Cambridge Assessment International Education

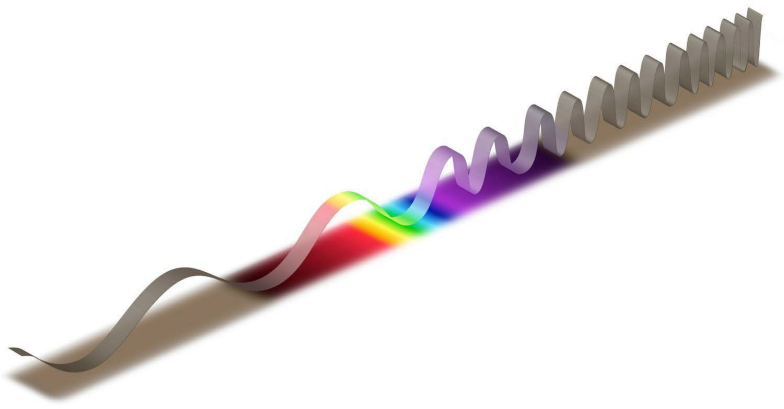
Specimen Paper Answers

Paper 2: Theory

Cambridge O Level Physics

5054

For examination from 2023



Version 1

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Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge O Level Physics 5054, and to show examples of very good answers.

In this booklet, we have provided answers for all questions with examiner comments. These exercises require candidates to answer short-answer and structured questions and candidates are awarded maximum of 80 marks for this paper and the mark scheme provides the answers required to gain the marks.

Each question and answer is followed by an examiner comment on the candidates answer. Additionally, the examiner has set out a number of common mistakes that occur when candidates answer the questions. In this way, it is possible to understand what candidates have done to gain their marks and how they could improve their answers and avoid errors.

The mark schemes for the Specimen Papers are available to download from the School Support Hub at **www.cambridgeinternational.org./support**

2023 Specimen Paper 2 Mark Scheme

Past exam resources and other teaching and learning resources are available on the School Support Hub www.cambridgeinternational.org/support

Assessment at a glance

The syllabus for Cambridge O Level Physics 5054 is available at www.cambridgeinternational.org

All candidates take three papers. Candidates will be eligible for grades A* to E.

Paper 1: Multiple Choice			Paper 2: Theory	
1 hour 40 Marks 40 four-option multiple-choice questions Externally assessed	30%	**And**	1 hour 45 minutes 80 Marks Short-answer and structured questions Externally assessed	50%

Practical assessment

Paper 3: Practical Test			Paper 4: Alternative to Practical	
1 hour 30 minutes 40 Marks Questions will be based on the experimental skills in Section 4 Externally assessed	20%	**Or**	1 hour 40 Marks Questions will be based on the experimental skills in Section 4 Externally assessed	20%

Question 1

Question 1(a)(i)

1 Fig. 1.1 is the speed-time graph for a stone as it falls to the ground.

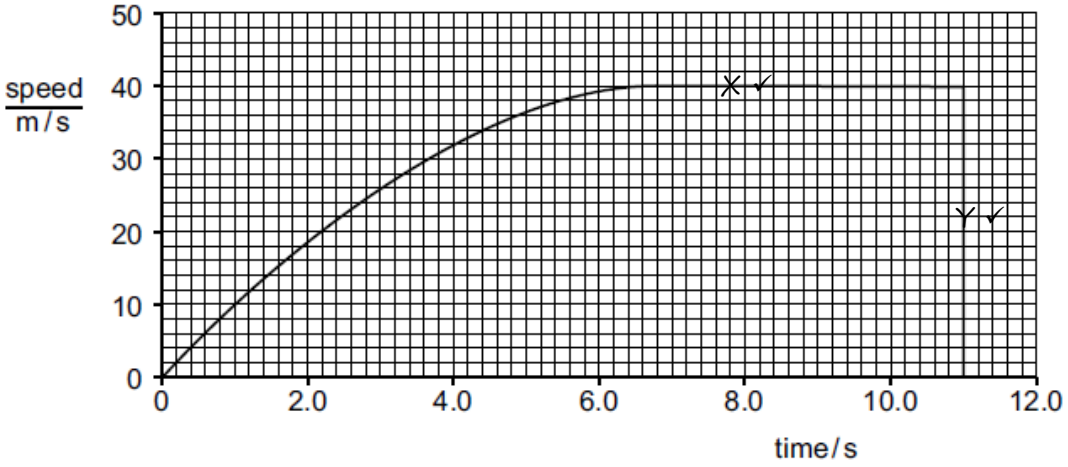


Fig. 1.1

(a) (i) On Fig. 1.1, mark:

- a letter **X** to indicate a point where the rock is moving with a constant speed
- a letter **Y** to indicate a point where the rock is decelerating.

[2]

Mark awarded = 2 out of 2

Examiner comment

On a speed time graph, a constant speed is represented by a horizontal line. An X can be placed anywhere on the horizontal section of the graph. Deceleration is represented by a line with a negative gradient. A Y can be placed anywhere on the (near) vertical line at time t = 11 s. The response scores 2 marks.

Question 1(a)(ii)

(ii) At time t = 0, the acceleration of the stone is equal to the acceleration of free fall.

Give the name of the force accelerating the stone at time t = 0.

weight ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

Recall initially the only force acting on the stone is weight. This response scores 1 mark.

Question 1(b)(i)

(b) The weight of the stone is 4.0 N.

As the stone falls, the force F of air resistance acting on the rock changes.

(i) State the value of F at time $t = 0$.

$F =$ 0 ✓ N [1]

Mark awarded = 1 out of 1

Examiner comment

When the speed of the stone is zero there is no air resistance. The response scores 1 mark.

Question 1(b)(ii)

(ii) State the value of F at time $t = 10.0$ s.

$F =$ 4 ✓ N [1]

Mark awarded = 1 out of 1

Examiner comment

At time $t = 10$ s, the speed is constant. This means the stone is travelling at terminal velocity. The weight and drag have an equal magnitude. The response scores 1 mark.

Question 1(b)(iii)

(iii) Suggest why F changes between $t = 0$ s and $t = 10.0$ s

The stone falls at a higher speed. ✓

[1]

Mark awarded = 1 out of 1

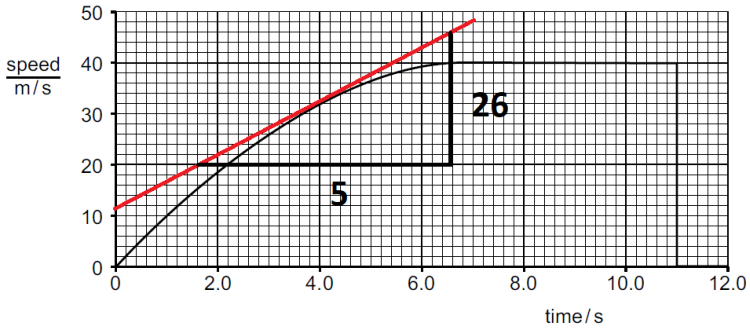
Examiner comment

Air resistance increases with increasing speed. The response scores 1 mark.

Question 1(c)(i)

(c) (i) Using Fig. 1.1, determine the acceleration of the rock at time t = 4.0 s. State the unit of your answer.

You will need to draw a tangent to the graph in Fig. 1.1 and show your working.



$gradient = \frac{rise}{run} = \frac{26}{5} = ✓$

acceleration = 5.2 ✓ unit = m/s^2 [3]

Mark awarded = 2 out of 3

Examiner comment

The acceleration is the gradient of a tangent to the graph. The tangent should be drawn to the curve at time t = 4.0 s. A large right-angled triangle below the line is helpful to find the rise and run. This calculation is performed correctly. However, the unit for acceleration is incorrect in this example answer. The response scores 2 marks.

Common mistakes

The length of the tangent or size of the triangle is too small leading to answers outside the acceptable range.

Question 1(c)(ii)

(ii) The mass of the stone is 408 g.

Determine the force F of air resistance acting on the rock at time t = 4.0 s.

Show your working.

$F = ma = 0.408 \times 5.2 = 2.12$ N

resultant force = weight − drag

$2.12 = 4.0 - drag$ ✓

F = 1.9 ✓ N [2]

Mark awarded = 2 out of 2

Examiner comment

At time t = 4.0 s the stone is falling with acceleration of 5.2 m / s². The resultant force causing this acceleration is found using $F=ma$. This is the resultant of the weight and the drag. A simple formula relating weight (4.0 N), drag and the resultant force (2.12 N) can be written. The response scores 2 marks.

Total mark awarded = 10 out of 11

Question 2

Question 2(a)(i)

2 Fig. 2.1 shows a black car going up a hill on a sunny day.

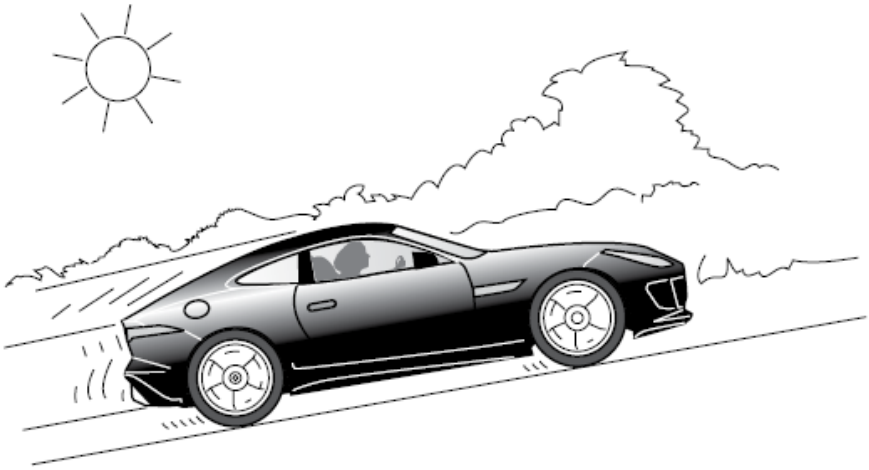


Fig. 2.1

(a) State:

(i) one way in which the car is gaining thermal energy

The car is absorbing radiation from the Sun. ✓

..... [1]

Mark awarded = 1 out of 1

Examiner comment

All objects emit and absorb radiation. Matt and/or black objects emit and absorb best. The question states the car is black, hinting at this answer. The response scores 1 mark.

Common mistakes

The question also states the car is going uphill, so a brief reading of the question might mean that thermal is missed and GPE given as an answer.

Question 2(a)(ii)

(ii) one way in which the car is losing thermal energy.

The car is emitting radiation. ✓

..... [1]

Mark awarded = 1 out of 1

Examiner comment

All objects emit and absorb radiation. Matt and/or black objects emit and absorb best. The question states the car is black, hinting at this answer. The response scores 1 mark.

Question 2(b)

(b) The car accelerates up the hill.

In addition to an increase in thermal energy, there are other energy transfers taking place.

Describe the other energy transfers.

Chemical energy ✓ is converted into gravitational potential energy. ✓

..... [3]

Mark awarded = 2 out of 3

Examiner comment

Chemical energy in either the petrol/diesel/hydrogen or the battery (for an electric car) decreases. Both the GPE and KE of the car increase as the car is going up the hill and accelerating. This answer has not explicitly stated that chemical energy is decreasing and GPE is rising so a benefit of the doubt may be applied to award marks to this answer. There is no mention of an increase in kinetic energy so this response can't score the third mark. The response scores 2 marks.

Question 2(c)

(c) At one point in the motion, the kinetic energy of the car is 90 kJ.

The mass of the car is 800 kg.

Calculate the speed of the car.

$$v = \sqrt{\frac{2E}{m}} = \sqrt{\frac{2 \times 90{,}000}{800}} = \checkmark$$

speed ..... 15 ✓ ..... m/s [3]

Mark awarded = 3 out of 3

Examiner comment

This response has the correct answer. However, the equation for kinetic energy has not been given with kinetic energy as the subject. The candidate has immediately rearranged the formula. The response scores 3 marks.

Common mistakes

If the candidate had made a mistake in the calculation and found the wrong answer, they would be awarded no marks. If they had written down the equation $E = \frac{1}{2}mv^2$ before rearranging / substituting incorrectly they would have scored the first C mark on the mark scheme.

Total mark awarded = 7 out of 8

Question 3

Question 3(a)

3 A passenger in an aircraft seals some air inside a plastic bag.

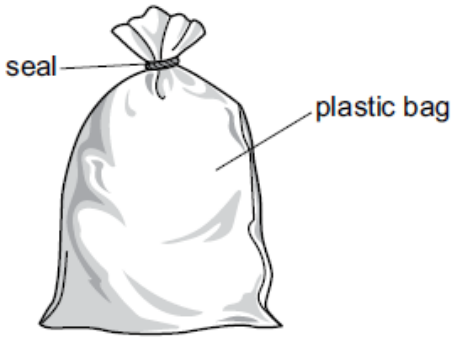


Fig. 3.1

(a) Explain how the particles of air in the bag exert a pressure on the inside of the bag.

The particles collide with the bag and produce a force outwards on the bag. ✓

Pressure is the force divided by area. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

Recall that pressure is caused by the force exerted by collisions of particles with the walls of its container and $p=F/A$. The response scores 2 marks.

Question 3(b)(i)

(b) When the bag is closed, the pressure of the air inside the aircraft is 80 kPa and the bag contains 500 cm^3 of air.

(i) When the aircraft is on the ground, the pressure of the air inside the aircraft is 100 kPa.

Calculate the volume of air inside the bag when the aircraft is on the ground.

$$p_1 V_1 = p_2 V_2$$

$$80 \times 500 = 100 \times V_2$$

$$V_2 = 400\ cm^3$$ ✓

volume = *400* ✓ cm^3 [2]

Mark awarded = 2 out of 2

Examiner comment

The question gives data on pressure and volume so the relevant equation should be recalled. Because this equation has pV on both sides there is no need to convert to standard units. The response scores 2 marks.

Question 3(b)(ii)

(ii) State **one** assumption that you made in your calculation in **(i)**.

constant temperature ✓

..... [1]

Mark awarded = 1 out of 1

Examiner comment

Recall that the equation applies if temperature is constant. The response scores 1 mark.

Question 3(c)

(c) The point plotted on the graph in Fig. 3.2 shows the initial pressure and volume of the air inside the bag.

Sketch a line on Fig. 3.2 to show how the volume of the air changes as the pressure increases.

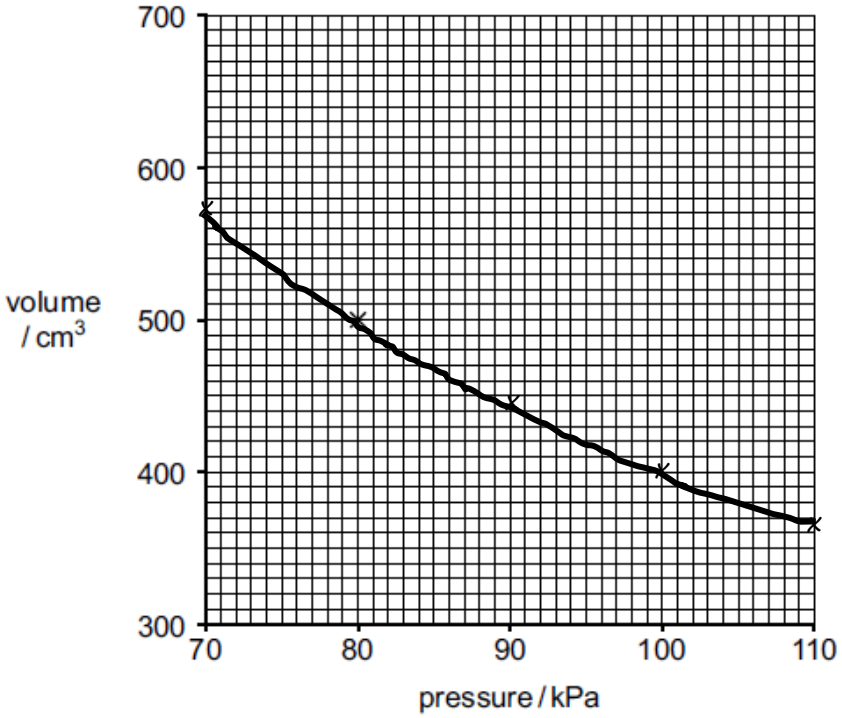


Fig. 3.2 [2]

Mark awarded = 2 out of 2

Examiner comment

As pressure increases, volume decreases. The curved line should go through the point given in the stem (and shown on the graph) and the point given in answer to 3bi. A strong candidate will place the line more accurately by calculating additional points e.g. (70,571), (90,444) and (110,364). The response scores 2 marks.

Total mark awarded = 7 out of 7

Question 4

Question 4(a)

4 One type of renewable energy source is shown in Fig. 4.1.

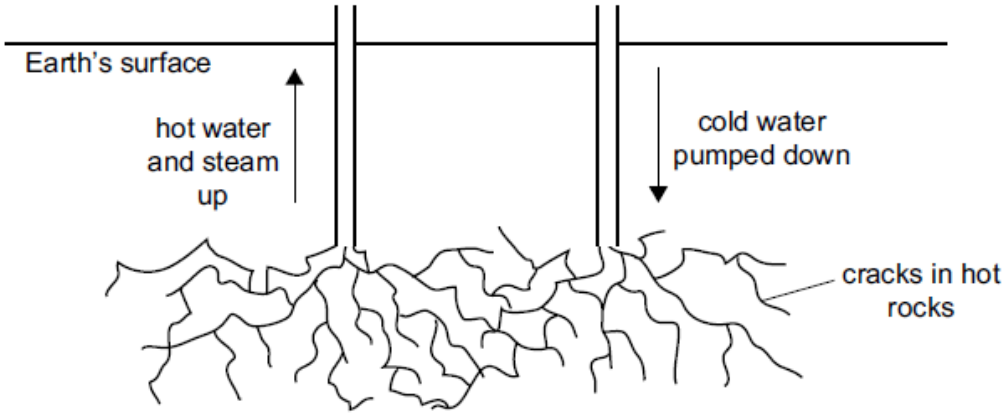


Fig. 4.1

(a) State the name of the renewable energy source shown in Fig. 4.1.

Geothermal ✓ ..... [1]

Mark awarded = 1 out of 1

Examiner comment

Recall that geothermal energy uses thermal energy recovered from hot rocks. The response scores 1 mark.

Question 4(b)(i)

(b) 1000 kg of cold water at a temperature of 20 °C is pumped down to the hot rocks.
The water returns partly as steam and partly as hot water.
The steam and the hot water are both at a temperature of 100 °C.

The specific heat capacity of water is 4200 J / (kg °C).

(i) Calculate the energy needed to heat 1000 kg of water from 20 °C to 100 °C.

$E = mcT = 1000 \times 4200 \times 80 = 3.4 \times 10^8$ J ✓

energy = ... 3.4×10^8 ✓ ..... J [2]

Mark awarded = 2 out of 2

Examiner comment

Recall the equation for specific heat capacity. The response scores 2 marks.

Question 4(b)(ii)

(ii) Explain why more energy is transferred when 1 kg of the steam cools to 20 °C than when 1 kg of the hot water cools to 20 °C.

You should include a reference to the arrangement of particles in liquids and in gases in your answer.

Steam is a gas and must condense ✓ to form water at 100°C. When it condenses it releases energy called the latent heat ✓ because the potential energy of the particles decreases. ✓

[3]

Mark awarded = 3 out of 3

Examiner comment

Recall the idea of latent heat of vaporisation. This energy is given out when steam condenses. This means more energy is transferred when steam cools. The energy comes from a decrease in the potential energy of the particles as they get closer together. The response scores 3 marks.

Total mark awarded = 6 out of 6

Question 5

Question 5(a)

5 Fig. 5.1 shows light in air, incident on the side of a rectangular glass block at an angle of 60°.

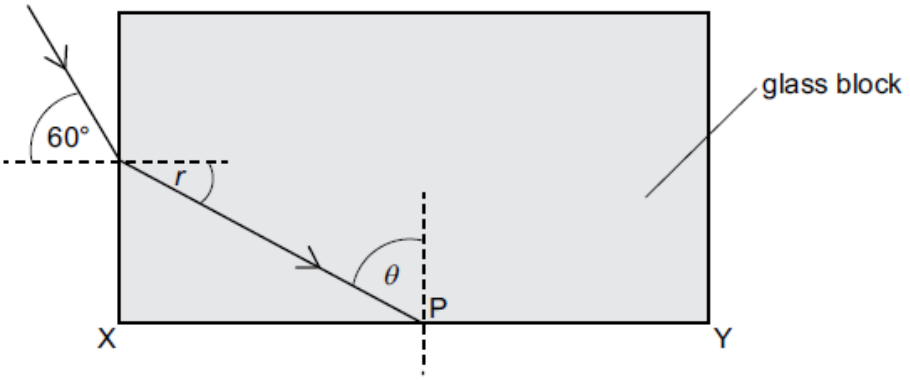


Fig. 5.1

The refractive index of the glass is 1.6. The light travels in the glass and is incident on side XY at P.

(a) Underline **all** the terms that describe a wave of light.

electromagnetic ✓ **longitudinal** **radioactive** **transverse** ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

Recall that light is a transverse electromagnetic wave. The response scores 1 mark.

Question 5(b)

(b) At the point where the light enters the glass, the angle of refraction is *r*.

Calculate angle *r*.

$n = \frac{\sin i}{\sin r}$ ✓

$1.6 = \frac{\sin 60}{\sin r}$

$r = \sin^{-1}\frac{\sin 60}{1.6}$

r = 33 ✓ ° [2]

Mark awarded = 2 out of 2

Examiner comment

Recall the equation

$$n = \frac{\sin i}{\sin r}$$

which relates angle of incidence and refraction to the refractive index of glass. The response scores 2 marks.

Question 5(c)(i)

(c) (i) Calculate the critical angle c for light travelling in the block.

$n = \frac{1}{\sin c}$ ✓

$1.6 = \frac{1}{\sin c}$

$c = \sin^{-1}\frac{1}{1.6}$

$c =$ 39 ✓ ° [2]

Mark awarded = 2 out of 2

Examiner comment

Recall the equation

$$n = \frac{1}{\sin c}$$

which relates the critical angle to the refractive index. The response scores 2 marks.

Question 5(c)(ii)

(ii) At P, the angle θ between the ray and the normal is given by $\theta = 90° - r$.

State and explain what happens to the light when it is incident on side XY.

$\theta = 90 - 33 = 57°$ ✓

Total internal reflection occurs because 57° is greater than the critical angle which is 39°. ✓ [2]

Mark awarded = 2 out of 2

Examiner comment

Total internal reflection occurs if the angle of incidence is greater than the critical angle. The response scores 2 marks.

Common mistakes

Numerical values of the angles should be quoted to make a comparison.

Total mark awarded = 7 out of 7

Question 6

Question 6(a)(i)

6 A 4.5 V battery is connected in a circuit with an ammeter, a light-dependent resistor (LDR) and a 1800 Ω fixed resistor.

Fig. 6.1 is the circuit diagram.

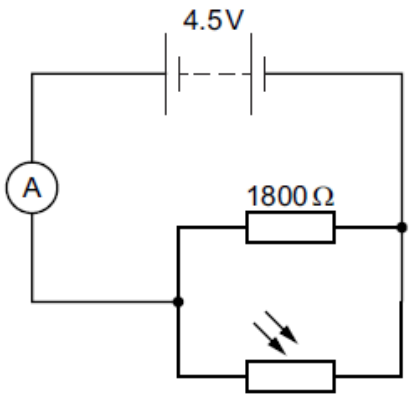


Fig. 6.1

(a) The light incident on the LDR causes its resistance to be 9000 Ω.

Calculate:

(i) the total resistance of the circuit

$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$ ✓

$\frac{1}{R}=\frac{1}{1800}+\frac{1}{9000}$

$\frac{1}{R}=0.000667$

resistance = 1500 ✓ Ω [2]

Mark awarded = 2 out of 2

Examiner comment

The resistor and LDR are connected in parallel. Recall and use the parallel resistor equation. The response scores 2 marks.

Common mistakes

When completing tables, it is essential that the headings are read carefully. Occasionally candidates write their answers in the wrong column and cannot be credited.

Question 6(a)(ii)

(ii) the reading on the ammeter.

$I = \frac{V}{R} = \frac{4.5}{1500} =$ ✓

reading = 0.0030 ✓ A [2]

Mark awarded = 2 out of 2

Examiner comment

Recall and use the equation $V=IR$. The potential difference is the e.m.f. of the battery (because it's a parallel circuit) and the resistance is the total resistance calculated in 6ai. The response scores 2 marks.

Question 6(b)(i)

(b) A very bright lamp is switched on and the intensity of the light incident on the LDR increases.

(i) State and explain what happens to the current in the LDR.

what happens to the current The current increases ✓

explanation The resistance of the LDR decreases ✓

[1]

Mark awarded = 1 out of 1

Examiner comment

Recall that as the light intensity increases the resistance of the LDR decreases. Lower resistance means a greater current. The response scores 1 mark.

Question 6(b)(ii)

(ii) State and explain what happens to the current in the 1800 Ω resistor.

what happens to the current The current stays the same ✓

explanation The resistance of the resistor stays the same ✓

[1]

Mark awarded = 1 out of 1

Examiner comment

The p.d. across the 1800 Ω resistor remains the same at 4.5 V. Obviously so does its resistance. Using $V=IR$ means the current is also unchanged. The response scores 1 mark.

Total mark awarded = 6 out of 6

Question 7

Question 7(a)(i)

7 **(a)** Fig. 7.1 shows a horizontal, current-carrying wire PQ in the gap between the poles of a permanent magnet.

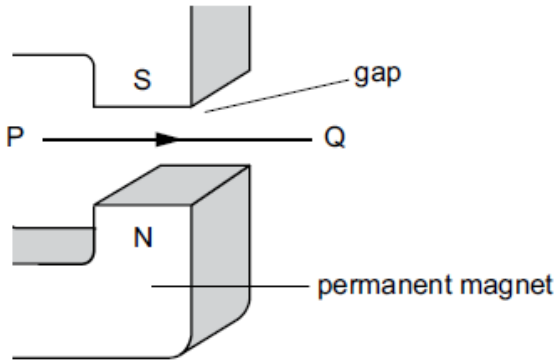


Fig. 7.1

(i) There is a magnetic field in the gap between the N pole and the S pole.

The current in PQ is from left to right.

Describe the effect of the magnetic field on PQ.

There is force ✓ on PQ out of the page. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

Recall that a current carrying conductor in a magnetic field experiences a force. The direction of the force is given by Fleming's left hand rule. The first finger (magnetic field) points upwards, the second finger (current) points to the right. Therefore, the thumb (force) points out of the page. The response scores 2 marks.

Common mistakes

Candidates are sometimes vague with directions in diagrams drawn in perspective like Fig. 7.1. There are only six appropriate direction labels they should choose from: up, down, left, right, into the page, out of the page.

Question 7(a)(ii)

(ii) State the effect on PQ of increasing the strength of the magnetic field in the gap.

The force gets stronger. ✓

..... [1]

Mark awarded = 1 out of 2

Examiner comment

Recall that if the magnetic field is stronger, the force has a greater magnitude. The response scores 1 mark.

Question 7(b)(i)

(b) Fig. 7.2 shows part of a torch. The torch does not contain a battery.

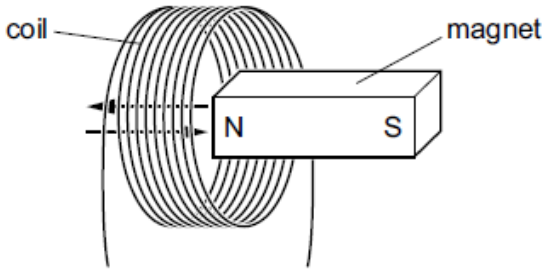


Fig. 7.2

The torch is shaken and this causes the magnet to move backwards and forwards through the coil.

(i) Explain why an electromotive force (e.m.f.) is induced across the coil when the magnet moves.

There is a change ✓ of magnetic flux in the coil. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

Recall that an e.m.f. is induced where magnetic field lines cut a coil / there is a change in the magnetic field linking a coil. The response scores 2 marks.

Question 7(b)(ii)

(ii) State **one** way to increase the e.m.f. induced.

Move the magnet faster. ✓

..... [1]

Mark awarded = 1 out of 1

Examiner comment

Recall that the magnitude of the e.m.f. is larger if there is a greater rate of change of flux. The response scores 1 mark.

Question 7(b)(iii)

(iii) As the magnet moves into the coil, the induced e.m.f. produces a current in the coil.

Explain how this opposes the motion of the magnet.

The current in the coil produces a magnetic field. ✓ Lenz's law says that a north pole will be created on the right of the coil to repel the magnet as it enters. ✓

[2]

Mark awarded = 2 out of 2

Examiner comment

Recall that effect of the current produced by an induced e.m.f. is to oppose the change producing it. In this context it means it repels the magnet as it enters the coil. The response scores 2 marks.

Total mark awarded = 8 out of 8

Question 8

Question 8(a)(i)

8 Fig. 8.1 shows a circuit containing a 230 V a.c. supply connected to a television and two lamps.

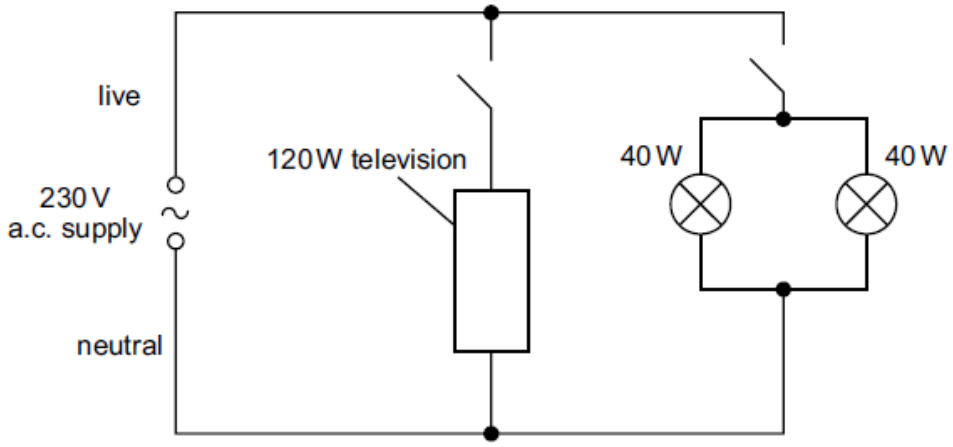


Fig. 8.1

In normal operation, both switches are closed. The power supplied to each lamp is 40 W and the power supplied to the television is 120 W.

(a) Calculate, in normal operation:

(i) the total number of kilowatt-hours (kW h) of energy supplied to the circuit in 1.0 hour

$120+40+40=200$ W

number of kW h = 0.2 ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

Add up the power of each component. Convert to kW and then multiply by the time in hours. The response scores 1 mark.

Question 8(a)(ii)

(ii) the current in each lamp.

$I = \frac{P}{V} = \frac{40}{230}$ ✓

current = 0.17 ✓ A [2]

Mark awarded = 2 out of 2

Examiner comment

Recall and use $I = \frac{P}{V}$. The response scores 2 marks.

Question 8(b)

(b) Explain why the switches are placed in the live wire and **not** in the neutral wire.

If the switch was in the neutral wire, the components would be connected to the live wire and still be at 230 V ✓ even when switched off. ✓

[2]

Mark awarded = 2 out of 2

Examiner comment

When the switch is placed in the live wire the components are not live when the switch is open. When the switch is placed in the neutral wire, the components are still connected to the live wire at 230 V when the switch is open. The response scores 2 marks.

Question 8(c)

(c) State **one** advantage of connecting the two lamps in parallel in this circuit.

If one bulb blows the other stays on. ✓

[1]

Mark awarded = 1 out of 1

Examiner comment

This is a simple consequence of connecting bulbs in parallel. The response scores 1 mark.

Total mark awarded = 6 out of 6

Question 9

Question 9(a)

9 Fig. 9.1 shows the main parts of a nuclear reactor.

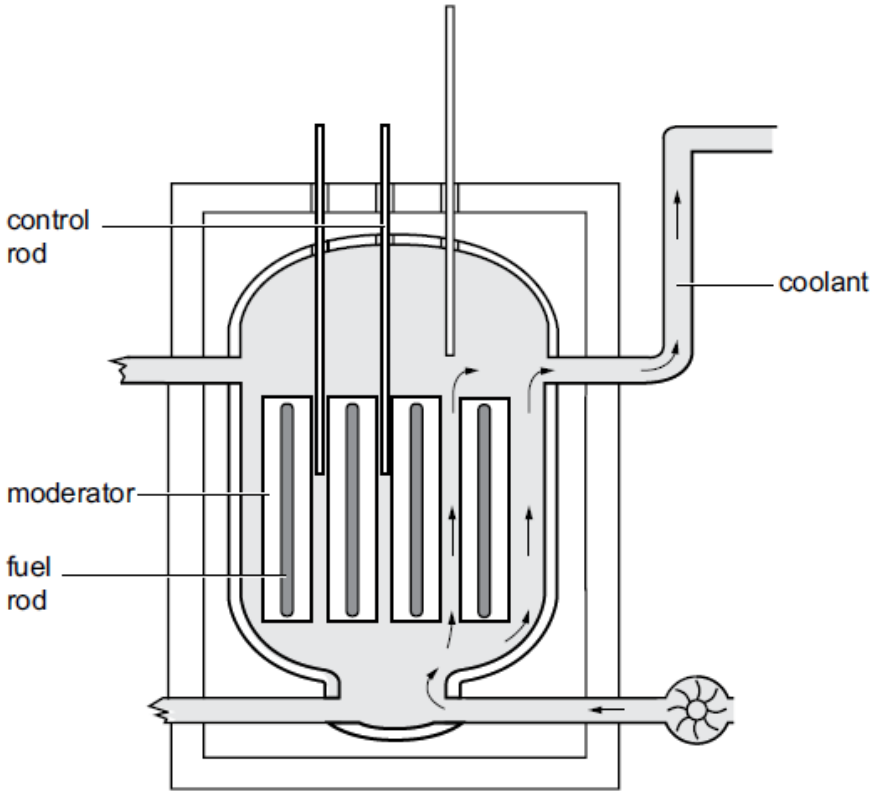


Fig. 9.1

(a) The fuel rod contains uranium-235, which can undergo nuclear fission.

Describe the process of nuclear fission that occurs in the fuel rod.

Your description should include the role of neutrons in the process.

A neutron is absorbed by a uranium atom × causing it to split into two daughter nuclei ✓ and 2 or 3 neutrons. ✓

[3]

Mark awarded = 2 out of 3

Examiner comment

Recall the process of nuclear fission. This answer refers to the neutrons correctly but refers to an atom and not a nucleus. The response scores 2 marks.

Common mistakes

Candidates often refer to atoms rather than nuclei. Candidates sometimes refer to daughter cells, rather than daughter nuclei.

Question 9(b)

(b) Explain what happens as a control rod is moved out of the reactor core.

Fewer neutrons are absorbed ✓ so the reactor produces more energy. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

Recall that the control rods absorb neutrons. If there are fewer mobile neutrons there is less nuclear fission and so less energy is produced. The response scores 2 marks.

Question 9(c)

(c) The nuclear reactor releases energy at a steady rate.

By referring to neutrons, describe what is happening to achieve this steady rate.

Only 1 neutron produced by each fission causes another nucleus to split. ✓

..... [1]

Mark awarded = 1 out of 1

Examiner comment

The reaction happens at a steady rate if only one neutron from each fission goes on to cause another fission. The control rods absorb the excess neutrons. The response scores 1 mark.

Question 9(d)

(d) Explain the purpose of the moderator in the nuclear reactor.

The moderator slows down neutrons ✓ so they are more likely to be absorbed by a uranium nucleus. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

Recall the role of the moderator is to slow down neutrons so they are more likely to be absorbed by a uranium nucleus (rather than bouncing off). The response scores 2 marks.

Total mark awarded = 7 out of 8

Question 10

Question 10(a)

10 The Sun is a star in a stable part of its life cycle.

(a) Using ideas about forces, explain how the Sun remains stable in this part of its life cycle.

The inwards force of gravity ✓ is equal to the outwards force of radiation pressure. ✓

..... [2]

Mark awarded = 2 out of 2

Examiner comment

The two forces acting in a main sequence star are gravity inwards and radiation pressure outwards. The response scores 2 marks.

Question 10(b)

(b) Describe what happens to stars of similar mass to the Sun at the end of the stable part of their life cycle.

When the hydrogen fuel runs ✓ out the star expands becoming a red giant. ✓ Once the helium fuel has run out the core collapses to become a dense white dwarf. ✓

..... [3]

Mark awarded = 3 out of 3

Examiner comment

Recall the stages in the life cycle of star with similar mass to the Sun. The response scores 3 marks.

Question 10(c)

(c) The orbital speed of Earth around the Sun is 30 km / s. Use this value to calculate the distance of Earth from the Sun.

Show your working. State the unit of your answer.

$$v = \frac{2\pi r}{T} \checkmark$$

$$r = \frac{vT}{2\pi} = \frac{30000 \times 365 \times 24 \times 60 \times 60}{2\pi} \checkmark$$

distance = 1.5×10^{11} ✓ unit = m ✓ [3]

Mark awarded = 3 out of 3

Examiner comment

Recall and rearrange the equation

$$v = \frac{2\pi r}{T}$$

where T is the time for one complete orbit of the Earth around the Sun (1 year) and $2\pi r$ is the circumference of the orbit. The response scores 3 marks.

Common mistakes

Candidates should ensure time is converted into seconds.

Question 10(d)(i)

(d) The light emitted by distant galaxies show various amounts of redshift.

(i) State the name of the galaxy that contains our Sun.

Milky Way ✓ [1]

Mark awarded = 1 out of 1

Examiner comment

Recall the name of our galaxy. The response scores 1 mark.

Question 10(d)(ii)

(ii) State what is meant by redshift and describe how it is caused.

Redshift is the increase in wavelength of radiation ✓ emitted by galaxies moving away from the Earth. ✓

[2]

Mark awarded = 1 out of 1

Examiner comment

The response scores 2 marks.

Question 10(d)(iii)

(iii) An astronomer compares the spectrum of light emitted by the Sun with the spectrum of light emitted by distant galaxies P and Q.

Fig. 10.1 shows the same four lines as observed in all three spectrums.

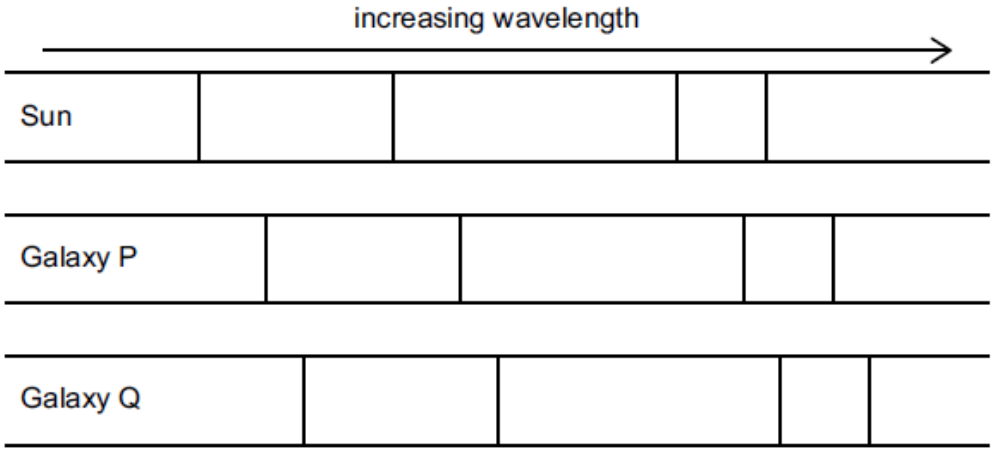


Fig. 10.1

State what Fig. 10.1 enables the astronomer to deduce about galaxy P and galaxy Q.

Explain the astronomer's reasons in your answer.

Galaxy Q is moving faster than galaxy P because the lines in the spectrum show a larger redshift. ✓ Galaxy Q is further away from Earth because redshift increases as distance increases. ✓

[2]

Mark awarded = 2 out of 2

Examiner comment

Notice that galaxy Q shows more redshift than P because the lines in the spectrum have moved further to the right. Recall the effects of this. The response scores 2 marks.

Common mistakes

Candidates often omit the reasons (the text after each “because”) e.g. Galaxy Q is moving faster than galaxy P. Galaxy Q is further away from Earth.

Total mark awarded = 13 out of 13

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