WJEC GCSE PHYSICS

PHYSICS



EXAM QUESTION PACK

UNIT P1 FOUNDATION TIER 0237 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0237/01

SCIENCE
FOUNDATION TIER
PHYSICS 1

A.M. WEDNESDAY, 30 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**4**	
3.	**3**	
4.	**3**	
5.	**3**	
6.	**4**	
7.	**4**	
8.	**5**	
9.	**5**	
10.	**5**	
11.	**5**	
12.	**5**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

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EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used (kWh) × cost per unit

$$\% \text{ efficiency} = \frac{\text{useful power transfer}}{\text{total power input}} \times 100$$

wave speed = wavelength × frequency

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

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Answer **all** *questions.*

1. The information plate below was found on the back of a microwave oven.

Serial No 1277993
230 V 50 Hz
0.8 kW
2450 MHz

Use the information on the rating plate to complete the following sentences.

The appliance should be connected to a mains voltage of ..... .

The appliance uses microwave radiation of frequency ..... .

The power of the appliance is ..... which means it transfers

..... joules of energy every second. [4]

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2. The table gives information about some ways of reducing energy costs in a house.

Method used to reduce energy costs	Cost (£)	Saving per year (£)	Saving in 10 years (£)
Fitting solar panels for water heating	2400	150	1500
Replacing lamps with energy saving lamps	100	25	.....
Fitting a new hot water boiler	1400	.....	1000

(a) Complete the table. [2]

(b) Calculate the payback time for the solar panels.
(This is the number of years it takes for the savings made to pay the cost of installation.)
[2]

Payback time = ... years

4

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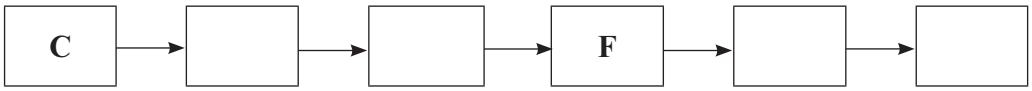
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3. Stars are created and eventually die over billions of years.
The sentences **A** to **F** describe the stages of the evolution of a high mass star.
The sentences are in the wrong order.

A	Temperature and pressure build up to start fusion.
B	Expansion and cooling to form a red supergiant star.
C	Massive clouds of gas and dust are pulled together by gravity.
D	The gas and dust cloud becomes more compressed and heats up.
E	A supernova occurs leaving a black hole or a neutron star.
F	A large stable blue star exists.

Arrange the sentences in the right order in the boxes below.
Two boxes have been completed for you. [3]



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3

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4. A £1 coin, inserted into a pre-payment electric meter, buys 4 units (kWh) of electricity.

(i) Use the equation

$$\text{cost per unit} = \frac{\text{cost}}{\text{units used (kWh)}}$$

to calculate the cost of 1 unit in pence. [1]

Cost of 1 unit = ... p

(ii) Use the equation

$$\text{time (h)} = \frac{\text{units used (kWh)}}{\text{power (kW)}}$$

to calculate how long a 1·6 kW electric fire can be used before the £1 coin runs out. [2]

Time = ... h

3

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5. The electromagnetic spectrum is the name given to a family of waves that includes light, infra red and ultra violet radiations. All members of the family can travel through a vacuum with the same high velocity.

Electromagnetic waves are produced when the energy of electrically charged particles is changed in some way. The greater the change in energy, the shorter the wavelength of the electromagnetic wave produced. Radio waves, with a wavelength of up to 10 km and gamma (γ) rays with wavelengths of a thousand millionths of a millimetre are found at opposite ends of the electromagnetic spectrum.

(a) (i) Name **one** part of the electromagnetic spectrum that is **not** mentioned in the above passage. [1]

.....

(ii) Name **one** part of the electromagnetic spectrum that has a frequency greater than that of visible light. [1]

.....

(b) Give **one** reason why radio waves have a longer wavelength than gamma (γ) rays. [1]

.....

.....

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3

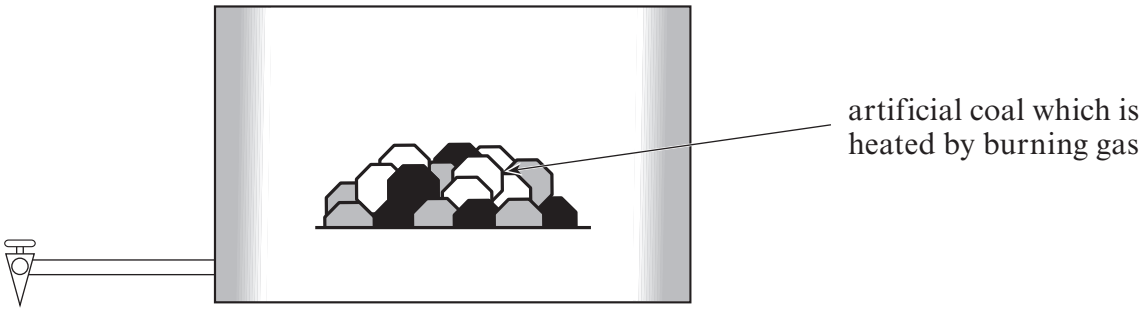
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6. The diagram shows a 'coal-effect' gas fire.



(a) Complete the following sentences by **underlining one word** from each bracket.

(i) Heat is transferred directly to a person sitting in front of the fire by

[conduction / convection / radiation]. [1]

(ii) Heat is transferred to the person by the movement of hot air in the room, caused by

[conduction / convection / radiation]. [1]

(b) The 'coal-effect' fire requires 5 kW of power to provide 2·5 kW to the room.
Use the equation

$$\% \text{ efficiency} = \frac{\text{useful power transfer}}{\text{total power input}} \times 100$$

to calculate the efficiency of the fire. [2]

Efficiency = ... %

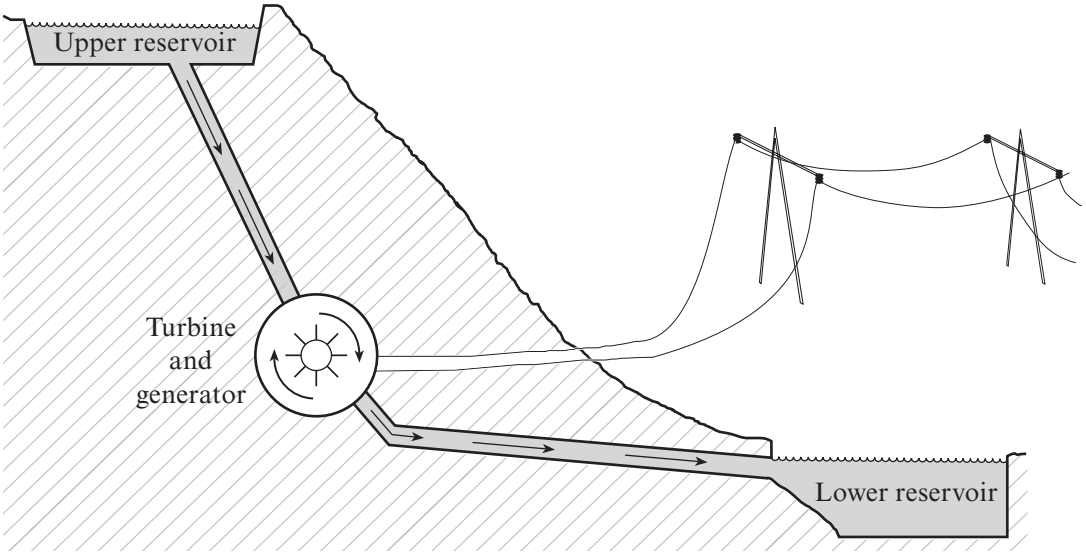
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7. The diagram shows how electricity is generated in a hydroelectric power station that is in a National Park – an area of outstanding natural beauty.



The electricity that is generated is passed to a transformer. It is then sent along wires that are underground for the first few kilometres and along wires supported by pylons after that.

The power station is only used when we need more electricity than the rest of the power stations around the country can supply.

(a) State **one** advantage of generating electricity in a hydroelectric power station. [1]

.....

.....

(b) (i) Give a reason why the electrical wires are taken underground for the first few kilometres. [1]

.....

.....

(ii) The transformer is used before the electricity is sent along the wires. Explain **what** the transformer does to the electricity and **why** it is used. [2]

.....

.....

.....

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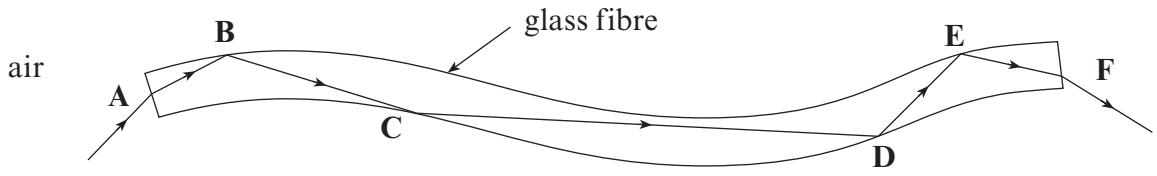
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8. The diagram shows a signal passing from air, through a glass fibre and back out into the air.



(a) Select from the boxes a phrase that correctly completes the sentences that follow.

Each phrase may be used **once**, **more than once** or **not at all**. [3]

is passing into a less dense medium	is passing into a more dense medium	hits at an angle greater than the critical angle	hits at an angle less than the critical angle

(i) The signal changes direction at **A** because it .....

.....

(ii) The signal changes direction at **D** because it .....

.....

(iii) The signal changes direction at **F** because it .....

.....

(b) State **two** ways in which optical fibres have improved long-distance communication. [2]

1. .....

2. .....

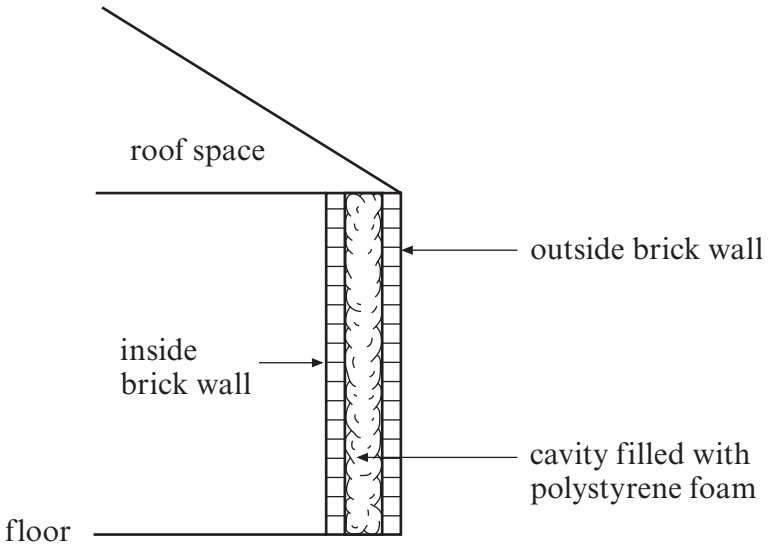
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9. The diagram represents a section through part of a building and it shows the side cavity wall, filled with polystyrene foam to reduce heat loss.



(a) State **two** *other* ways of reducing heat loss from buildings. [2]

(i) .....

.....

(ii) .....

.....

(b) (i) Explain how heat loss by **conduction** through the wall is reduced by the foam. [2]

.....

.....

.....

(ii) Explain how heat loss by **convection** in the wall cavity is reduced by the foam. [1]

.....

.....

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10. A gas customer had double glazing installed on 1st February.
The table shows the gas meter readings 3 months before installation and 3 months after.

Date	1st November	1st February	1st May
Readings (units)	5 100	6 325	7 335

(a) Calculate:

(i) the number of units used in the 3 months **before** the double glazing was installed; [1]

Number of units = ...

(ii) the number of units used in the 3 months **after** the double glazing was installed. [1]

Number of units = ...

(b) If each gas unit cost 43 p, calculate how much money **was saved** on the gas bill after installing double glazing. [2]

Money saved = ... p

(c) The gas customer claimed that the money saved was entirely due to the installation of the double glazing.
Give a reason why this claim is not scientifically correct. [1]

.....

.....

.....

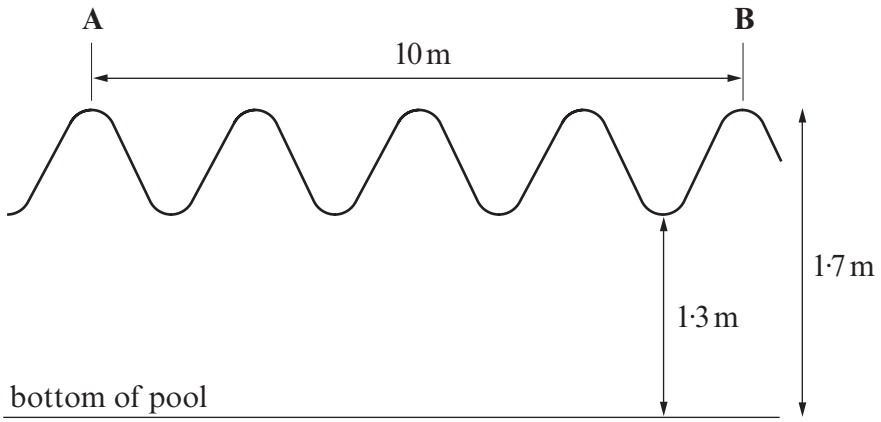
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11. The diagram shows a side view of the water waves, produced in a swimming pool by a wave machine.



(a) Use information given on the diagram to find:

(i) the amplitude of the waves; [2]

Amplitude = ... m

(ii) the number of complete waves between **A** and **B**; ..... [1]

(iii) the wavelength of the water waves. [1]

Wavelength = ... m

(b) State what happens to the wavelength of the water wave when the frequency of the wave machine is increased. [1]

.....

.....

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12. The Solar System consists of the Sun and its planets.

The table gives data on four planets in the Solar System.

Planet	Distance from the Sun (million km)	Time for one orbit (years)	Average surface temperature
Earth	150	1·0	15 °C
Mars	228	1·9	–23 °C
Jupiter	778	11·9	–120 °C
Saturn	1 427	29·5	–180 °C

Ceres is a large asteroid which orbits the Sun in the asteroid belt.

(a) What is the asteroid belt? [1]

.....

.....

(b) Use the data in the table to make a reasonable estimate of: [2]

(i) the distance of Ceres from the Sun; ..... million km

(ii) the temperature on the surface of Ceres. ..... °C

(c) Astronomers believe that, after the Sun formed 4·5 billion years ago, the remaining gas, dust and ice collected together to form the planets.
The 4 inner planets have a different make up (structure) from the 4 outer planets (excluding Pluto).

(i) State how the inner planets are structurally different from the outer planets. [1]

.....

.....

(ii) Explain how the structural difference between the planets was influenced by the energy from the newly-formed Sun. [1]

.....

.....

.....

.....

END OF PAPER

5

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GCSE MARKING SCHEME

SCIENCE - PHYSICS (LEGACY)

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE SCIENCE - PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
P1 - FOUNDATION TIER	1
P1 - HIGHER TIER	4
P2 - FOUNDATION TIER	7
P2 - HIGHER TIER	10
P3 - FOUNDATION TIER	13
P3 - HIGHER TIER	16

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GCSE Science - Physics (Legacy) - P1

Mark Scheme

FOUNDATION TIER

Question			Marking details	Marks Available
1.			230[V 50 Hz], 2450[MHz], 0.8 kW/800 W, 800 **Question total**	4 **[4]**
2.	*(a)* *(b)*		250 (1) 100 (1) 2400/150 = 16 years substitution (1), answer (1) **Question total**	2 2 **[4]**
3.			D A B E 3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark **Question total**	3 **[3]**
4.		(i) (ii)	100/4 = 25 [p] 4/1.6 = 2.5 [h] substitution (1) answer (1) **Question total**	1 2 **[3]**
5.	*(a)* *(b)*	(i) (ii) 	X rays / microwaves UV / X rays / gamma smaller / lower change in energy [of the charged particle] **Question total**	1 1 1 **[3]**

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Question			Marking details	Marks Available
6.	*(a)*	(i)	radiation	1
		(ii)	convection	1
	(b)		$\frac{2.5}{5}$ = 50 [%] substitution (1) answer (1)	2
			Question total	**[4]**
7.	*(a)*		No fuel costs / limited pollution / generated immediately Don't accept renewable	1
	(b)	(i)	An environmental decision	1
		(ii)	Step-up / change voltage (1) so that energy loss in the cables is minimised. (1)	2
			Question total	**[4]**
8.	*(a)*	(i)	Box 2	1
		(ii)	Box 3	1
		(iii)	Box 1	1
	(b)		Any 2 x (1): More signals per cable / less interference / faster /more secure	2
			Question total	**[5]**
9.	*(a)*		Any 2 x (1): Lagging roof space / double glazing / draught excluding on doors etc	2
	(b)	(i)	Bad conductor / traps heat (1) because of air gaps (1)	2
		(ii)	Prevents movement of air pockets in the cavity	1
			Question total	**[5]**

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Question			Marking details	Marks Available
10.	*(a)*	(i)	6325-5100 = 1225 (1)	
		(ii)	7335-6325 = 1010 (1)	2
	(b)		Units saved = 1225-1010 = 215 units (1) **ecf**	
			Money saved = 215 **ecf** x 43 = 9245 [p] / [£]92.45 (1)	2
			Both answers to (*a*) x 43 award 1 mark only	
	(c)		No account taken of different conditions re: weather and gas charges	1
			Question total	**[5]**
11.	*(a)*	(i)	$\frac{(1.7-1.3)(1)}{2} = \frac{0.4}{2} = 0.2$[m] (1)	2
		(ii)	4	1
		(iii)	10/4 = 2.5 [m]	1
	(b)		Reduced [when speed is constant]	1
			Question total	**[5]**
12.	*(a)*		A group of rocks of various sizes orbiting the Sun / between Mars and Jupiter	1
	(b)	(i)	Between 350-650 [million km]	2
		(ii)	-50 and -100 [^{o}C]	
	(c)	(i)	Inner rocky / outer gaseous	1
		(ii)	Sun's radiant energy easily pushed the gases to the outer reaches	1
			Question total	**[6]**
			Total Foundation paper	**50**

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HIGHER TIER

Question			Marking details	Marks Available
1.	*(a)*	(i)	6325-5100 = 1225 (1)	
		(ii)	7335-6325 = 1010 (1)	2
	(b)		Units saved = 1225-1010 = 215 units (1) **ecf**	
			Money saved = 215 **ecf** x 43 = 9245 [p] / [£]92.45 (1)	2
			Both answers to (*a*) x 43 award 1 mark only	
	(c)		No account taken of different conditions re: weather and gas charges	1
			Question total	**[5]**
2.	*(a)*	(i)	$\frac{(1.7-1.3)(1)}{2} = \frac{0.4}{2} = 0.2$[m] (1)	2
		(ii)	4	1
		(iii)	10/4 = 2.5 [m]	1
	(b)		Reduced [when speed is constant]	1
			Question total	**[5]**
3.	*(a)*		A group of rocks of various sizes orbiting the Sun / between Mars and Jupiter	1
	(b)	(i)	Between 350-650 [million km]	2
		(ii)	-50 and -100 [^{o}C]	
	(c)	(i)	Inner rocky / outer gaseous	1
		(ii)	Sun's radiant energy easily pushed the gases to the outer reaches	1
			Question total	**[5]**

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Question			Marking details	Marks Available
4.			Kettle: 2000 (1) 2(1) **ecf** on power (W) conversion Food mixer: $\frac{5}{60}$ x 0.72 = 0.06 (1) correct power (1), conversion (1) Answer of 3.6 with no working shown award 1 mark Answer of 3.6 with working shown award 2 marks **Question total**	5 **[5]**
5.	*(a)*	(i)	Award (1) x 3: By conduction through the metal (1), radiates heat to people directly in front of the radiation (1), air in contact becomes heated and rises – circulating the room / forming convection currents to heat the room (1) mechanism of convection (1).	3
		(ii)	Dark colours are best **<u>radiators / emitters</u>** of heat	1
	(b)	(i)	Conduction [through ceiling] (1) and mainly convection [through the roof space] (1)	2
		(ii)	Air gaps in fibre glass reduces conduction through the ceiling (1) and [as a consequence] reduces convection since little heat conducted (1)	2
			Question total	**[8]**

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Question			Marking details	Marks Available
6.	*(a)*		Any 3 x (1): Localised heating effects e.g. rivers Inefficient (can be implied) Carbon dioxide / CO_2 leads to global warming Sulphur dioxide / SO_2 leads to acid rain	3
	(b)	(i)	% efficiency = <u>useful power transfer</u> x 100 total power input	1
			$\frac{82x400}{100} = 328$ [MW] substitution (1) answer (1)	2
		(ii)	328-118=210 [MW]	1
		(iii)	To minimise heat losses / ease of access to the energy / benefit to more people	1
			Question total	**[8]**
7.	*(a)*	(i)	Forces unbalanced, radiation pressure greater than gravity	1
		(ii)	Correct sequence red giant to white dwarf (1) Any 2 points from the graph relevant to the red giant or white dwarf (1) (don't accept reference to colour)	2
	(b)	(i)	More energy produced by fusion / more hydrogen to fuse	1
		(ii)	Any 3 x (1): Expand to a red supergiant (1) and cools (1) and eventually becomes a supernova (1) leaving behind a black hole / neutron star (1)	3
			Question total	**[7]**
8.	*(a)*		Satellite takes the same <u>time</u> to orbit / 24 hours (1) as it takes for the Earth to spin once on its axis (1)	2
	(b)	(i)	$\frac{3x10^8}{5x10^9} = 0.06$ [m] substitution (1) answer (1)	
		(ii)	$\frac{2(1)x3.6x10^7}{3x10^8} = 0.24$ [s] substitution (1) answer (1)	5
			Question total	**[7]**
			Total Higher Tier	**50**

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Other Names		0

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SCIENCE
FOUNDATION TIER
PHYSICS 1

P.M. FRIDAY, 15 June 2012

45 minutes

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Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**5**	
3.	**4**	
4.	**3**	
5.	**4**	
6.	**4**	
7.	**4**	
8.	**7**	
9.	**5**	
10.	**5**	
11.	**5**	
Total	**50**	

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ADDITIONAL MATERIALS

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INSTRUCTIONS TO CANDIDATES

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Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

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INFORMATION FOR CANDIDATES

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You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

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EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used × cost per unit

$$\%\ \text{efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100$$

wave speed = wavelength × frequency

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

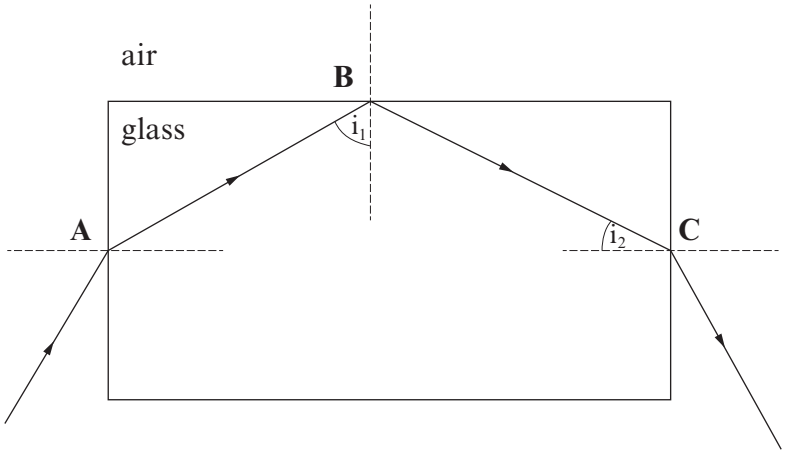
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Answer **all** *questions.*

1. The diagram shows the path of a ray of light through a glass block.



Complete the following sentences by underlining the correct word or phrase contained in the brackets. [4]

(a) At **B** the light ray is [refracted / reflected / totally internally reflected] because angle i_1 is [less than / equal to / more than] the critical angle for glass.

(b) At **C** the light ray is [refracted / reflected / totally internally reflected] because angle i_2 is [less than / equal to / more than] the critical angle for glass.

4

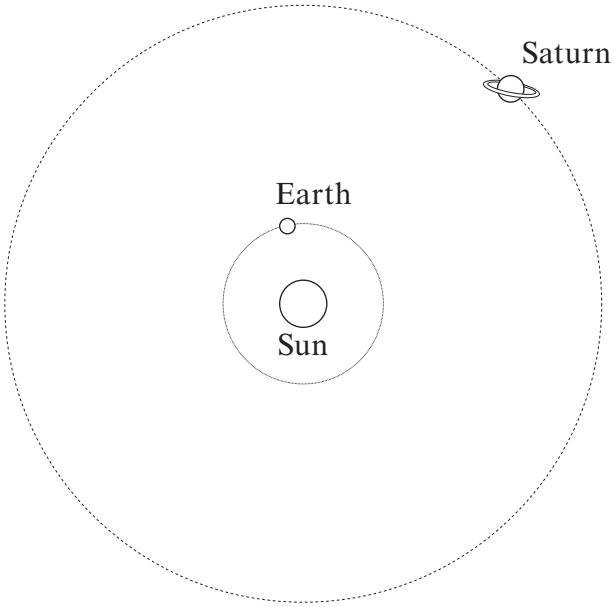
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2. The diagram shows two planets in the Solar System in orbit around the Sun.
The diagram is not drawn to scale.



(a) Add to the diagram **the orbit** of planet Mars. [1]

(b) (i) Saturn is described as a Gas Giant.
Name another Gas Giant that exists in the Solar System ..... [1]

(ii) Give a reason why the temperature on the surface of Saturn is lower than that on the surface of Earth. [1]

.....

.....

.....

(c) (i) What is the Asteroid Belt?

.....

.....

(ii) Between the orbits of which two planets is the Asteroid Belt found?

..... and ..... [2]

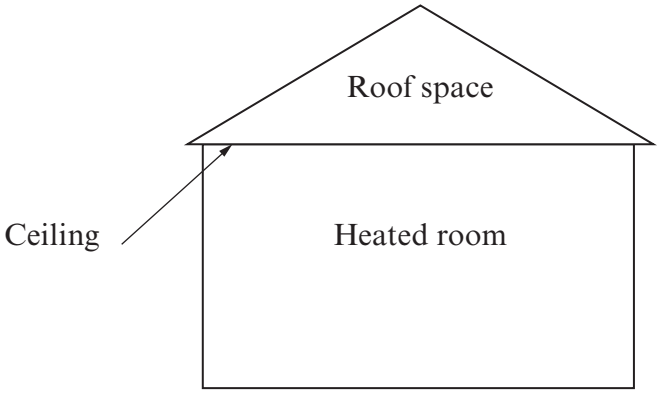
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3. Heat is lost from a room through the ceiling and the roof space.



(a) (i) Name the main process by which heat is lost through the ceiling.

.....

(ii) Name the main process by which heat is lost through the roof space.

..... [2]

(b) Explain how a thick layer of glass fibre on the floor of the roof space affects the heat loss through the ceiling of the room. [2]

.....

.....

.....

4

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Turn over.

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4. Electrical power is transmitted throughout the country at high voltage by the National Grid. It consists of a network of pylons, cables and transformers, which connect power stations together to factories and other users of electricity.

(i) Why is electrical power transmitted at high voltages?

.....

.....

(ii) State how a voltage of 230 V is obtained from the National Grid to use in the home.

.....

.....

(iii) What is the advantage of connecting all power stations to the National Grid?

.....

.....

[3]

3

5. *(a)* State **two** ways that the gases emitted from coal fired power stations pollute the environment. [2]

1. .....

.....

2. .....

.....

(b) (i) State a reason why coal fired power stations need a plentiful supply of water.

.....

.....

(ii) State a reason why coal fired power stations need good transport links with the rest of the country.

.....

.....

[2]

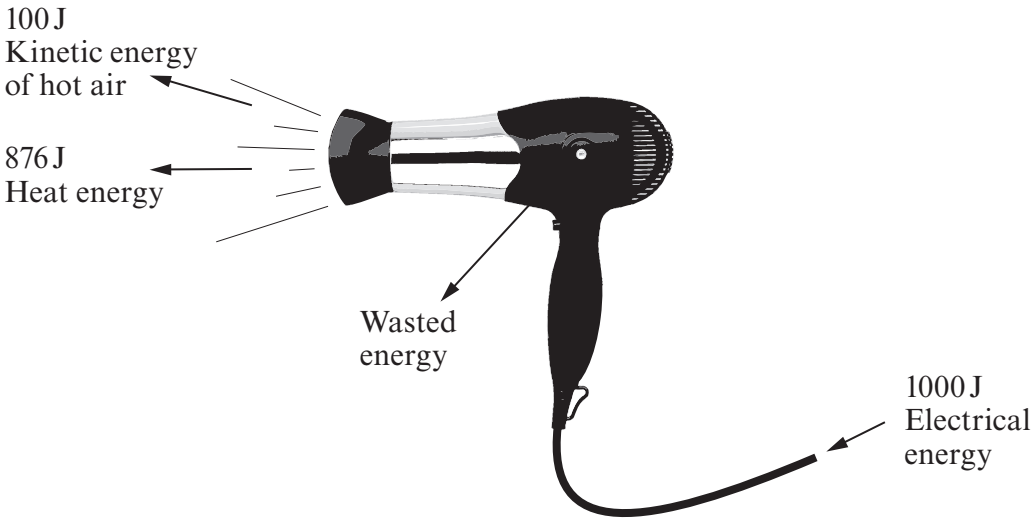
4

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6. The diagram gives information about the energy transfers in a hairdryer in each second.



(a) Calculate the amount of energy wasted in each second. [1]

Energy wasted = ... J

(b) Use the equation

$$\% \text{ efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100$$

to calculate the efficiency of the hairdryer in **transferring electrical energy to useful energy in blow drying the hair**. [3]

Efficiency = ... %

4

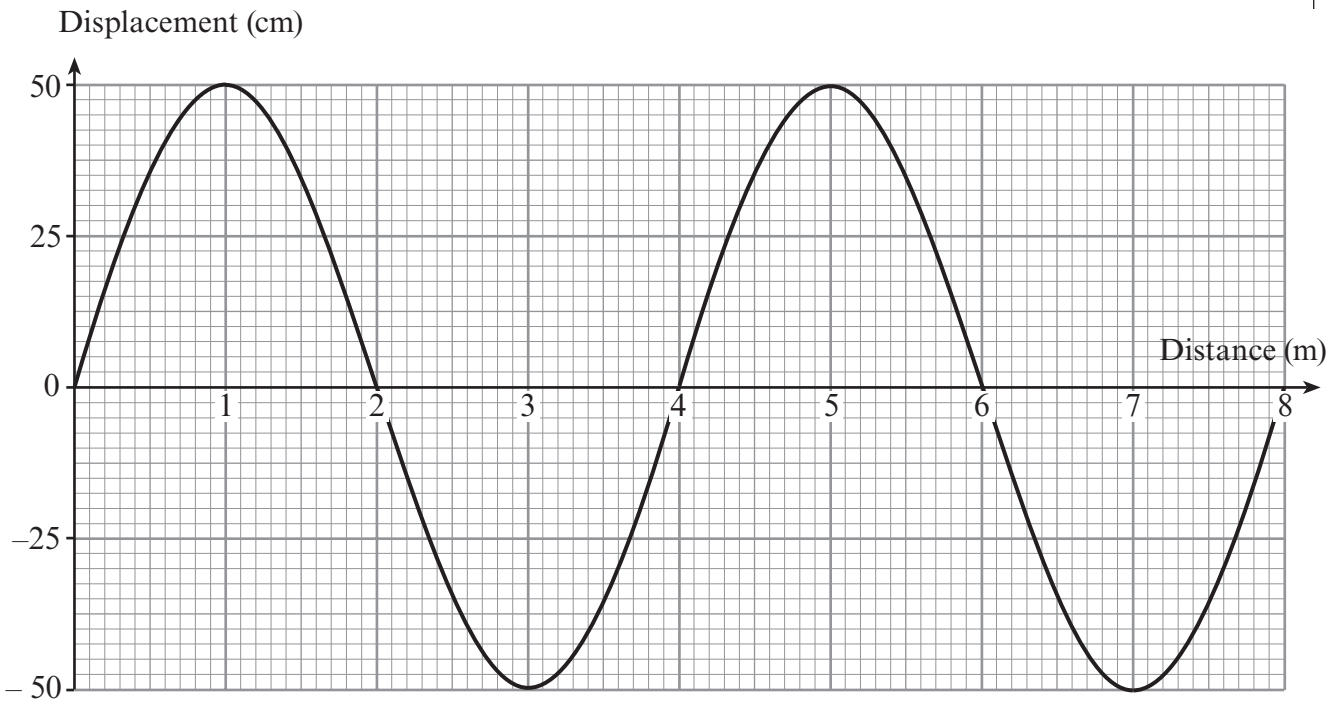
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7. The diagram represents a water wave on the ocean.



(a) Write down the:

(i) wavelength of the wave; ..... m

(ii) amplitude of the wave. ..... cm

[2]

(b) If the wave travels with a speed of 2.8 m/s along the surface, use the equation

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

to calculate the frequency of the wave. [2]

Frequency = ... Hz

4

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8. A householder left home for a 14 day holiday. To deter burglars she left 5 filament lamps timed to come on for 5 hours a night. Each lamp had a power of 100 W.

(a) Calculate the total electrical power of the lamps in kW. [1]

Power = ... kW

(b) Using the equations

number of units (kWh) = power (kW) × time (h)

cost = units used × cost per unit

(i) calculate the number of units (kWh) of electricity used during the 14-day holiday; [2]

Number of units (kWh) = ...

(ii) calculate the cost to the householder if electricity costs 8p per unit. [1]

Cost = ... p

(c) A 20 W low energy lamp produces the same amount of light as a 100 W filament lamp.

(i) Give a reason why the cost would be less if the filament lamps were replaced by 20 W lamps. [1]

.....

(ii) Calculate the saving to the householder if 20 W lamps were used instead of the filament lamps. [2]

Saving = ... p

7

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9. Microwaves are a type of electromagnetic radiation. They are reflected from metals but can pass through glass, pottery and some plastics.

Most food cooked in a microwave oven has a high water content, which readily absorbs the microwave energy producing a rapid rise in temperature. This results in the food being cooked quickly.

(a) (i) Explain why the choice of container for the food is important in microwave cookery. [2]

.....

.....

.....

(ii) Give a reason why microwave ovens cook food quicker than a conventional oven. [1]

.....

.....

.....

(b) X-rays and gamma rays are other types of electromagnetic radiation. State **two** ways in which they differ from microwave radiation. [2]

.....

.....

.....

5

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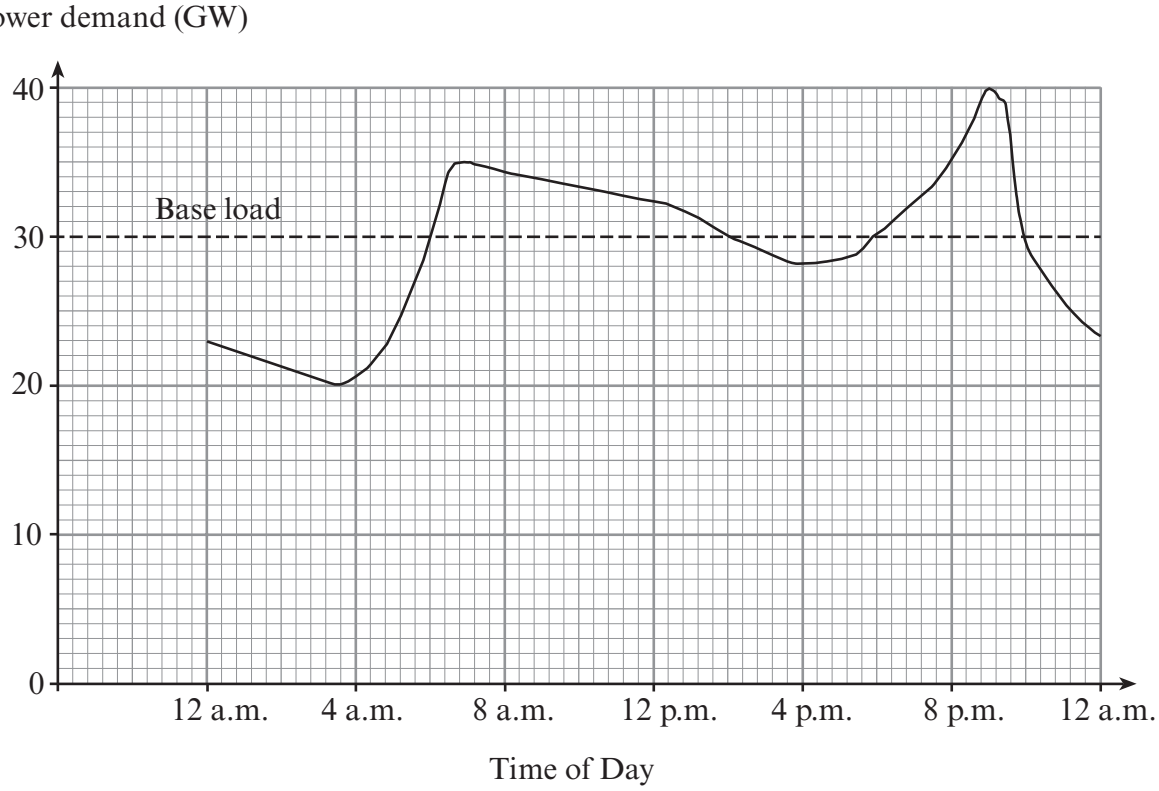
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10. The graph shows how the demand for electricity changes over a 24 hour period, in this country, during winter.



Since electrical power cannot be stored in large quantities most fossil fuelled and nuclear power stations are run continuously, to provide a minimum amount of power to the National Grid. This is called the base load. Most hydroelectric power stations only operate at times of peak demand for power because they have a much shorter start-up time than other power stations.

(a) (i) Between 4 a.m. and 4 p.m. how many hours is the demand above the "base load"? [1]

Number of hours = ...

(ii) How much reserve generating capacity must the electrical industry have available, to meet the peak demand for the 24 hour period shown by the graph? [1]

Reserve capacity = ... GW

(b) Give a reason why electrical power is offered at low cost between 12 a.m. and 5 a.m. [1]

.....

.....

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(c) Why does a hydroelectric power station have a much shorter start-up time than fossil fuelled power stations? [1]

.....

.....

(d) Suggest how the electrical industry deals with the reduced demand for power during the summer months. [1]

.....

.....

5

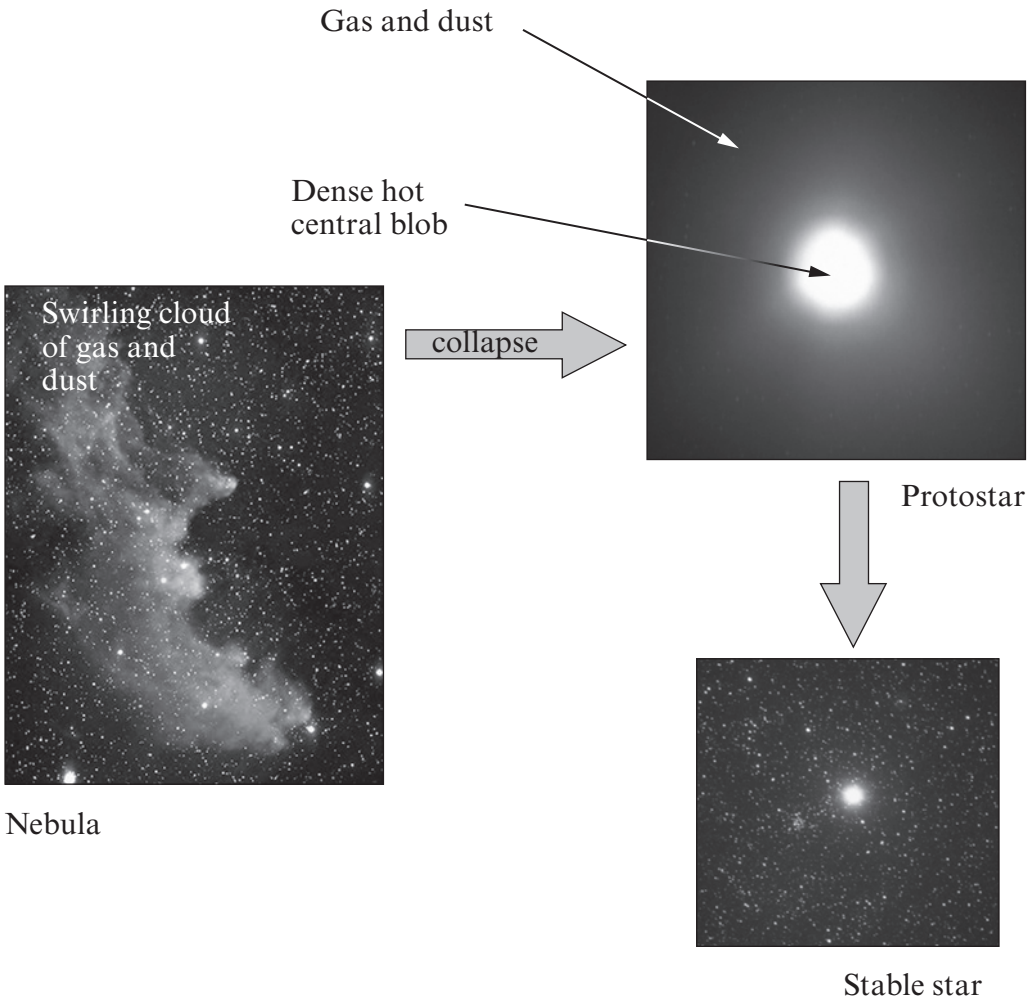
TURN OVER FOR QUESTION 11.

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11. The diagram shows the stages in the birth of a star which takes place over many millions of years.



(a) What causes the gas and dust in the nebula to collapse? [1]

.....

(b) Explain what happens in the core of the protostar to cause it to glow and produce a large outward radiation pressure force. [2]

.....

.....

.....

(c) Explain what causes the protostar to eventually become a stable or main sequence star. [2]

.....

.....

.....

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION.

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GCSE MARKING SCHEME

SCIENCE - PHYSICS (LEGACY)

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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PHYSICS 1 (LEGACY)

FOUNDATION TIER

Question			Marking details	Marks Available
1.	*(a)*		Totally internally reflected (1) …more than… (1)	
	(b)		refracted (1) ….. less than…. (1)	4
			Question total	**[4]**
2.	*(a)*		Complete orbit drawn nearer the Earth's than to Saturn's.	1
	(b)	(i)	Jupiter, Uranus, or Neptune	1
		(ii)	Saturn is further from [the Sun] or Earth is closer.	1
	(c)	(i)	A collection of rocks [with sizes smaller than that of the smallest planet] in an orbit (1) around the Sun between the orbits of	
		(ii)	Mars and Jupiter (1) [could credit in (c)(i)]	2
			Question total	**[5]**
3.	*(a)*	(i)	Conduction (1)	
		(ii)	Convection (1)	2
	(b)		Glass fibre is a good insulator / traps air (1)	
			reduces heat loss / keeps more heat in (1)	2
			Question total	**[4]**
4.		(i)	Reduces heat / energy loss in the cables / not much voltage drop in the cables (1)	
		(ii)	Step-down transformers (1)	
		(iii)	To give a consistent / reliable supply [to everyone] / support for breakdowns etc (1)	3
			Question total	**[3]**
5.	*(a)*		[CO_2 produces] global warming / greenhouse effect (1)	
			[SO_2 produces] acid rain (1)	2
	(b)	(i)	Cooling required / prevents overheating / to produce steam (1)	
		(ii)	Transport of coal / fuel / removal of waste (1)	2
			Question total	**[4]**

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Question			Marking details	Marks Available
6.	*(a)*		Wasted energy = 1000 – 876 – 100 = 24 [J]	1
	(b)		Efficiency = $\frac{976}{1000} \times 100 = 97.6[\%]$ [976 (1) subs(1); ans (1)] Accept 98% [Award 2 marks only for answers of 10% / 87.6% / 97%] No **ecf** from (a)	3
			Question total	**[4]**
7.	*(a)*	(i) (ii)	wavelength = 4 [m] (1) amplitude = 50 [cm] (1)	2
	(b)		Frequency = $\frac{2.8}{4}$ = 0.7 [Hz] [subs (1); ans (1)] **ecf** from (a)(i)	2
			Question total	**[4]**
8.	*(a)*		0.5 [kW]	1
	(b)	(i)	No. of kWh = 0.5 **ecf** × 5 × 14 = 35 [Subs (1); ans (1)]	2
		(ii)	Cost = 35 **ecf** × 8 = 280 [p] / £2.80	1
	(c)	(i)	Less power / less energy / not as many Watts / less units of electricity	1
		(ii)	New cost = $\frac{1}{5}$ × 280 **ecf** [p] [or 0.1 × 5 × 14 × 8] = 56 [p](1) Saving = 280 – 56 **ecf** = 224 [p] [ans] (1)	2
			Question total	**[7]**
9.	*(a)*	(i)	Plastic / glass containers allow microwaves to pass through them (2) **or** metal containers reflect microwaves / produce sparks / don't allow microwaves to pass through them (2)	2
		(ii)	Microwave energy causes the <u>water</u> to be <u>heated</u> rapidly	1
	(b)		Any 2 × (1) from • different wavelength / frequency ✓ • greater penetration ✓ • ionises / damages cells of the body ✓ • transfer more energy ✓	2
			Question total	**[5]**

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Question			Marking details	Marks Available
10.	*(a)*	(i)	8 [hours]	1
		(ii)	10 [GW]	1
	(b)		A period of low demand from users	1
	(c)		Source of energy [falling water] at the flick of a switch or no time needed for the source to warm up	1
	(d)		Reduces base load / produces less power by closing down for maintenance or reducing output further	1
			Question total	**[5]**
11.	*(a)*		Gravitational attraction / gravity	1
	(b)		Both produced by fusion / hydrogen to helium or heavier elements / atoms forced together (1) with a release of [a large amount] of energy / heat and light (1)	2
	(c)		Balanced forces (1) Named forces (1)	2
			Question total	**[5]**
			Total Foundation paper	**50**

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PHYSICS 1 (LEGACY)

HIGHER TIER

Question			Marking details	Marks Available
1.	*(a)*	(i)	Plastic / glass containers allow microwaves to pass through them (2) **or** metal containers reflect microwaves / produce sparks / don't allow microwaves to pass through them (2)	2
		(ii)	Microwave energy causes the <u>water</u> to be <u>heated</u> rapidly	1
	(b)		Any 2 × (1) from • different wavelength / frequency ✓ • greater penetration ✓ • ionises / damages cells of the body ✓ • transfer more energy	2
			Question total	**[5]**
2.	*(a)*	(i)	8 [hours]	1
		(ii)	10 [GW]	1
	(b)		A period of low demand from users	1
	(c)		Source of energy [falling water] at the flick of a switch or no time needed for the source to warm up	1
	(d)		Reduces base load / produces less power by closing down for maintenance or reducing output further	1
			Question total	**[5]**
3.	*(a)*		Gravitational attraction / gravity	1
	(b)		Both produced by fusion / hydrogen to helium or heavier elements / atoms forced together (1) with a release of [a large amount] of energy / heat <u>and</u> light (1)	2
	(c)		Balanced forces (1) Named forces (1)	2
	(d)	(i)	19^{th}century model used the idea of chemical reaction / energy (burning) [produce the heat and light generated by the star] (1). A short finite life of a few thousand years was predicted (1)	2
		(ii)	Geologists discovered that the Earth was millions of years old.	1
			Question total	**[8]**

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Question			Marking details	Marks Available
4.	*(a)*	(i)	7 [kW] (1)	
		(ii)	3 [kW] (1)	2
	(b)		[Total] heat lost (10 kW) = [Total] heat gained (10 kW)	1
	(c)	(i)	Heat now lost by <u>convection</u> [as well as conduction and radiation] /more heat lost than gained. (1)	
		(ii)	Rad = 1.4 [kW] ;Cond = 4 [kW]; Conv = 8 [kW] [(1) for all readings correct] Total = 13.4 [kW] [(1) for the correct addition of 3 readings] x 1000 or presence of kW (1)	4
		(iii)	22 °C	1
			Question total	**[8]**
5.	*(a)*		% Efficiency = $\frac{168000(1)}{198000} \times 100$ = 84.8 [%] accept 85% / 84.85% Subs (1); Ans (1) [Award 2 marks for 84.84%]	3
	(b)		Energy = Power × time (1)	1
			198 000 = 2200 × time x1000 or /1000 (1) Time = $\frac{198000}{2200}$ = 90 [s] subs/manip (1); ans (1) Alternatives: $\frac{198}{2.2}$ = 90 [s] → 3 marks $\frac{168000}{2200}$ → 2 marks $\frac{168}{2.2}$ → 2 marks $\frac{198}{2200}$ → 1 mark $\frac{198000}{2.2}$ → 1 mark $\frac{168}{2200}$ → 0 marks	3
			Question total	**[7]**

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Question			Marking details	Marks Available
6.	*(a)*	(i)	Reduces convection [losses] / traps radiation	1
		(ii)	Black surfaces are <u>better / good absorbers of radiation / infra-red</u> so temperature increases.	1
	(b)	(i)	Maximum power = 2.4 [kW] (1) Minimum power = 0.96 [kW] (1) Award 1 mark for 2400 & 960 Award 1 mark for 4.8 & 1.92	2
		(ii)	Average of maximum and minimum powers shown **ecf** (1) 1.68 **ecf** x 10 = 16.8 [kWh] (1)	2
	(c)		Any 2 x (1) from: • Average power of sunlight greatly reduced in winter • Sunlight is available for less day time • Energy delivered much less • Outside temperature is colder • Water starts off colder so requires more heat to be supplied to it	2
			Question total	**[8]**
7.	*(a)*		Wave speed decreases as the frequency increases (1); non-linearly / inversely proportional (1)	2
		(b)	speed = $\frac{\text{distance}}{\text{time}} = \frac{311000}{12 \times 60 \times 60} = 7.20$ [m/s] Subs (1); conversion (1); ans (1) From graph speed = 7.20, frequency = 0.22 [Hz] (1) $v = f\lambda$, 7.22 = 0.22 **ecf** λ $\lambda = \frac{7.22}{0.22} = 32.73$ [m] Subs (1); manipulation (1); ans (1) No penalty for incorrect rounding throughout.	7
			Question total	**[9]**
			Total Higher Tier	**50**

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0237/01

SCIENCE
FOUNDATION TIER
PHYSICS 1

P.M. MONDAY, 30 January 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**3**	
3.	**5**	
4.	**5**	
5.	**3**	
6.	**4**	
7.	**5**	
8.	**6**	
9.	**5**	
10.	**6**	
11.	**4**	
Total	**50**	

0237
010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

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EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used (kWh) × cost per unit

$$\%\ \text{efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100$$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

wave speed = wavelength × frequency

Answer **all** *questions.*

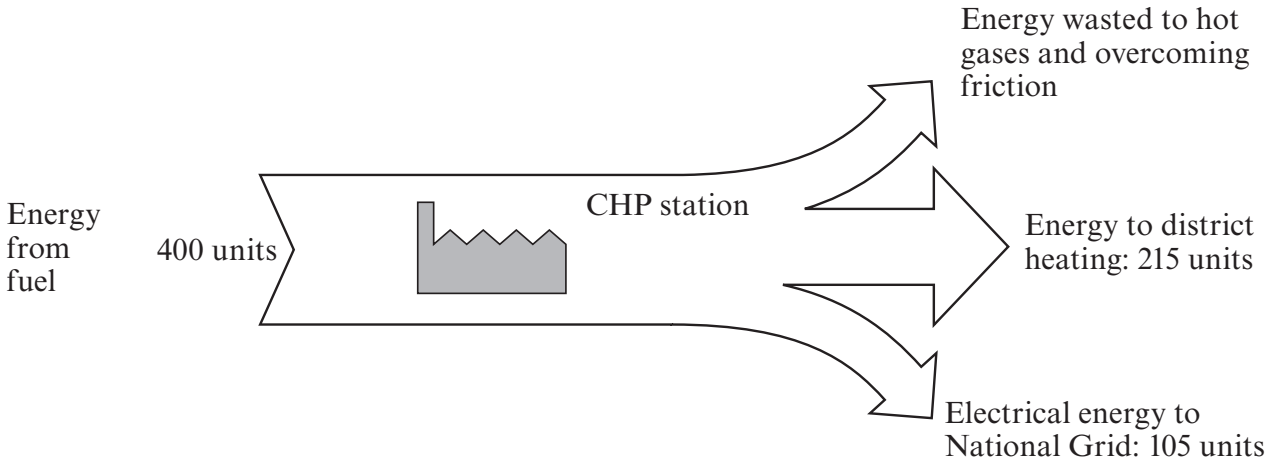
1. List A gives four **situations** where heat is transferred. List B gives three **processes** by which heat is transferred.
Draw a line from **each** box in List A to the main process involved in the transfer of heat in List B. [4]

List A	List B
From the Sun to a roof mounted solar panel.	Conduction
From an electrical hotplate through the base of a metal saucepan.	Radiation
From the element of an electric kettle to heat all the water in the kettle.	Convection
From a fire to a person sitting directly in front of it.	

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2. The energy flow diagram below is for a Combined Heat and Power [CHP] Station. These stations make use of the energy in the water that is used for cooling to provide useful energy to heat the homes close to the station.



(a) Calculate the number of units of wasted energy. [1]

Wasted energy = ... units

(b) Use the equation

$$\% \text{ efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100$$

to calculate the efficiency of the combined heat and power station.

Efficiency = ... %

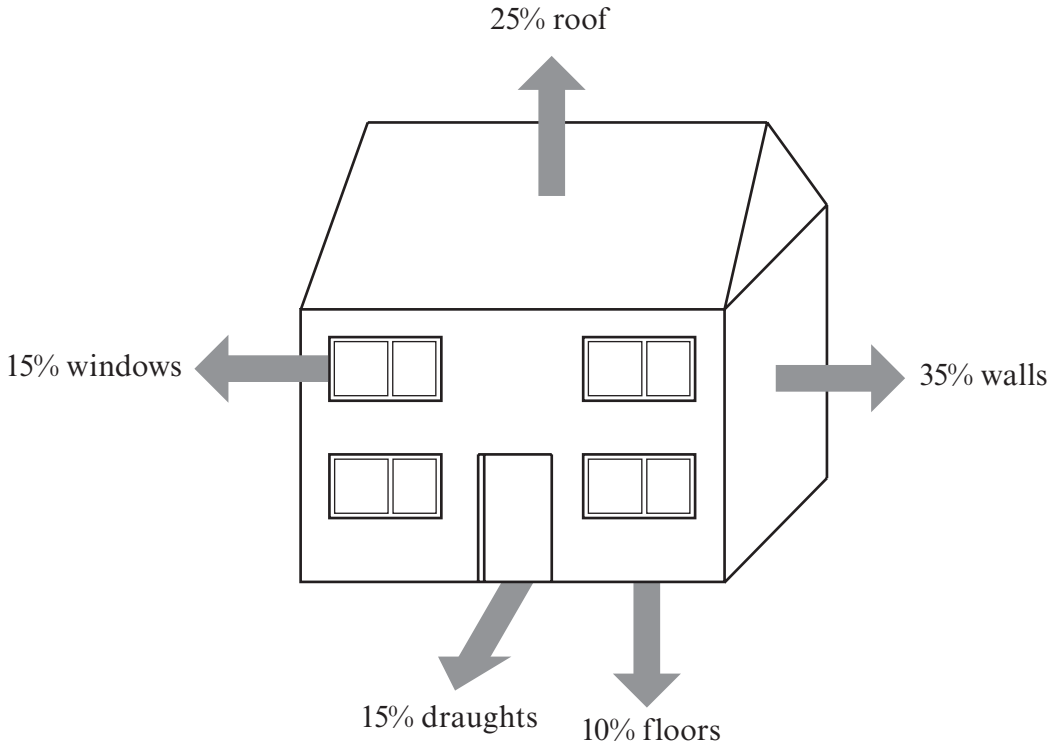
[2]

3

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3. The diagram shows the percentage of energy lost through various places from a house without insulation.



The house has gas central heating and the gas meter readings for 2010 were as follows:

1st January 2010 = 2515 units

31st December 2010 = 4865 units

(a) (i) Calculate the number of units of gas used in 2010. ..... [1]

(ii) Use the equation

cost = units used × cost per unit

to calculate the gas bill for 2010 given that each unit of gas cost 40p.
Give the answer in £. [2]

Cost = £ .....

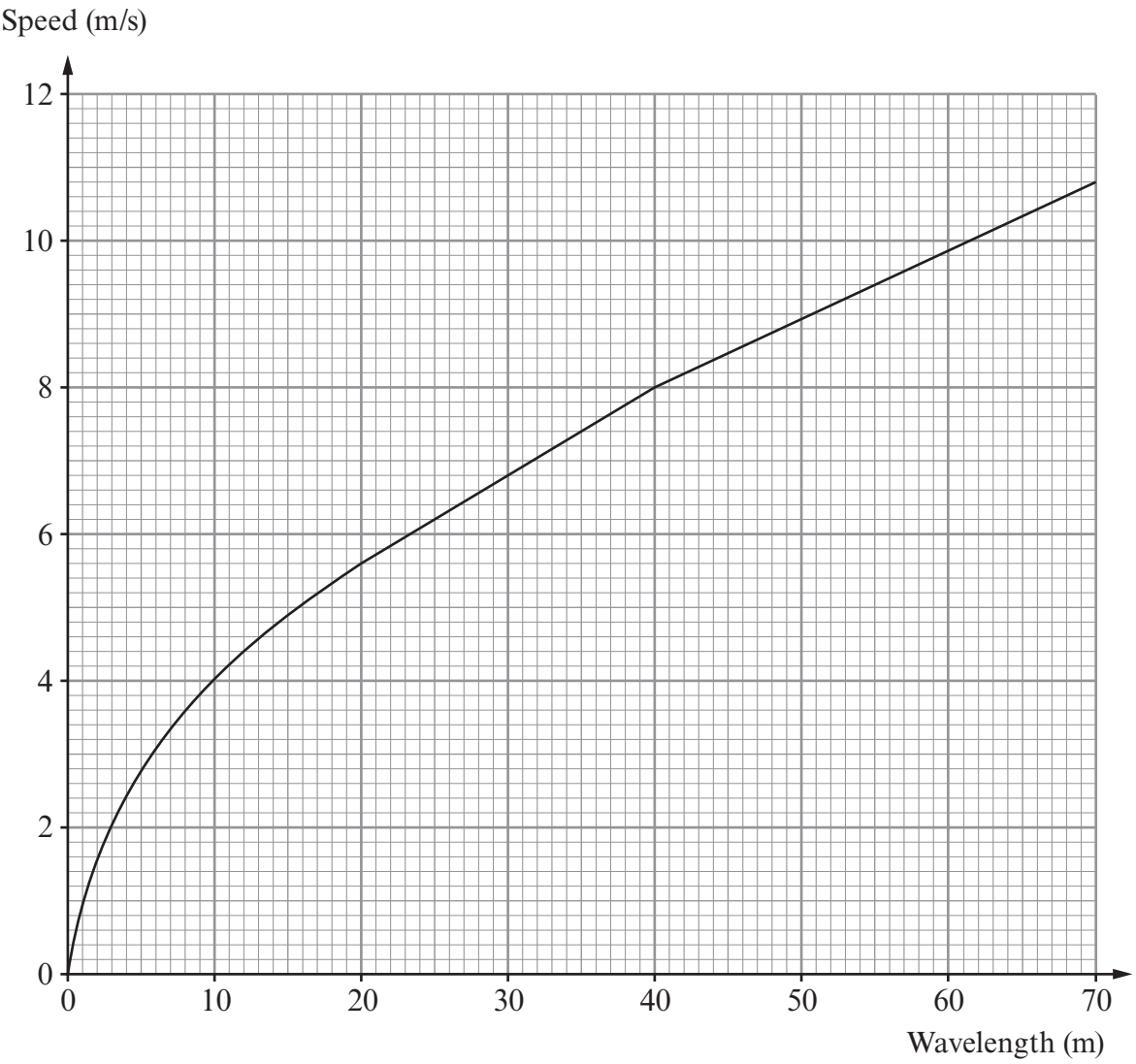
(b) Calculate the cost of the energy lost through the roof of the house. [2]

Cost = £ .....

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4. The graph shows how the speed of deep ocean waves depends on their wavelength.



(a) (i) Use the graph to find the speed of waves that have a wavelength of 40 m. [1]

Speed = ... m/s

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(ii) Use the equation

$$\text{frequency} = \frac{\text{wave speed}}{\text{wavelength}}$$

to calculate the frequency of these 40 m waves. [2]

Frequency = ... Hz

(b) Apart from wavelength, state **two** ways in which the properties of 10 m waves and 40 m waves are different. [2]

1. .....

.....

2. .....

.....

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5

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5. Nuclear power stations operating safely are capable of generating a large amount of electricity. Many people have strong objections to using more nuclear power.

Give **three** objections, apart from cost, that people have against the use of nuclear power. [3]

1. .....

.....

2. .....

.....

3. .....

.....

3

6. All stars are made up of mainly hydrogen and helium. They produce large amounts of energy.

When their source of energy runs out the star dies.

Astronomers have found that all galaxies contain evidence of dying stars. This evidence includes the presence of red giant stars, white dwarf stars, red super giant stars, neutron stars, black holes, and occasionally a supernova.

(a) Describe the process by which stars produce their energy. [2]

.....

.....

.....

(b) (i) What is a supernova? [1]

.....

.....

(ii) Explain why only some stars end their life in a supernova. [1]

.....

.....

.....

4

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7. The table gives information about three fuels used in a house. Use the data in the table to answer the questions that follow.

Fuel	Unit	Cost per unit	Number of MJ of energy per unit	Cost per MJ
Gas	1 therm	50p	100	0.5p
Electricity	1 kWh	12p	4	3.0p
Coal	1 kg	28p	28	1.0p

(a) (i) State which fuel provides the least amount of energy per unit. ..... [1]

(ii) State how the data shows that gas gives the best value for money. [1]

.....

.....

.....

(b) On average the household uses 8 therms of gas a week.

(i) Calculate the cost of gas per week.

Cost = ...

(ii) Calculate the number of MJ of gas used per week.

Number of MJ = ...

(iii) Calculate how much it would have cost for coal to provide the same number of MJ of energy.

Cost = ...

[3]

5

Turn over.

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8. The table below gives data about five planets in the Solar System in order of their distance from the Sun. Use the data to answer the questions that follow.

Planet	Mean surface temperature (°C)	Time for 1 orbit (years)	Length of day	Orbital speed (million km/year)
Mercury	350	0.2	0.16 years	1560
Venus	480	0.6	0.67 years	1100
Earth	22	1.0	24hr	945
Mars	–23	1.9	24hr 37min	754
Jupiter	–150	12.0	9hr 50min	413

(a) Which planet has a day which is longer than the time that it takes the planet to orbit the Sun?

[1]

.....

(b) The large amount of carbon dioxide in the atmosphere of Venus produces a massive greenhouse effect. Explain how the table shows this. [2]

.....

.....

.....

(c) Use the equation

$$\text{distance} = \text{speed} \times \text{time}$$

to calculate the distance travelled by Jupiter in making one complete orbit of the Sun.

[3]

Distance travelled = ...

Unit = ...

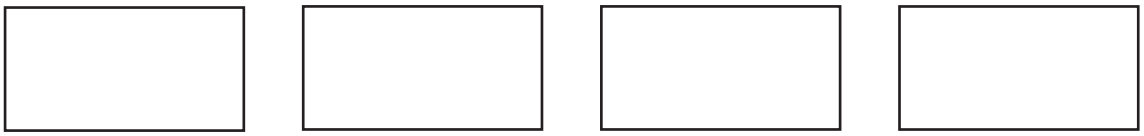
6

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9. **Visible light, X-rays, Infra-red radiation and Radio waves** are four members of the electromagnetic spectrum.

(a) Place these four radiations in the boxes below in the order of decreasing wavelength. [2]



Longest wavelength

Shortest wavelength

(b) State **two** practical uses of Infra-red radiation. [2]

1. .....

.....

2. .....

.....

(c) State how large doses of X-rays damage cells in the body. [1]

.....

.....

.....

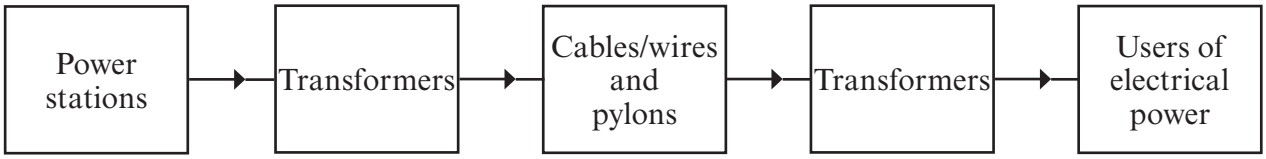
5

Turn over.

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10. The National Grid is a network of cables and pylons which connects power stations together and supplies electricity to factories and homes across the country.
The block diagram shows the main parts of the National Grid.



(a) State an advantage of connecting power stations together. [1]

.....

.....

(b) (i) Give a reason why low resistance cables/wires are used for the transmission of electricity in the National Grid. [1]

.....

.....

(ii) Give a reason why the cables/wires that carry the power are held **high** above ground level. [1]

.....

.....

(c) State how and explain why both "step-up" and "step-down" transformers are used throughout the National Grid. [3]

.....

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.....

6

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11. The information plate below was found on the back of a microwave oven.

Serial No. 7JAN300010X
240 V a.c. 50 Hz
0.8 kW
2450 MHz

(a) (i) Write down the power of the microwave oven in W. ..... [1]

(ii) Use the equation

energy transfer = power × time

to find how much energy is transferred by the microwave oven in 60 s. [2]

Energy transferred = ... J

(b) What does the figure 2450 MHz tell you about the microwaves? [1]

.....

.....

4

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION

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WJEC
CBAC

GCSE MARKING SCHEME

SCIENCE – PHYSICS (LEGACY)

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE SCIENCE – PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
Physics 1 (Legacy) Foundation Tier	1
Physics 1 (Legacy) Higher Tier	4
Physics 2 (Legacy) Foundation Tier	7
Physics 2 (Legacy) Higher Tier	10

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PHYSICS 1 (LEGACY)

FOUNDATION TIER

Question			Answer / Explanatory Notes	Marks Available
1.			Line from 1 to Radiation Line from 2 to Conduction Line from 3 to Convection Line from 4 to Radiation	1 1 1 1 **4**
2.	(a)		400 – 215 – 105 = 80 (1)	1
	(b)		$\frac{320}{400} \times 100 = 80(\%)$ Subs (1) Ans (1) allow e.c.f. (0.8 award 1 mark)	2 **3**
3.	(a)	(i)	4865 – 2515 = 2350 (1)	1
		(ii)	Cost = 2350 × 40 Subs / Ans (1) allow e.c.f. = 94000 p = (£)940 Conversion to £ (1)	2
	(b)		$\frac{25}{100} \times 940$ (94000) = (£)235/ (23500) Subs (1) Ans (1) allow e.c.f	2 **5**
4.	(a)	(i)	8 (m/s) (1)	1
		(ii)	$f = \frac{v}{\lambda} = \frac{8}{40} = \frac{1}{5}$ or 0.2 (Hz) Subs (1) Ans (1) allow e.c.f.	2
	(b)		Speed – 4 m/s / slower (1) Freq – 0.4 Hz / greater (1) **Or** speed different (1) Frequency different (1)	2 **5**
5.			Disposal of waste Contamination of the water used for cooling Decommissioning time Meltdown / explosion Safety – needs to be qualified Transport of fuel to and from for reprocessing Risk of terrorist attack Pollution – needs to be qualified e.g. risk of leaks Any (3 × 1)	3 **3**

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Question			Answer / Explanatory Notes	Marks Available
6.	*(a)*		Fusion (1) Hydrogen **<u>to</u>** Helium / light elements to heavier elements (1)	2
	(b)	(i) (ii)	Explosion of a star (1) Stars of a high mass / big enough star (1)	2 **4**
7.	*(a)*	(i) (ii)	Electricity Has best value for cost per MJ / gets more energy for 50 p	1 1
	(b)	(i) (ii) (iii)	Cost of gas = £4 /400(p) (1) Number of MJ = 800 (MJ) (1) Cost using coal = £8/800 (p) (1) allow e.c.f.	3 **5**
8.	*(a)*		Venus	1
	(b)		Highest temperature (1) even though further from the Sun than Mercury / even though not the nearest planet to the Sun(1)	2
	(c)		12 × 413 Subs (1) 4956 million km [Answer (1) **Unit** (1)] Unit must match answer	3 **6**
9.	*(a)*		Radio waves in 1st LH box or X-rays in RH box (1) Correct sequence for remaining parts (1)	2
	(b)		Remote (controls) , thermal imaging, optical fibres, radiant heaters, burgular alarms, grilling/toasting, mobile phones Night lights, Heat treatment Any (2×1)	2
	(c)		X-rays ionises [molecules in] cells / damages DNA / mutates cells (1)	1 **5**

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Question			Answer / Explanatory Notes	Marks Available
10.	*(a)*		To maintain supply to customers when a breakdown occurs / changes in demand	1
	(b)	(i)	[Low resistance] to keep heat loss to minimum	1
		(ii)	High voltages are dangerous / stop people being eletrocuted / people can't touch them / can't get damaged	1
	(c)		'Step- up' to raise voltage (to a suitable level) (1) (for transmission) with minimum loss of energy (1) 'Step-down' to lower voltage to safe value for domestic use (1) Statement of value correctly used in transmission or domestic use, e.g. 132 000 V, 400 000 V 230[accept 240] V (1) **Award a maximum of 5 marks only for (b) and (c)**	3 **6**
11.	*(a)*	(i)	800 (W)	1
		(ii)	800 × 60 = 48000 (J) Or = 0.8 x 60 = 48 kJ Subs (1) Ans (1) allow e.c.f.	2
	(b)		This is the frequency of the radiation used / or correct definition of frequency	1 **4**

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HIGHER TIER

Question			Answer / Explanatory Notes	Marks Available
1.	*(a)*		Radio waves in 1st LH box or X-rays in RH box (1) Correct sequence for remaining parts (1)	2
	(b)		Remote (controls) , thermal imaging, optical fibres, radiant heaters, burgular alarms, grilling/toasting, mobile phones Night lights, Heat treatment Any (2×1)	2
	(c)		X-rays ionises [molecules in] cells / damages DNA /mutates cells (1)	1
				5
2.	*(a)*		To maintain supply to customers when a breakdown occurs / changes in demand	1
	(b)	(i)	[Low resistance] to keep heat loss to minimum	1
		(ii)	High voltages are dangerous / stop people being eletrocuted / people can't touch them / can't get damaged	1
	(c)		'Step- up' to raise voltage (to a suitable level) (1) (for transmission) with minimum loss of energy (1) 'Step-down' to lower voltage to safe value for domestic use (1) Statement of value correctly used in transmission or domestic use, e.g. 132 000 V, 400 000 V 230[accept 240] V (1) **Award a maximum of 5 marks only for (b) and (c)**	3
				6
3.	*(a)*	(i)	800 (W)	1
		(ii)	800 × 60 = 48000 (J) Or = 0.8 x 60 = 48 kJ Subs (1) Ans (1) allow e.c.f.	2
	(b)		This is the frequency of the radiation used / or correct definition of frequency	1
	(c)		Wave speed = wavelength × frequency [accept $v = f\lambda$]	1
			Use of 2450×10^6 Hz [or equiv] i.e. conversion (1) $\lambda = \frac{3\times10^8}{2450\times10^6} =$ 0.122 (m) Substitution (1) Manipulation with formula or numbers (1) ($\frac{3\times10^8}{50}$ award 1 mark only)	3
				8

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Question			Answer / Explanatory Notes	Marks Available
4.	*(a)*	(i)	20 000 × 1000 = 20000000 (W) / 20 MW / 20 000 kW	1
		(ii)	$\%\ \text{Efficiency} = \frac{\text{Useful power [transfer]}}{\text{Total power [input]}} \times 100$	1
			$75 = \frac{20\,000\,000}{\text{input power}} \times 100$ substitution (1) Input = 26.7 M(W) / 2.67×10^7 (W) / 27 M(W) manipulation from formula or numbers(1) answer (1) allow e.c.f.	3
	(b)	(i)	Less demand for electricity at night or by implication	1
		(ii)	Heat is also given to the water in pumping / reference to efficiency of pumps	1
	(c)		Low start-up time so instant energy to grid [need reference to quickness](1) Must reuse water so only a finite amount of energy can be generated each day.(1)	2
				9
5.	*(a)*		(When it runs out of fuel it will expand and cool) to become a red super giant (1) and then produce a supernova (1) leaving dense neutron star or black hole (1)	3
	(b)		Fusion occurring (1) with example explained e.g. helium fuses into heavier elements (1)	2
				5
6.	*(a)*		3 x 10^8 (km / year)	1
	(b)	(i)	4.5 x 10^8 (km)	1
		(ii)	$\text{time} = \frac{2.67 \times 10^9}{5.8 \times 10^8} = 4.6$ (yr) Substitution (1) Answer (1)	2
	(c)		Ceres by value of distance from Sun and an orbit time is between Mars + Jupiter (1) Temperature – 50 (°C) to -100 (°C) (1) allow e.c.f. from (b)(i) Or some mathematical way of working it out based on the distances of Mars +Jupiter + Ceres from the Sun or on orbital times. (2 e.c.f. marks can be obtained from (b)(ii))	2
	(d)		Travels more slowly (1) and has further to go (1)	2
				8

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Question			Answer / Explanatory Notes	Marks Available
7.	*(a)*	(i)	Saving = 940 – 640 = £300 (1) Payback = $\frac{6000}{300}$ (1) for substitution = $16\frac{2}{3}$ (yrs)	2
		(ii)	Costs may increase or decrease, weather may change (colder not hotter)	1
	(b)		Less power generated Less fuels used Smaller carbon footprint / less greenhouse effect less acid rain Any (2 × 1)	2
	(c)		Cost = no. of units x cost of 1 unit £640 = no. of units x 40p No. of units = $\frac{640 \times 100(1)}{40}$ = 1600 (1) No. lost through cavity = $\frac{35}{100}$ (1) × 1600 = 560 (1) allow e.c.f. 2 marks available for correct methodology (£224 is 35% of £640 award 2 marks)	4
				9

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

237/01

SCIENCE
FOUNDATION TIER
PHYSICS 1

P.M. FRIDAY, 17 June 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**4**	
3.	**4**	
4.	**3**	
5.	**6**	
6.	**6**	
7.	**4**	
8.	**3**	
9.	**7**	
10.	**4**	
11.	**4**	
Total	**50**	

0237
010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

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EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used × cost per unit

$$\%\ \text{efficiency} = \frac{\text{useful power transfer}}{\text{total power input}} \times 100$$

wave speed = wavelength × frequency

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Examiner only

*Answer **all** questions.*

1. *(a)* Choose a word from the box that best completes each sentence below. [4]

coal	nuclear	hydroelectric	wind	sunlight

(i) A power station that releases carbon dioxide gas uses ..... as its fuel.

(ii) A solar panel on the roof of a house gets its energy from .....

(iii) A ..... power station needs water as its source of energy.

(iv) A ..... power station produces radioactive waste.

(b) State one **non-renewable** source of energy for power stations that is not given in the box above. [1]

.....

5

0237 010003

2. *(a)* In each of the sentences that follow, underline the correct word or words from each bracket. [3]

(i) Power stations produce electrical power in millions of (watts, volts, amps).

(ii) A step up transformer is used to increase the (power, voltage, current).

(iii) The electric current passes to our homes through (wires, pylons, wires and pylons).

(b) What name is given to the arrangement of wires, pylons and transformers that gets the electricity from the power stations to factories, schools and homes? [1]

.....

4

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Turn over.

Examiner only

3. The table below gives data about 5 of the planets in our solar system that are nearest to the Sun. They are not in any order. The planet Earth has been identified for you.

Planet	Name	Distance from Sun (millions of km)	Diameter (thousands of km)	Number of moons
A		228	6.8	2
B		780	143	63
C		108	12	0
D		58	4.9	0
E	Earth	150	12.8	1

(a) Name planet D. ..... [1]

(b) Answer the following questions with the letters A, B, C, D or E only:

(i) Which planet is nearest in size to Earth? ..... [1]

(ii) Which planet would you expect to be the coldest? ..... [1]

(iii) Which planet is made up of gas? ..... [1]

4

4. The table below gives information about three household appliances that are used for different lengths of time.

Appliance	Energy transfer (J)	Time (s)	Power (W)
Lamp	660	60	11
Phone charger	.....	1800	5
Radio	6 000	300	20

(a) Use the equation

$$\text{energy transfer} = \text{power} \times \text{time}$$

to fill the gap in the table. [1]

(b) Which appliance uses energy at the highest rate? ..... [1]

(c) Give a reason why the phone charger is the cheapest to run. [1]

.....

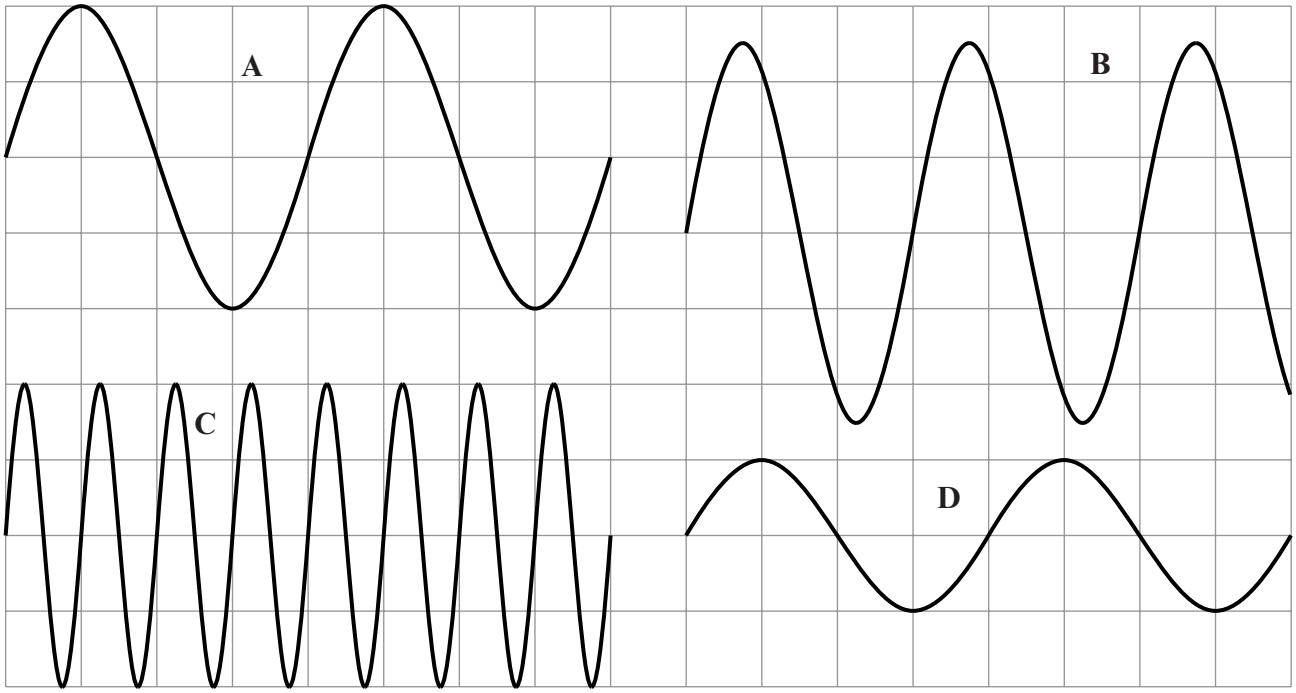
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3

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Examiner only

5. The diagrams show four different waves, **A**, **B**, **C** and **D** drawn on a 1 cm grid.



(a) (i) Which two waves have the same amplitude? ..... and .....

(ii) Which two waves have the same wavelength? ..... and ..... [2]

(b) (i) Write down the wavelength of wave B. ..... cm [1]

(ii) This wave travels 48 cm in 4 seconds along the water.
Use the equation

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate the speed of wave B. [2]

Speed = ... cm/s

(iii) If all of the waves travel at the same speed, which **one** has the highest frequency? [1]

.....

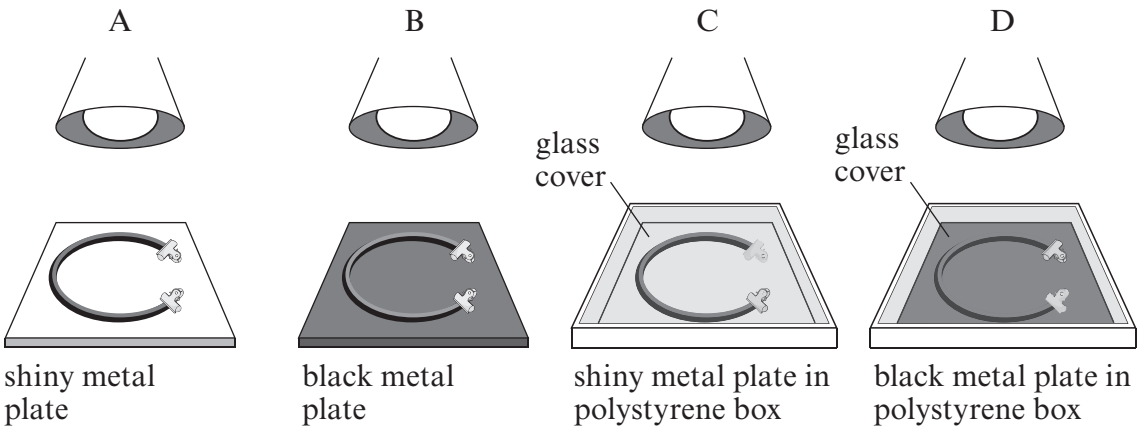
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Turn over.

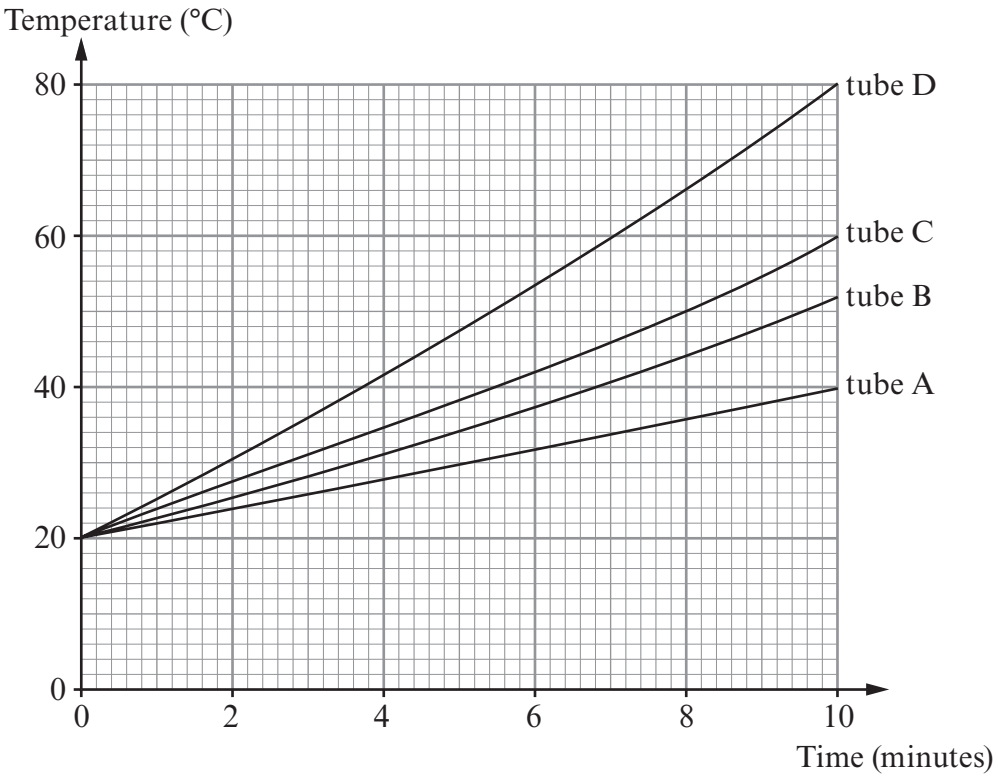
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Examiner only

6. In a school laboratory, a group of pupils set up the following experiment.
They took four equal sized pieces of black plastic tube, filled them with water and closed the ends.
The four were placed under identical lamps for 10 minutes.



A graph of their results is shown below.



(a) (i) What was the starting temperature of the water? ..... °C [1]

(ii) How long did the water temperature in tube C take to rise to 30°C?

..... min [1]

(iii) How much hotter was tube C than tube A at the end of the experiment?

..... °C [1]

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(b) (i) Give a reason why all 4 tubes were made of black plastic rather than clear plastic. [1]

.....

(ii) Give a reason why tube D had a greater rise in temperature than tube B. [1]

.....

(c) The temperature of the water in tube D increased by 60°C in 10 minutes.
State how the graph shows that the temperature did not rise steadily by 6°C per minute. [1]

.....

.....

6

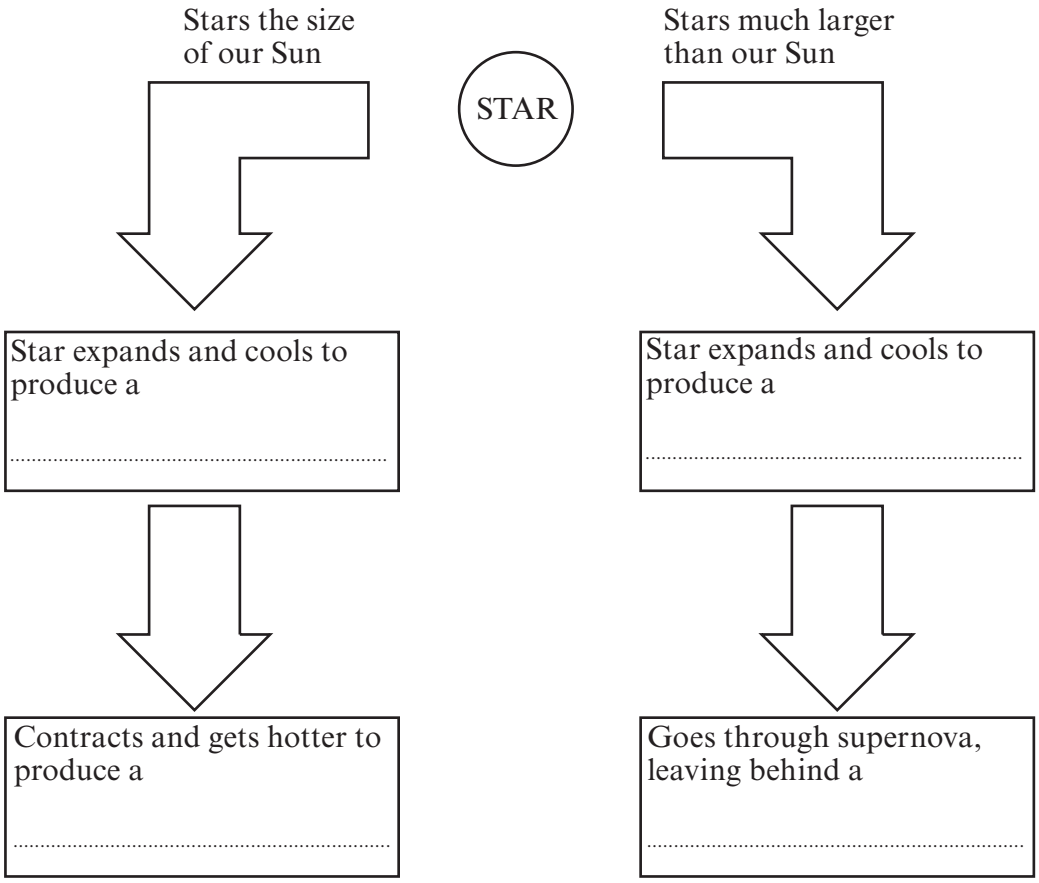
Turn over.

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Examiner only

7. When stars reach the end of their 'lives', the stages that they go through depend on their size. Choose phrases from the box to complete the diagram below. [4]

red super giant	white dwarf	black hole	red giant	black dwarf	neutron star



4

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Examiner only

8.

Mobile phone firms have been accused of not giving clear warnings about the health risks of using their handsets.

Manuals that are provided with new mobile phones give warnings about keeping the phones away from the body when used but the warnings are in small print deep inside the manuals.

The radio waves from mobiles are transmitted from their aerials that are positioned near the back of the phones. This puts them further away from the head but some phones are so thin that there is little protection for the user. For all phones, there are better ways of keeping them away from the body during use.

(Extract adapted from an article in a national newspaper)

(a) How can the possible dangers from mobile phones be made more obvious to people who buy them? [1]

.....

.....

(b) The extract states that mobile phones give out radio waves. Using your knowledge of the electromagnetic spectrum, correct this statement. [1]

.....

.....

(c) State **one** way in which mobile phones can be kept well away from the body when they are being used. [1]

.....

.....

3

Turn over.

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Examiner only

9. *(a)* A wind turbine that is designed to produce 2000 kW only produces on average 600 kW. Give a reason why. [1]

.....

.....

(b) On a particular day the wind power input to a wind turbine is 1500 kW. The turbine produces 900 kW of electrical power.

Select an equation from page 2 and use it to calculate the efficiency of the wind turbine.

Equation: .....

..... [1]

Calculation: [2]

Efficiency = ...

(c) Fossil-fuelled power stations release 430 grams of carbon dioxide (CO_2) for each unit (kWh) of electricity produced, but wind turbines release none whilst they are working.

(i) Give a reason why it is important to try to reduce the amount of CO_2 produced when generating electrical power. [1]

.....

.....

(ii) Calculate the number of grams of CO_2 saved by generating 900 kW for one hour from wind rather than coal. [2]

Mass of CO_2 saved = ... g

7

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Examiner only

10. The table shows the heat energy lost per second through parts of a house.

Part of house	Insulated or not	Heat energy (J) lost per second
ATTIC	Non insulated	3000
	Fibre glass laid on floor of attic	400
CAVITY WALL	Non insulated	2000
	Insulated with foam	700
WINDOWS	Single glazed	2000
	Double glazed	1200

(a) (i) Find the total energy lost per second from the house if the attic and cavity wall are **not** insulated and it has single glazed windows. [1]

Energy lost = ... J/s

(ii) How much energy is saved per second by fitting double glazing? [1]

Energy saved = ... J/s

(b) Explain why insulating the attic benefits the environment more than the other **two** insulating measures. [2]

.....

.....

.....

.....

4

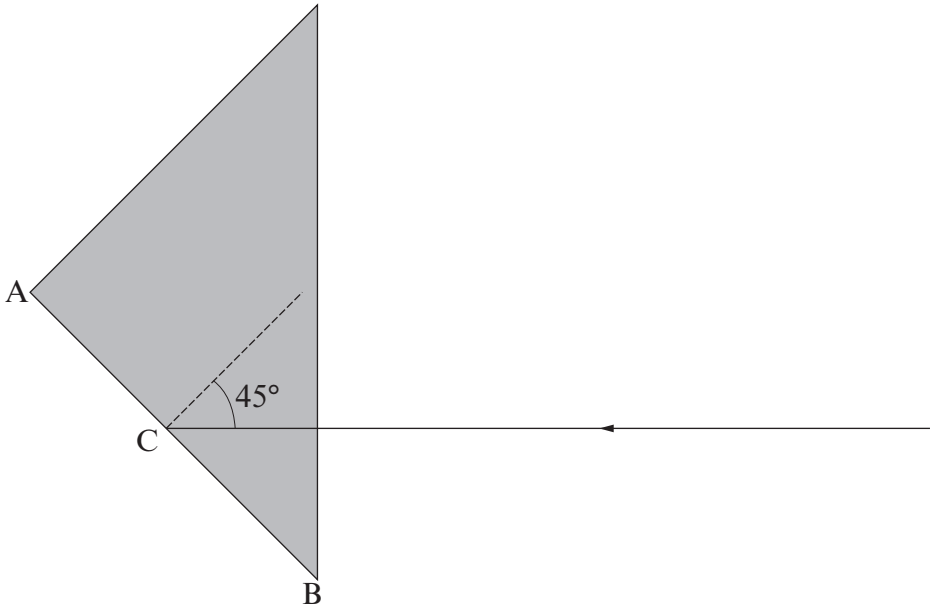
Turn over.

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Examiner only

11. A reflector on the back of a bicycle is made up of many glass prisms, one of which is shown in the diagram.
A ray of light strikes the back surface of the prism at point C at an angle of 45°.

The critical angle for glass is 42°.



(a) (i) Explain why the light does **not** leave the prism at point C. [1]

.....

(ii) What is the name given to this effect? [1]

.....

.....

(b) **Draw on the diagram** the path taken by the ray of light through the glass and into the air. [2]

4

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Candidate Name	Centre Number	Candidate Number
		0

WJEC CBAC

GCSE

237/01

SCIENCE
FOUNDATION TIER
PHYSICS 1

A.M. WEDNESDAY, 19 January 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**4**	
2.	**4**	
3.	**3**	
4.	**3**	
5.	**4**	
6.	**6**	
7.	**7**	
8.	**4**	
9.	**5**	
10.	**5**	
11.	**5**	
Total	**50**	

0237 010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

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EQUATIONS

power = voltage × current

energy transfer = power × time

units used (kWh) = power (kW) × time (h)

cost = units used (kWh) × cost per unit

$$\%\ \text{efficiency} = \frac{\text{useful energy transfer}}{\text{total energy input}} \times 100$$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

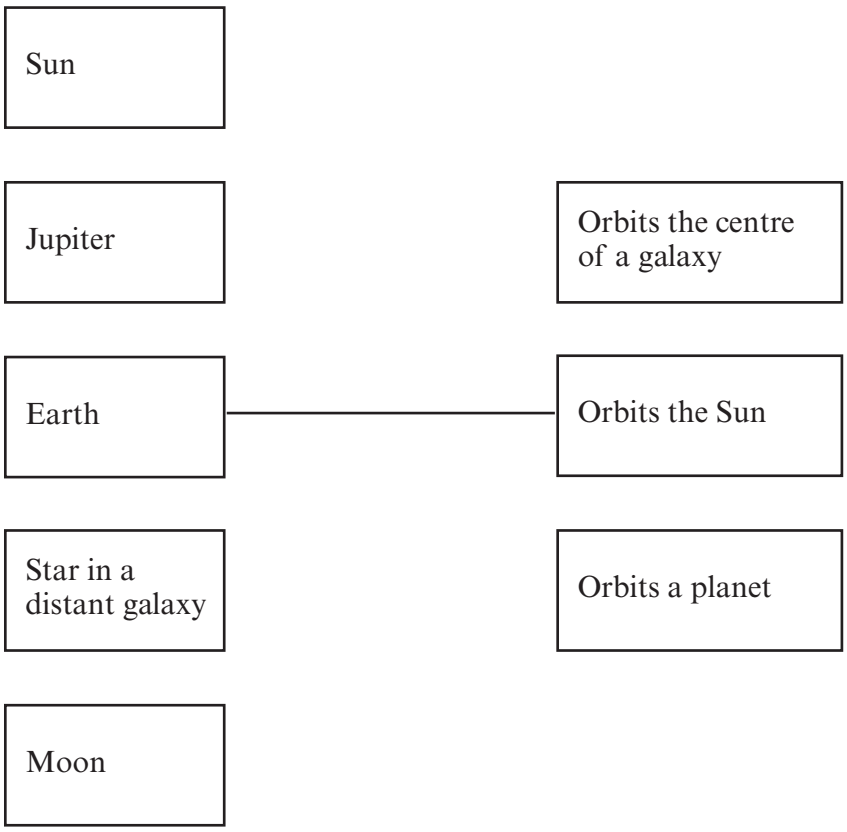
wave speed = wavelength × frequency

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Examiner only

Answer **all** *questions.*

1. The boxes on the left name objects found in space.
The boxes on the right say something about orbits.
Draw lines from **each object** to its orbit (some orbits will be used more than once).
One has been done for you. [4]



0237 010003

4

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Examiner only

2. The Sun has been around for billions of years and is now in its stable state. It will eventually change into a red giant and later into a white dwarf.

(a) State which gas will be used up when the Sun comes to the end of its stable state.

..... [1]

(b) Complete the following sentences by choosing phrases from the box below.

smaller than	equal to	bigger than

(i) In its stable state, the outward force on the Sun is ..... the inward force due to the Sun's gravity.

(ii) As the Sun expands to become a red giant, the outward force will be ..... the inward force due to the Sun's gravity.

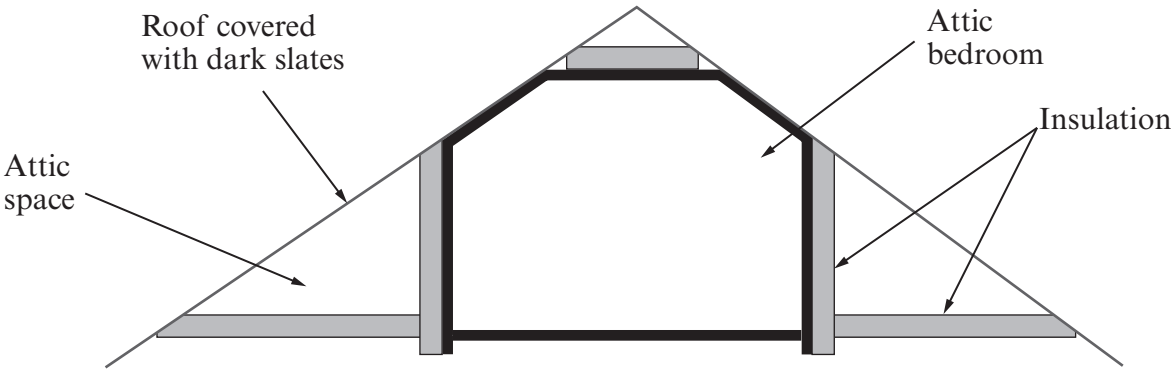
(iii) As the Sun shrinks to become a white dwarf, the outward force will be ..... the inward force due to the Sun's gravity. [3]

4

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Examiner only

3. In a sunny summer, the attic space of a house gets hot. The diagram shows an attic with a room built into it.



(a) Underline the correct word in each bracket.

The attic space gets hot because the heat (conducted, convected, radiated) from the Sun is (absorbed, attracted, reflected) by the dark roof slates. [2]

(b) The attic bedroom is well insulated with fibre glass to stop it getting too warm. Explain why fibre glass is a good insulator. [1]

.....

.....

.....

3

4. A power station produces 1200 kJ of electricity from 3500 kJ of chemical energy in coal.

(i) How much energy is wasted? ..... kJ [1]

(ii) Use the equation

$$\% \text{ Efficiency} = \frac{\text{Useful energy transfer}}{\text{Total energy input}} \times 100$$

to calculate the efficiency of the power station. [2]

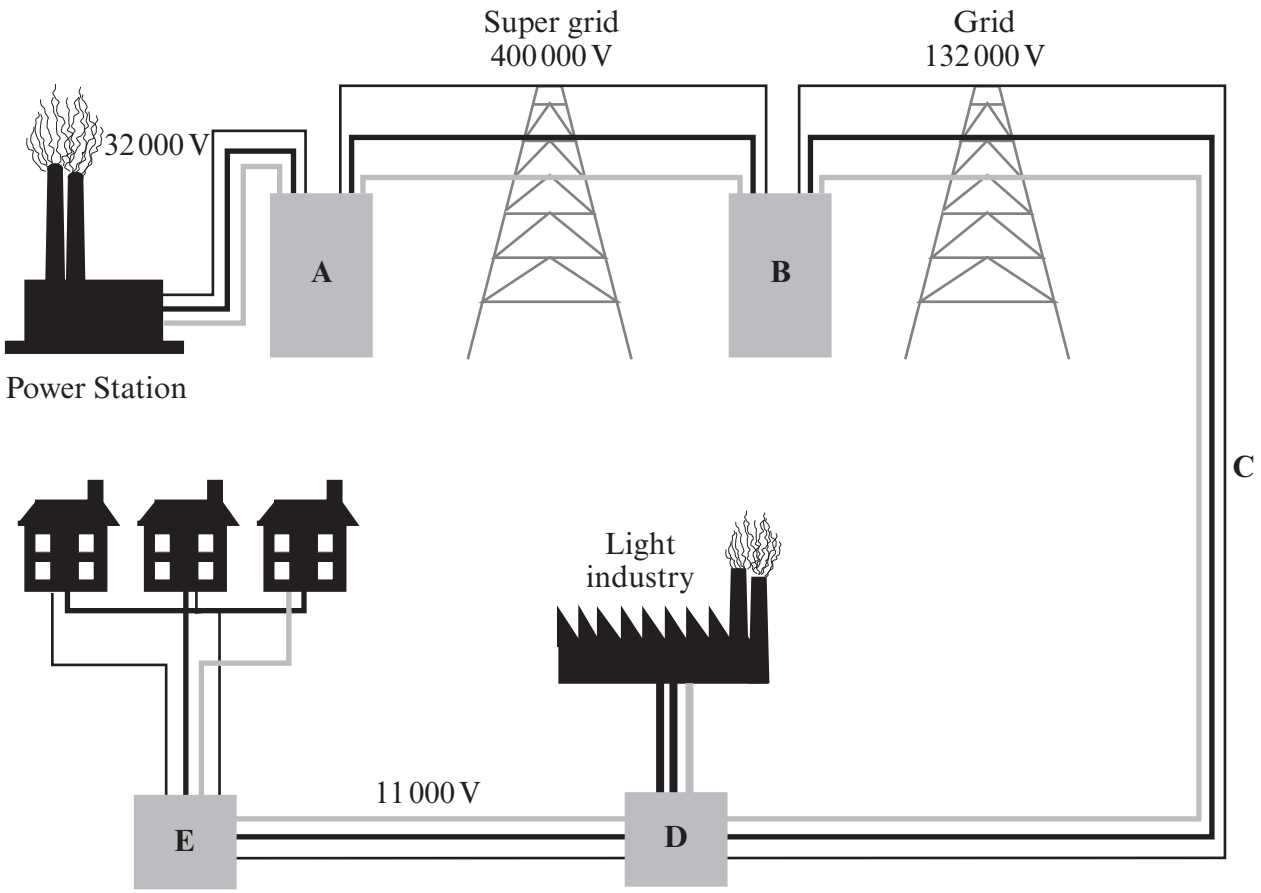
Efficiency = ... %

3

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Examiner only

5. The diagram shows part of the national grid.



(a) At which point A, B, C, D or E would you find a step up transformer? ..... [1]

(b) Underline the correct answer in each bracket below.

(i) The voltage at point C is (11 000, 32 000, 132 000, 400 000) volts?

(ii) The voltage is stepped down to 230 V at (A, B, C, D, E).

(iii) A high voltage is used in the National Grid so that the current in the cables is (zero, small, big). [3]

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6. *(a)* Using the words below fill in the missing parts of the electromagnetic spectrum. [2]

Ultra violet waves
Radio waves
Sound waves
Water waves

....	microwaves	Infra red	Visible light	....	X rays	Gamma Rays

(b) Some electromagnetic waves can be used for communications.

(i) Name the wave that is used by remote controls. .....

(ii) Name the wave that is used to communicate with satellites in space.

..... [2]

(c) Some of these waves can be harmful.

(i) Name **one** wave from the list that can ionise cells in the body.

.....

(ii) What is the danger from a large dose of infra red rays?

.....

..... [2]

6

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7. The table shows information about three electrical appliances.

Appliance	Power (W)	Power (kW)	Units (kWh) used in 1 week
Kettle	2100	2.1	5
Electric oven	.....	4.0	12
Microwave oven	900	0.9	1

(a) (i) What does "kW" stand for? ..... [1]

(ii) **Complete the table**. [1]

(iii) State which appliance uses the most energy every second. ..... [1]

(b) Use the equation:

$$\text{time (h)} = \frac{\text{units used (kWh)}}{\text{power (kW)}}$$

to calculate the number of hours that the electric oven is used in 1 week. [1]

Time used = ... h

(c) All three appliances are used for 1 week.

(i) Calculate the total number of units used. [1]

Number of units used = ... kWh

(ii) 1 unit of electricity costs 12p.
Use the equation

Cost = units used × cost per unit

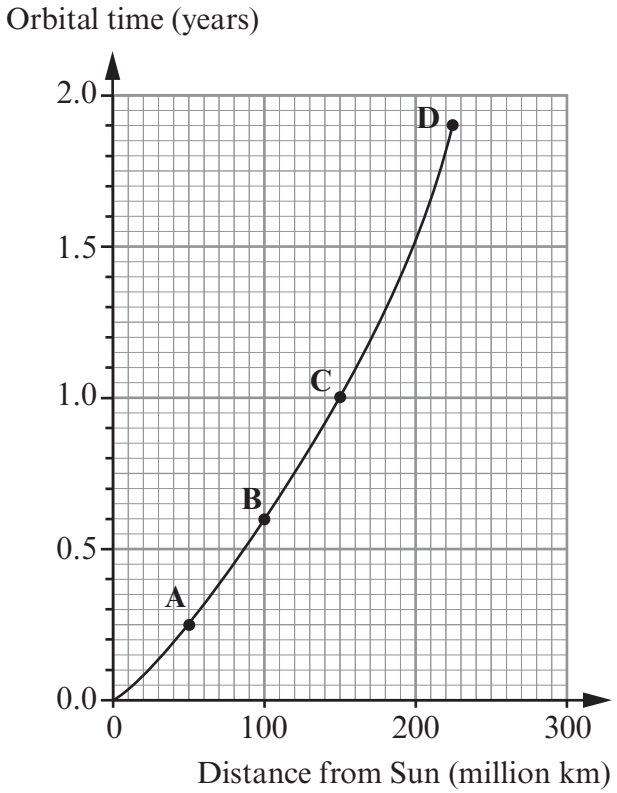
to calculate the cost of using all three appliances for 1 week. [2]

Cost = ...

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8. The graph shows how the orbital time of the inner four planets varies with their distance from the Sun.



(a) How far from the Sun is the planet with an orbital time of 0.6 years? [1]

Distance from Sun = ... million km

(b) **Name** the planet labelled C on the graph. ..... [1]

(c) How much longer does planet D take to orbit than planet C?

Time = ... years [1]

(d) **Name** the planet that is one third the distance of C from the Sun.

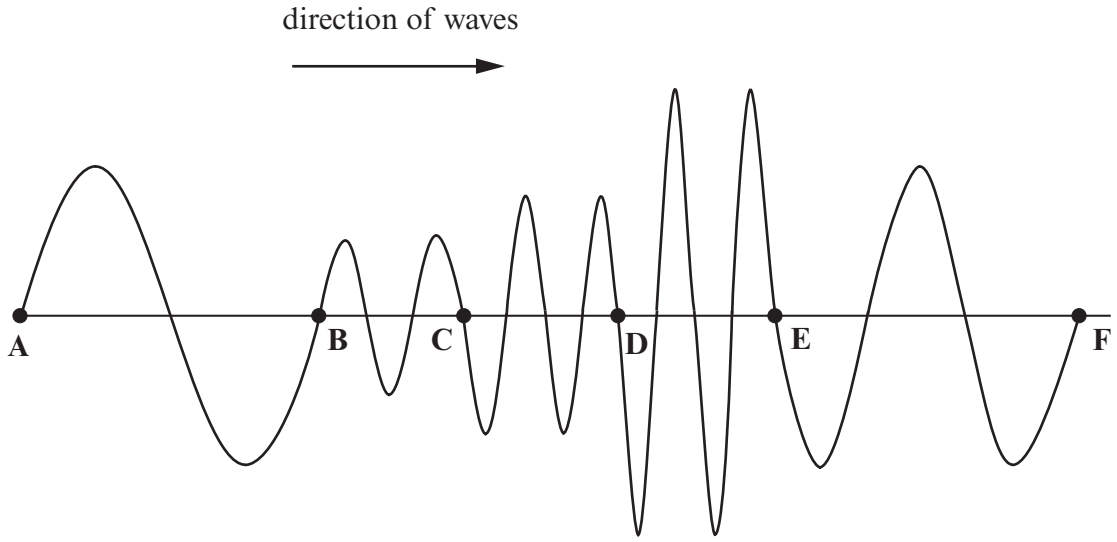
..... [1]

4

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9. The diagram shows a train of waves.



(a) How many waves are shown between A and C? ..... [1]

(b) **Between which two of the points**, A, B, C, D, E and F is

(i) the wavelength biggest? .....

(ii) the amplitude smallest? ..... [2]

(c) (i) The eight waves between A and F cover a distance of 240 cm.
Calculate the **average** wavelength of the waves. [1]

Average wavelength = ... cm

(ii) The frequency of these waves is 10 Hz.

Use the equation:

Wave speed = frequency × wavelength

to calculate the average speed of these waves. [1]

Wavespeed = ... cm/s

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10. A number of windfarms are due to be built around Britain in the near future. The following table shows where they are to be built. The highlands of Scotland which are some of the windiest places in Britain face the Atlantic Ocean.

WINDFARMS BEING BUILT FOR FUTURE USE				
Location	Onshore (on land)		Offshore (at sea)	
	Number	Total power output (MW)	Number	Total power output (MW)
England	3	21	5	1450
Northern Ireland	1	20	0	0
Scotland	18	810	0	0
Wales	3	33	0	0
Totals	**25**	**884**	**5**	**1450**
Average power output		**35.4**		**290**

Source: *Information adapted from: http://www.bwea.com/statistics*

(a) In which part of Britain is the largest number of windfarms due to be built?

..... [1]

(b) Give **two** reasons why offshore wind farms are expected to produce much more energy than onshore wind farms. [2]

.....

.....

.....

.....

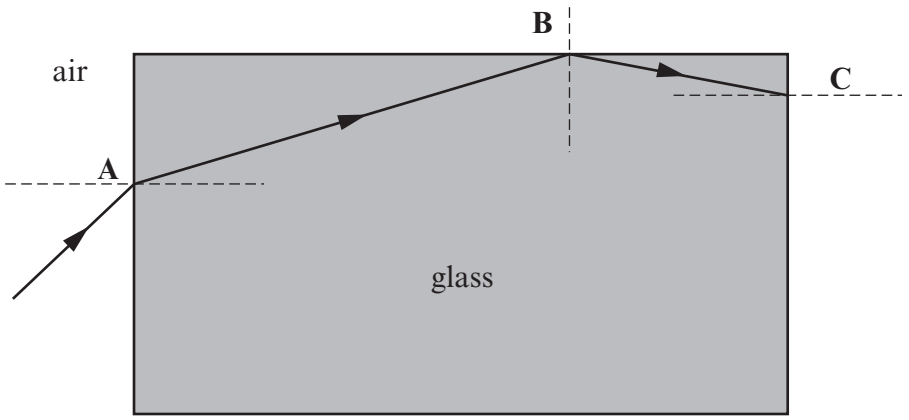
(c) Calculate the average (mean) power expected from the Scottish wind farms. [2]

Average (mean) power = ... MW

5

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11. The diagram shows light travelling from air into a glass block.



(a) (i) What name is given to the bending of light at point **A**? ..... [1]

(ii) Give a reason why the light changes direction at **A**. [1]

.....

.....

(b) State what is happening to the light at point **B**. [1]

.....

(c) At point **C**, the light passes out into the air.

(i) Give **one** reason why it does not go back into the block as it does at point **B**. [1]

.....

.....

(ii) **Draw** the ray direction into the air at point **C**. [1]

5

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