Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

NEW GCSE

4463/01

SCIENCE A
FOUNDATION TIER
PHYSICS 1

A.M. FRIDAY, 20 January 2012

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**9**	
3.	**4**	
4.	**6**	
5.	**6**	
6.	**6**	
7.	**6**	
8.	**5**	
9.	**8**	
10.	**5**	
Total	**60**	

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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 pages 2 and 3. In calculations you should show all your working.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **9**(*b*).

Equations and Units

Physics 1

energy transfer = power × time	$E = Pt$
units used (kWh) = power (kW) × time (h) cost = units used × cost per unit	
% efficiency = $\dfrac{\text{useful energy [or power] transfer}}{\text{total energy [or power] input}} \times 100$	
density = $\dfrac{\text{mass}}{\text{volume}}$	$\rho = \dfrac{m}{V}$
wave speed = wavelength × frequency	$v = \lambda f$
speed = $\dfrac{\text{distance}}{\text{time}}$	

Physics 2

power = voltage × current	$P = VI$
current = $\dfrac{\text{voltage}}{\text{resistance}}$	$I = \dfrac{V}{R}$
acceleration [or deceleration] = $\dfrac{\text{change in velocity}}{\text{time}}$	$a = \dfrac{\Delta v}{t}$
momentum = mass × velocity	$p = mv$
resultant force = mass × acceleration	$F = ma$
force = $\dfrac{\text{change in momentum}}{\text{time}}$	$F = \dfrac{\Delta p}{t}$
work = force × distance	$W = Fd$

Physics 3

pressure = $\dfrac{\text{force}}{\text{area}}$	$p = \dfrac{F}{A}$		
	$v = u + at$ $x = \frac{1}{2}(u + v)t$	where	u = initial velocity v = final velocity a = acceleration t = time x = displacement

Units

1 kWh = 3.6 MJ
T / K = θ / °C + 273

SI multipliers

Prefix	Multiplier
p	10^{-12}
n	10^{-9}
μ	10^{-6}
m	10^{-3}

Prefix	Multiplier
k	10^{3}
M	10^{6}
G	10^{9}
T	10^{12}

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*Answer **all** questions.*

1. *(a)* Electrical power is made and distributed around the country using the following:

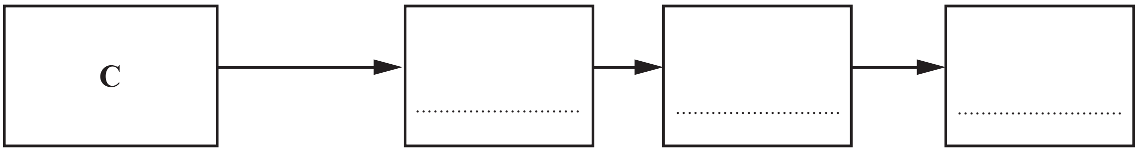
A Step-down transformer to homes

B National grid power lines

C Power station

D Step-up transformer

Put the letters **A**, **B**, **C** and **D** in the correct order into the boxes of the flowchart below.
The first has been done for you. [2]



(b) List **three** things that must be taken into account when deciding whether to build a nuclear or a coal-fired power station. [3]

1. ....

2. ....

3. ....

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2. *(a)* An incomplete diagram of the electromagnetic spectrum is shown. Complete it using words from the following list. [2]

X-rays
Sound waves
Infra-red

Radio waves	Microwaves	....	Visible light	Ultra-violet	....	Gamma

Increasing frequency

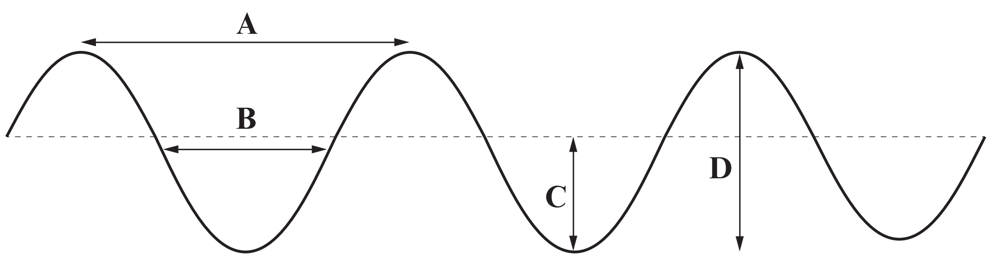
(b) Complete **each** sentence that follows by **underlining** the correct statement in brackets.

(i) The speed of gamma radiation is (less than / the same as / greater than) the speed of radio waves in a vacuum.

(ii) The frequency of microwaves is (less than / the same as / greater than) the frequency of infra-red.

(iii) The wavelength of microwaves is (less than / the same as / greater than) the wavelength of infra-red. [3]

(c) The diagram shows a wave.



(i) How many wavelengths are shown in the diagram? ....

(ii) Which label, **A**, **B**, **C**, or **D**, represents the amplitude of the wave? ....

(iii) **On the same diagram draw a wave** with a larger amplitude and a smaller wavelength. [4]

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Turn over.

Examiner only

3. The table gives some data on 6 planets:

Planet	Distance from Sun (million km)	Average surface temperature (°C)	Type of Atmosphere
Mercury	57	180	None
Venus	108	400	Carbon dioxide and thick cloud
Earth	150	15	Mainly nitrogen
Mars	228		Mainly carbon dioxide and very thin
Jupiter	778	–120	Hydrogen
Saturn	1429	–180	Hydrogen

(a) Which planet is 4 times as far from the Sun as Mercury? .... [1]

(b) (i) Estimate the surface temperature of Mars. .... °C [1]

(ii) Explain why the average surface temperature of Venus is higher than that of Mercury even though Venus is further from the Sun. [2]

....

....

....

....

4

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4. *(a)* The statements below are about energy sources.
Tick (✓) the correct statements. [3]

Photovoltaic cells give out dangerous gases. ☐

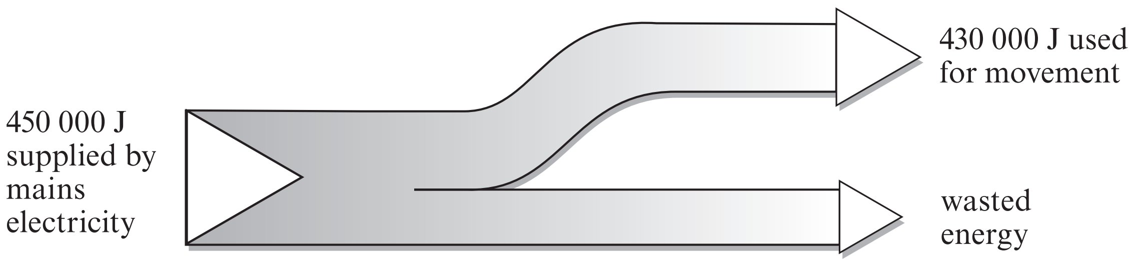
Burning gas in a power station adds to global warming. ☐

Coal is a renewable source. ☐

Wind turbines produce no air pollution. ☐

Oil is a non-renewable source. ☐

(b) The energy flow diagram is shown for a modern moving electric car.



(i) Calculate the number of joules of wasted energy. [1]

.... J

(ii) Name **two** types of energy that would be wasted in a moving electric car. [2]

....

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Turn over.

Examiner only

5. Read the passage below and answer the questions that follow.

When white light passes through a prism it separates into a spectrum of colours.

The spectrum of our closest star, the Sun, is crossed by dark lines.

Spectrum of our Sun

Each element in the outer atmosphere of the Sun absorbs light of a certain colour to produce each dark line. This is how we know what elements are in the Sun.

(a) What happens when scientists pass the light of a star through a prism? [1]

....

(b) What produces the dark lines? [1]

....

....

(c) Helium was first discovered in the Sun. How would scientists have done this? [1]

....

....

(d) (i) How would the dark lines in the spectrum of a star in a distant galaxy be different from those in the spectrum of our Sun? [2]

....

....

....

(ii) Why does this difference occur? [1]

....

....

6

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6. Students measure the speed of sound using two different methods.

(i) **Method 1:** Two students stand in front of a wall. One starts a stopwatch as the other hits two wooden blocks together once.

(from esfscience.wordpress.com/category/physics/page/2/)

As soon as the students hear the echo from the wall they stop the stopwatch. The time measured is 0.56 s. They measure the distance to the wall as 98 m.
Use this information and an equation from page 2 to calculate the speed of sound in air. [3]

Speed of sound = ... m/s

(ii) **Method 2:** In a laboratory they find that the wavelength of a sound wave of frequency 260 Hz is 1.3 m.
Use this information and an equation from page 2 to calculate the speed of sound waves in air. [2]

Speed of sound waves = ... m/s

(iii) The true speed of sound in air is 330 m/s.
Method 1 is less accurate than **Method 2**. Suggest a reason for this. [1]

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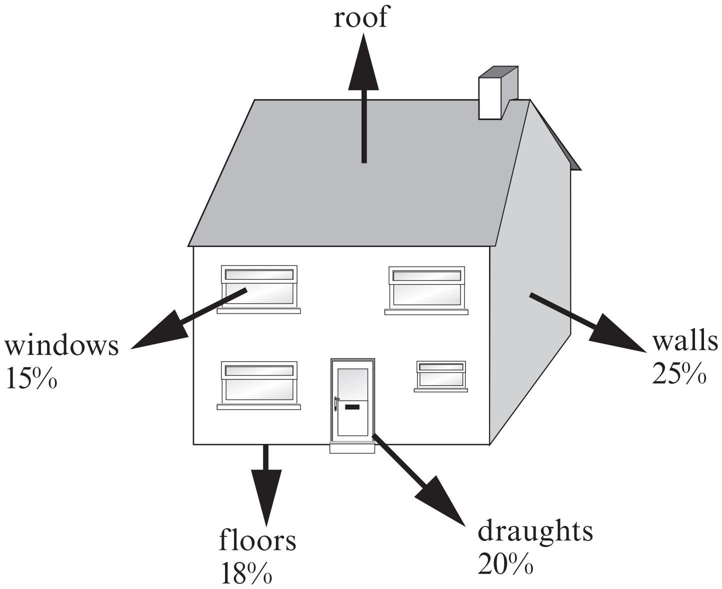
6

Turn over.

Examiner only

7. The diagram shows how energy is lost from a house.



(a) (i) Calculate the percentage energy loss through the roof. [1]

.... %

(ii) State a method of reducing energy loss through the roof. [1]

....

....

(iii) Explain **how** this method reduces energy loss through the roof. [2]

....

....

....

....

Examiner only

(b) The table gives information about reducing energy loss from a house.

Method	Cost	Savings per year	Payback time in years
Double glazed windows	£2800	£140	....
Under floor insulation	£800	£80	10
Cavity wall insulation	£800	£160	5

(i) **Complete the table** to show the payback time for double glazed windows. [1]

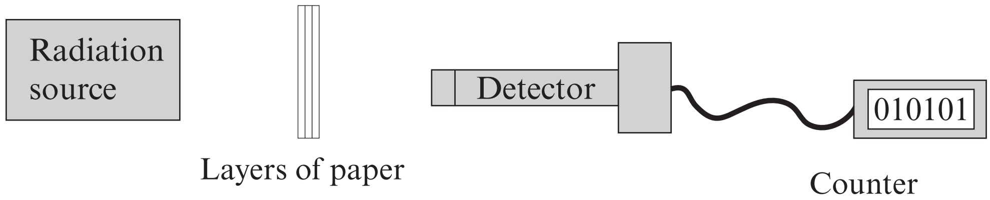
(ii) State why the householder should install cavity wall insulation instead of under floor insulation even though they cost the same. [1]

....

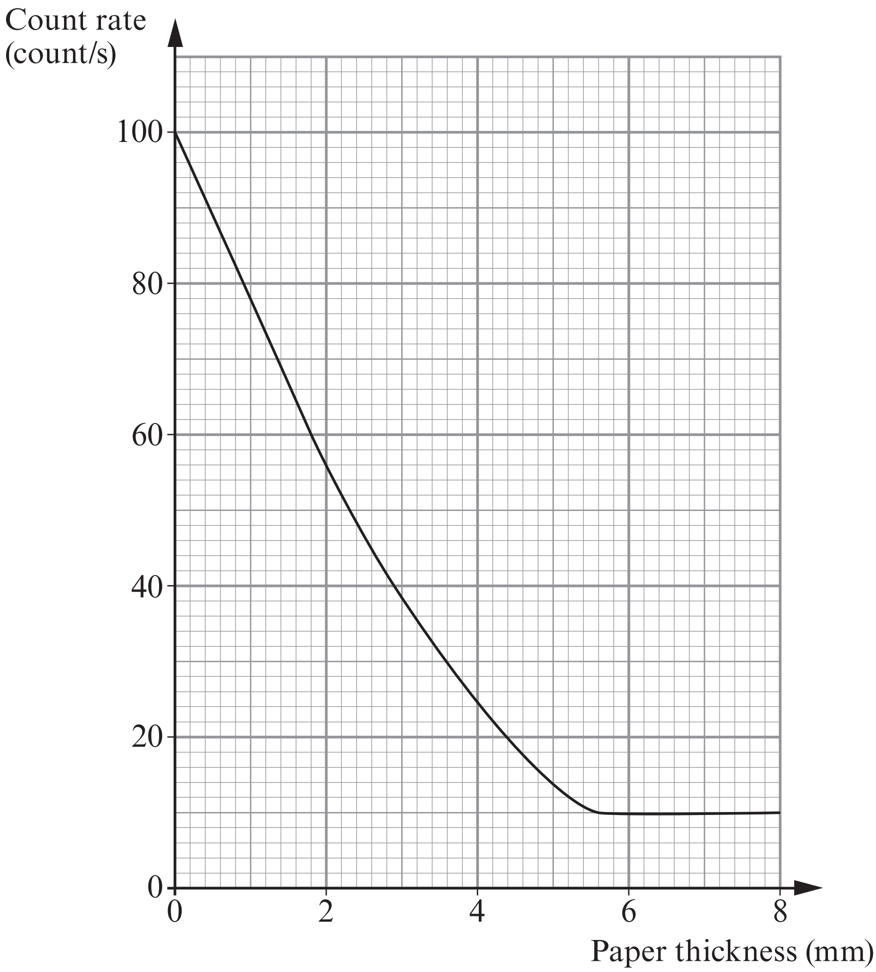
....

6

8. A student set up an experiment to see how much nuclear radiation could pass through different thicknesses of paper.



The following graph was plotted from the results obtained:



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(a) Use the graph to complete the table of results that was obtained. [1]

Count rate (count/s)	Paper thickness (mm)
20	....
40	2.9
60	1.8
80	0.9
100	0.0

(b) Use the graph to estimate the value of the background radiation and show how you arrived at your answer. [2]

....

....

....

Background radiation = ... count/s

(c) The radioactive source only emitted one type of nuclear radiation.

Name the type of radiation emitted by the source and state how you arrived at your answer. [2]

Type of radiation: ....

....

....

5

Turn over.

Examiner only

9. The National Grid is a system that supplies electrical energy to users all over the country.

(a) State **two** ways in which the National Grid system maintains a reliable energy supply to all users. [2]

1. ....

....

2. ....

....

(b) Explain why step-up and step-down transformers are used in the National Grid. [6 QWC]

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8

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10. Compact fluorescent lamps (CFL), with a life of 10 000 hours, have replaced filament light bulbs. Light-emitting diodes (LED), with a life of 50 000 hours, are being developed. Information about both types of lights is given in the table below.

	LED	CFL
Power (W)	6	14
kWh of electricity used over 50 000 hours	300	**A** ....
Cost of using electricity	£36	**B** ....
Price per bulb	£23	£2.50
Bulbs needed for 50 000 hours of use	1	5
Cost of bulbs over 50 000 hours	£23	....
Total cost for 50 000 hours	£59	....

(i) The cost of electricity is 12 p / kWh.
Use the equations:
units used (kWh) = power (kW) × time (h)
cost = units used × cost per unit
to complete boxes **A** and **B** in the table. [3]

(ii) Complete the table to show that the total cost of buying and using **five** CFLs is more than buying and using **one** LED. [2]

5

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION.