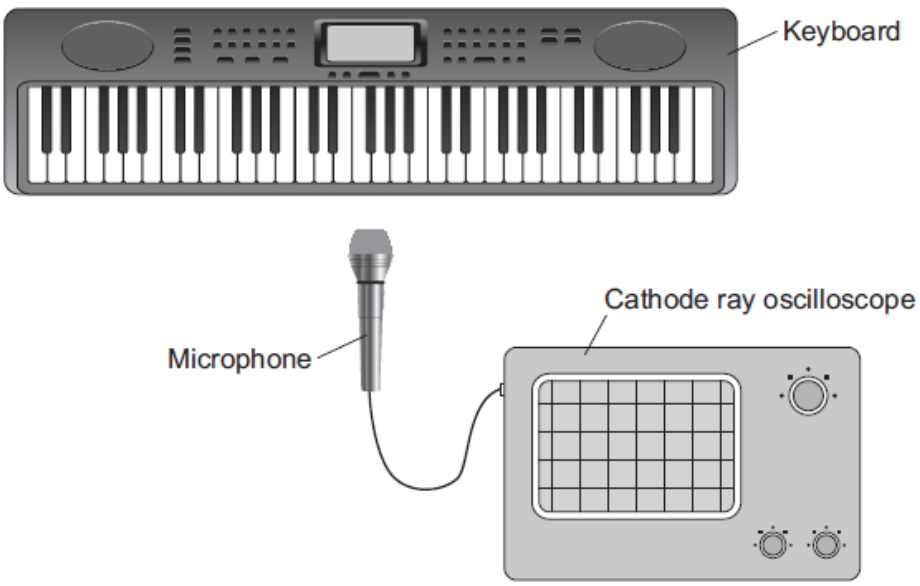
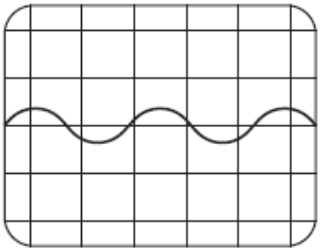


Figure 4 shows the trace produced by the sound wave on the CRO.

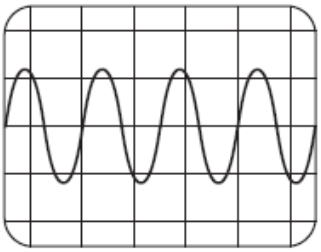
Figure 4



A second note, of different wavelength, was played on the keyboard.

Figure 5 shows the trace produced by the sound wave of the second note on the CRO.

Figure 5



The settings on the CRO were unchanged.

Consider the pitch and loudness of the two sound waves produced by the keyboard.

What two conclusions can be made about the second sound wave compared with the first sound wave?

Gives reasons for your conclusions.

[4 marks]

[Total for Question 7 = 6 marks]

8.

The rocket shown in Fig. 2.1 is about to be launched.

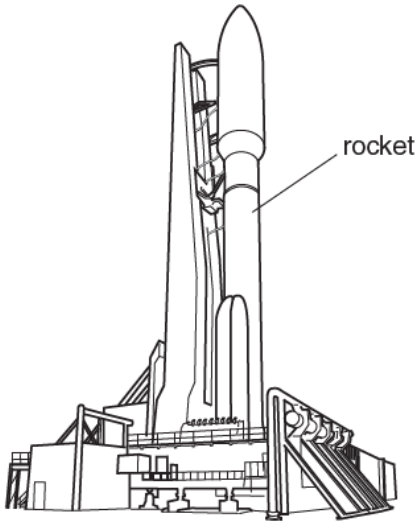


Fig. 2.1

The total mass of the rocket and its full load of fuel is 2.8×10^6 kg. The constant force provided by the rocket's motors is 3.2×10^7 N.

(a) Calculate

(i) the total weight of the rocket and the fuel,

weight = ... [1]

(ii) the resultant force acting on the rocket,

resultant force = ... [2]

(iii) the vertical acceleration of the rocket immediately after lift-off.

acceleration = ... [2]

(b) Suggest why the acceleration of the rocket increases as it rises above the Earth's surface.

.....

..... [1]

[Total for Question 8 = 6 marks]

9.

(a) Nuclear power stations generate about 14% of the world's electricity.

(a) (i) Uranium-235 is used as a fuel in some nuclear reactors.

Name **one** other substance used as a fuel in some nuclear reactors.

.....

(1 mark)

(a) (ii) Energy is released from nuclear fuels by the process of nuclear fission.
This energy is used to generate electricity.

Describe how this energy is used to generate electricity.

Do **not** explain the nuclear fission process.

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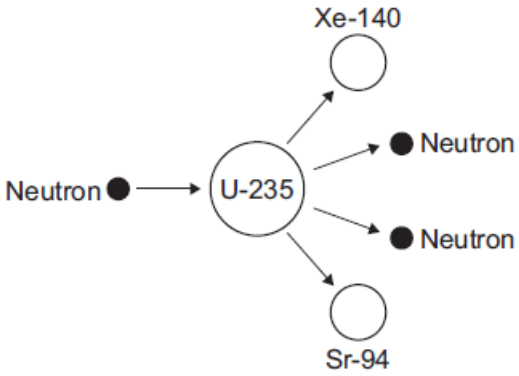
(3 marks)

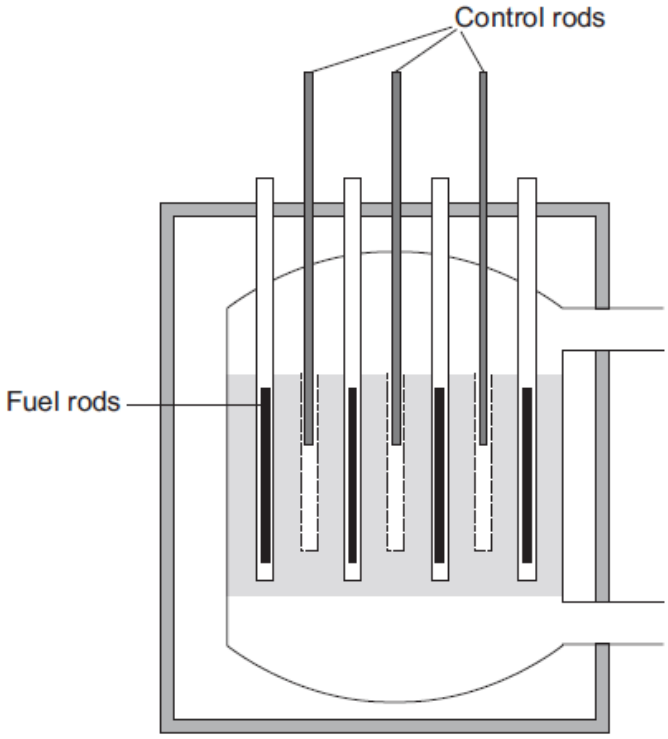
(b) The diagram shows the nuclear fission process for an atom of uranium-235.

Complete the diagram to show how the fission process starts a chain reaction.



(2 marks)

(c) The diagram shows the cross-section through a nuclear reactor.



The control rods, made from boron, are used to control the chain reaction. Boron atoms absorb neutrons without undergoing nuclear fission.

Why does lowering the control rods reduce the amount of energy released each second from the nuclear fuel?

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(2 marks)

(d) Graphite or water is commonly used as a moderator in nuclear reactors.
Explain the purpose of the moderator in a nuclear reactor.

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(3 marks)

[Total for Question 9 = 11 marks]

10.

The nucleus of one of the different nuclides of polonium can be represented by the symbol

$$^{218}_{84}Po$$

The nucleus decays according to the following equation.

$$^{218}_{84}Po \rightarrow {}^{214}_{82}Pb + \text{emitted particle}$$

(i) State the proton number of the emitted particle. ..... [1]

(ii) State the nucleon number of the emitted particle. ..... [1]

(iii) Name the emitted particle. Tick one box.

α-particle	☐
β-particle	☐
neutron	☐
proton	☐

[1]

[Total for Question 10 = 3 marks]

11.

A skydiver jumps from an aircraft.

(a) The mass of the skydiver is 70 kg.

(i) State the equation linking weight, mass and *g*.

(1)

(ii) Calculate the weight of the skydiver and state the unit.

(2)

weight = ... unit .....

(b) The diagram shows the skydiver at an instant during his fall.

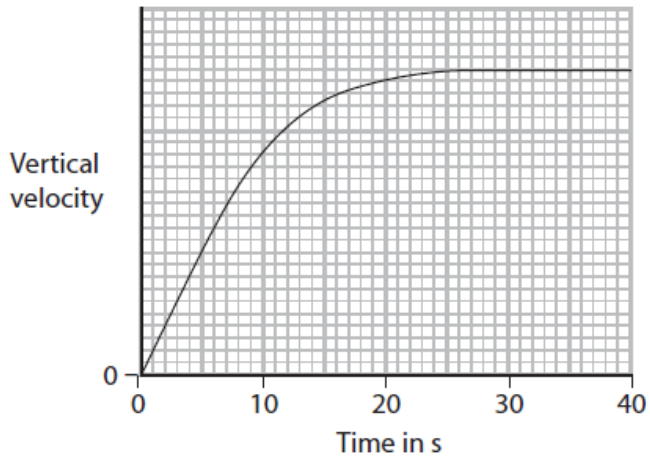
Add **two** labelled arrows to the diagram to represent the forces acting on the skydiver.

(2)

(c)

The graph shows the vertical velocity of the skydiver during the first 40 s of the fall.

His parachute is not open during this time.



Use your knowledge about the forces acting on the skydiver to explain why the velocity of the skydiver changes as shown on the graph.

(5)

[Total for Question 11 = 10 marks]

12.

A lamp shines with full brightness when connected to a 12 V battery, as shown in Fig. 11.1.

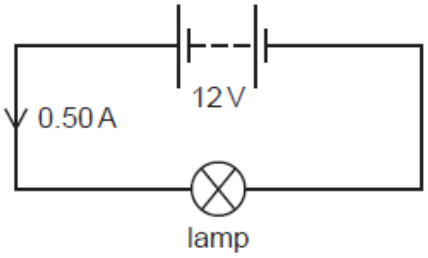


Fig. 11.1

(i) (a) Write down the equation that links resistance with potential difference and current.

(b) The current in the lamp is 0.50A. Calculate the resistance of the lamp.

Resistance of lamp = ……

(3)

(ii) A resistor of resistance 10 Ohms and a different lamp of resistance 20 Ohms are now connected in series to the 12 V battery as shown in Fig. 11.2.

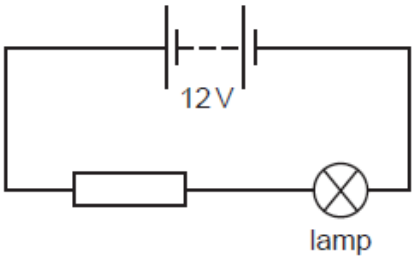


Fig. 11.2

(a) Underline the statement that is correct about the current flowing through the resistor and the lamp in Fig 11.2.

1. The current through the 10 Ohms resistor is lower than the current through the 20 Ohms lamp

2. The current through the 10 Ohms resistor is the same as the current through the 20 Ohms lamp

3. The current through the 10 Ohms resistor is higher than the current through the 20 Ohms lamp

(1)

(b) Calculate the potential difference across the lamp in Fig. 11.2.

potential difference = ……

(2)

[Total for Question 12 = 6 marks]

Question 13 is on the next page.

13.

(a) A narrow beam of red light strikes one face of a triangular prism at A, as shown in Fig. 12.1.

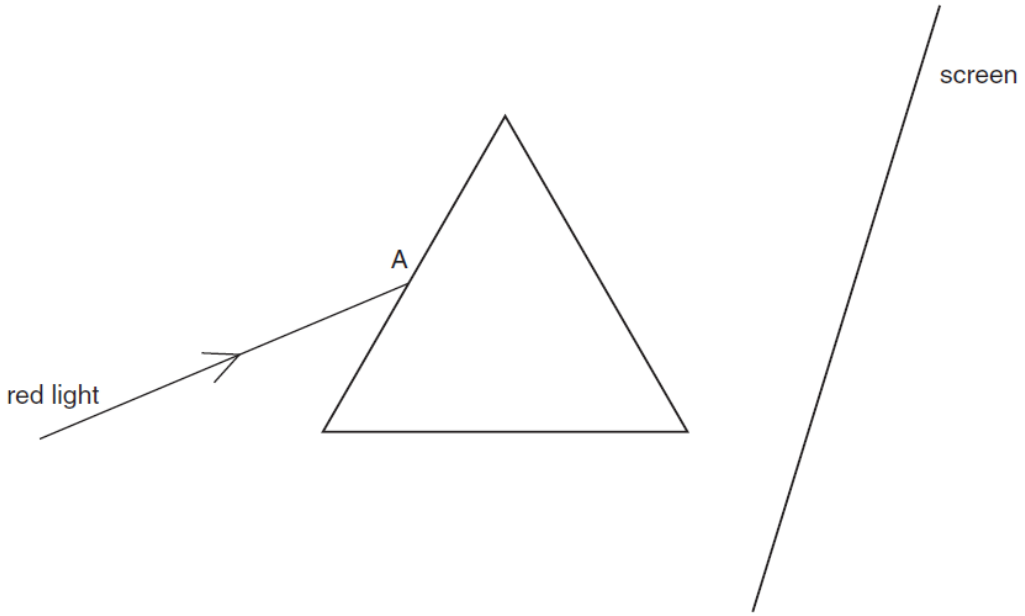


Fig. 12.1

(i) On Fig. 12.1, show the path of the beam until it reaches the screen.

(ii) What name do we use to describe what happens to the beam at A?

.....

[4]

(b) The red light is replaced by a narrow beam of mixed red and violet light, as shown in Fig. 12.2.

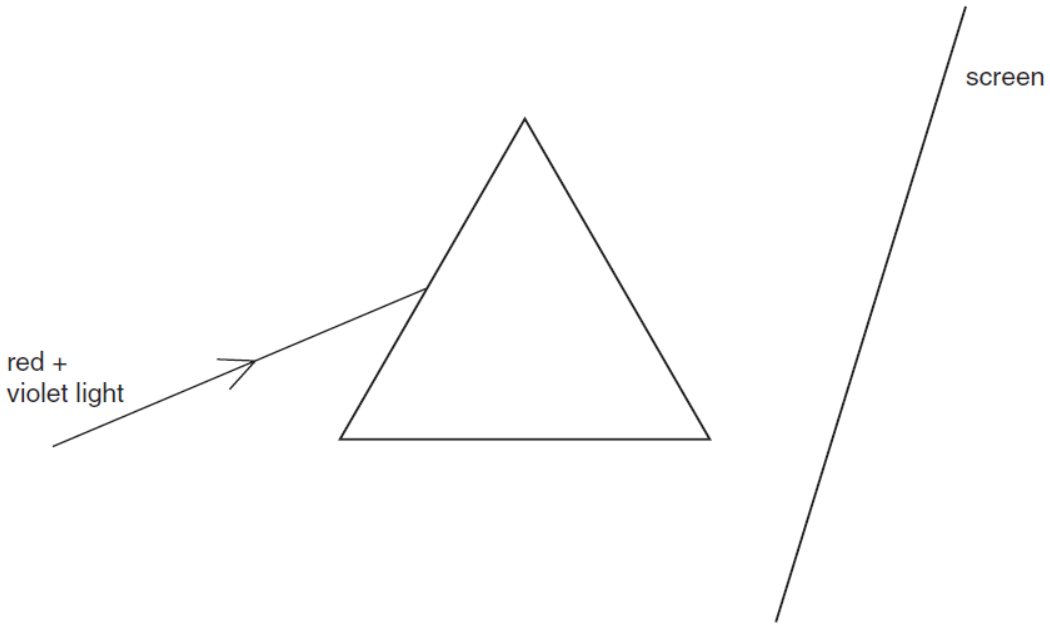


Fig. 12.2

Complete Fig. 12.2 to show what happens to the red and the violet light. [2]

(c) The beam of red and violet light is replaced by a narrow beam of white light from the Sun. State what is now seen on the screen.

.....[1]

(d) The rays from the Sun also include infra-red rays. Infra-red radiation can pass through glass.

(i) On Fig. 12.2, mark with the letter X the place where infra-red radiation from the Sun might strike the screen after passing through the prism.

(ii) Why can infra-red not be seen on the screen?

.....

(iii) What could be used to detect the infra-red radiation?

.....
[3]

[Total for Question 13 = 10 marks]

Question 14 is on the next page.

14.

Some cars have a pedestrian airbag for safety.

If a pedestrian is hit and lands on the front of the car, the airbag inflates.

©volvocars

Use ideas about momentum to explain how this airbag can reduce injuries to pedestrians.

(4)

[Total for Question 14 = 4 marks]

- End of Test -