Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

New GCSE

4463/01

SCIENCE A
FOUNDATION TIER
PHYSICS 1

P.M. THURSDAY, 17 January 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**2**	
2.	**3**	
3.	**3**	
4.	**6**	
5.	**3**	
6.	**8**	
7.	**9**	
8.	**7**	
9.	**6**	
10.	**13**	
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 page 2. 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 **10***(a)*.

Equations

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

SI multipliers

Prefix	Multiplier
m	10^{-3}
k	10^{3}
M	10^{6}

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Answer **all** *questions.*

1. The Big Bang theory of the origin of the Universe was built up based on some of the following facts.

Tick (✓) only **two** boxes alongside the facts that helped to set up this theory. [2]

Light from distant galaxies is red shifted. ☐

Our Sun is one of billions of stars in the Milky Way galaxy. ☐

Scientists have discovered that stars are made from gases. ☐

Scientists have detected Cosmic Microwave Background Radiation (CMBR). ☐

There are billions of galaxies in the Universe. ☐

2

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2. The boxes in the left column show four energy sources.
Draw a single line from each energy source to the correct statement on the right. [3]

Coal	An energy source used in power stations that have high decommissioning costs.
Nuclear fuel	An energy source that is burned in power stations.
The Sun	An energy source that drives turbines directly.
Wind	An energy source that supplies solar panels.

3

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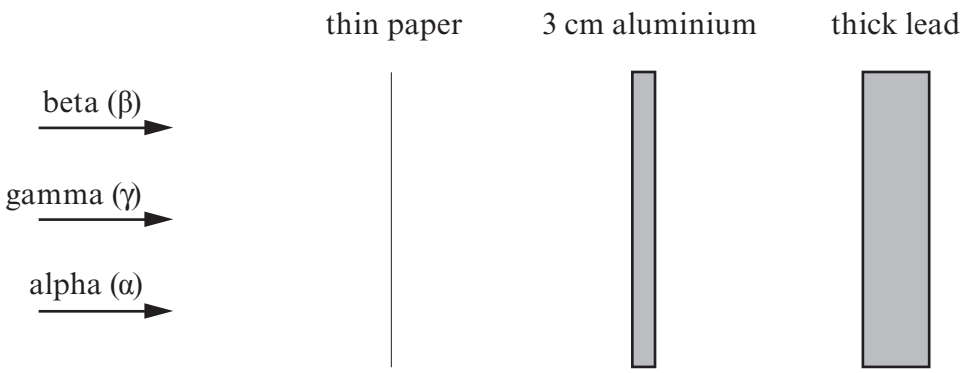
3. The diagram shows three types of radiation, alpha (α), beta (β) and gamma (γ).



Continue each arrow to show how far **each type** of radiation travels before it gets absorbed. [3]

3

4.

Earth	Universe	Milky Way	Sun	Solar system

(a) Write the objects named above in order of **increasing size**. [4]

....

Smallest **Largest**

(b) Which **one** of the above objects is a galaxy? ..... [1]

(c) State what is meant by a 'light year'. [1]

.....

6

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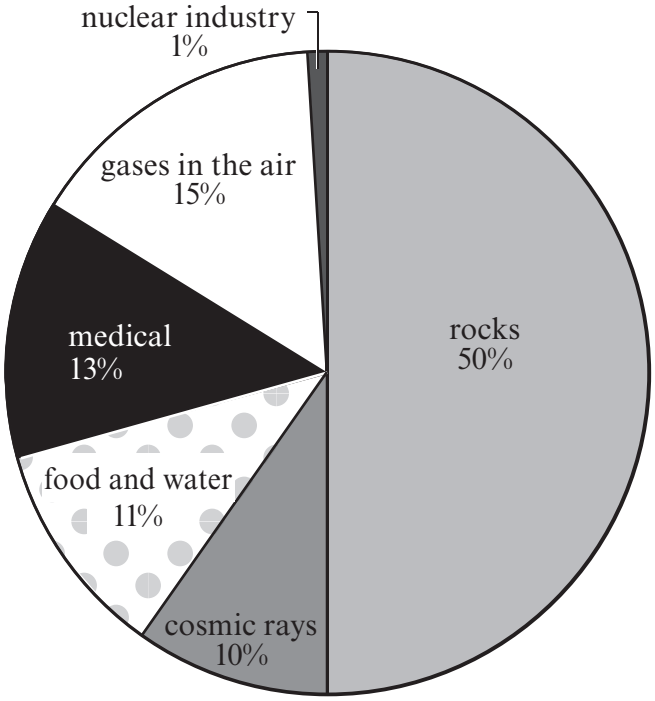
5. Background radiation is all around us. The pie chart shows the main sources of this radiation in one area of the U.K.



(a) Name a radioactive gas that is released from the ground. ..... [1]

(b) The background count rate in the area concerned was 30 counts per minute (cpm). Calculate the count rate due to rocks alone. [1]

Count rate = ... cpm

(c) The government is considering doubling the number of nuclear power stations in the country. State why this would not significantly change the pie chart. [1]

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3

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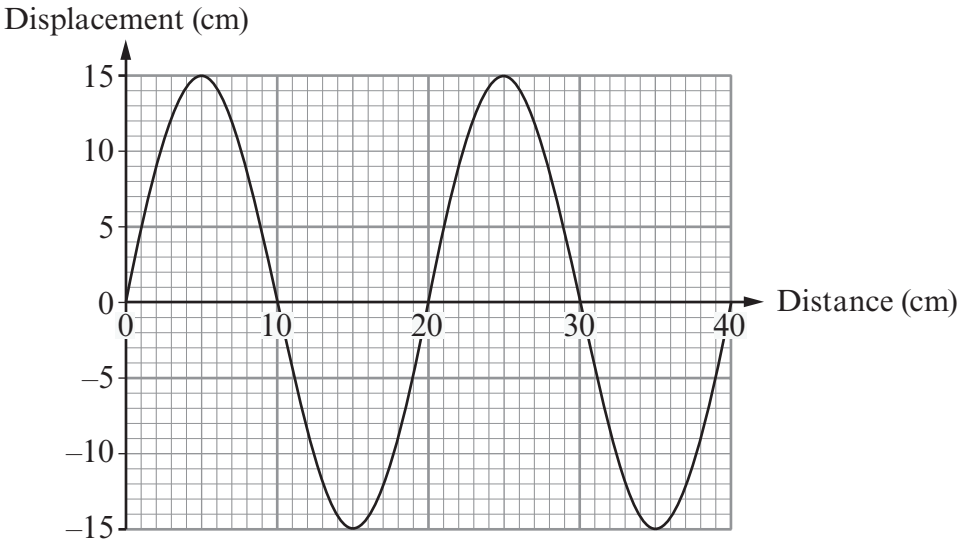
6. Waves are shown on the grid below.



(a) Write down the amplitude of the waves. ..... cm [1]

(b) Write down the wavelength of the waves. ..... cm [1]

(c) If 10 waves are produced in 5 seconds, calculate their frequency. [2]

frequency = ... Hz

(d) Use the equation:

wave speed = wavelength × frequency

to calculate the speed of the waves and state the unit. [3]

wave speed = ...

unit = ...

(e) **Underline** the correct statement in the bracket below.

If the wave amplitude was doubled the speed of the waves would (double / stay the same / halve). [1]

8

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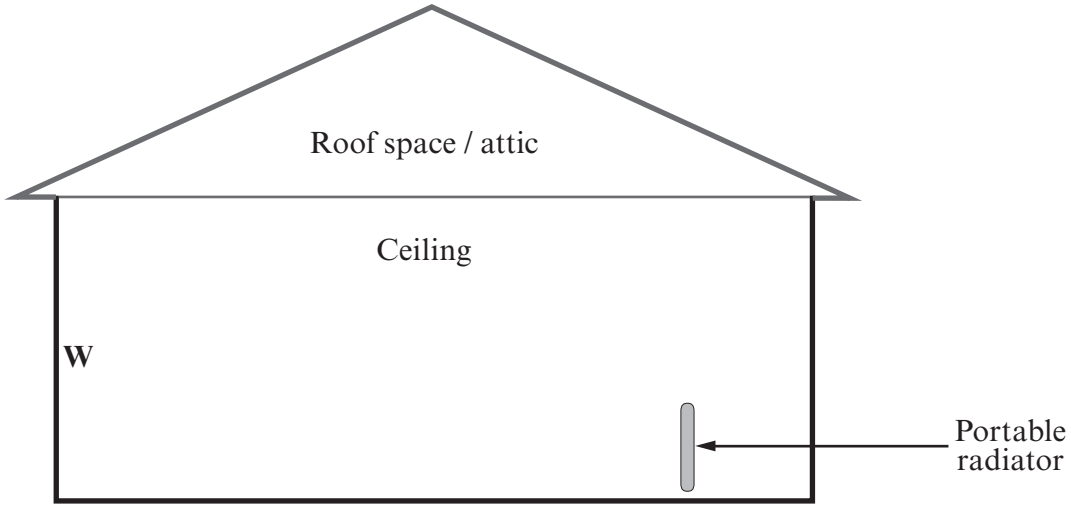
7. A family moves into a bungalow where all the walls and ceiling are damp. They decide to dry it out using a portable oil-filled radiator that is placed in the position shown below.



(a) Heat transfer by conduction, convection or radiation is responsible for the following effects. **Circle** the correct word in each case.

(i) The wall near to the radiator dries before the wall **W** due to [1]

Conduction Convection Radiation

(ii) Heat energy, from the hot oil in the radiator, passes **through the metal** to the air outside due to [1]

Conduction Convection Radiation

(b) Explain how a convection current arises, which dries the ceiling quickly. [2]

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Examiner only

(c) The following table gives information about heat losses from a bungalow without insulation.

Part of the bungalow	Percentage of heat lost without insulation	Cost of insulation (£)	Saving per year (£)
Roof	50%	600	200
Walls	25%	1 000	150
Floor	5%	2 300	40
Doors and windows	.....	3 500	100

(i) Complete the table to show the percentage of heat lost through the doors and windows. [1]

(ii) Explain why insulating the attic would be the most cost-effective method of reducing heat loss. [2]

.....

.....

(iii) State how heat is lost through the ceiling **and then** the attic space when the attic is not insulated. [2]

.....

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9

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8. The following table gives information about 4 metals that may be used in overhead cables in the National Grid.

Metal	Strength of cable (units)	Ability to conduct electricity (units)	Density (kg/m^3)
Copper	250	600	8 950
Steel	800 to 2 000	10	7 900
Aluminium	220	35	2 700
Lead	10	5	11 300

(a) Use only the information in the table above to answer the following questions.

(i) Give **one** reason why copper is usually the best metal to use for electrical wires.[1]

.....

(ii) Name the metal that would be most unsuitable for overhead cables. [1]

.....

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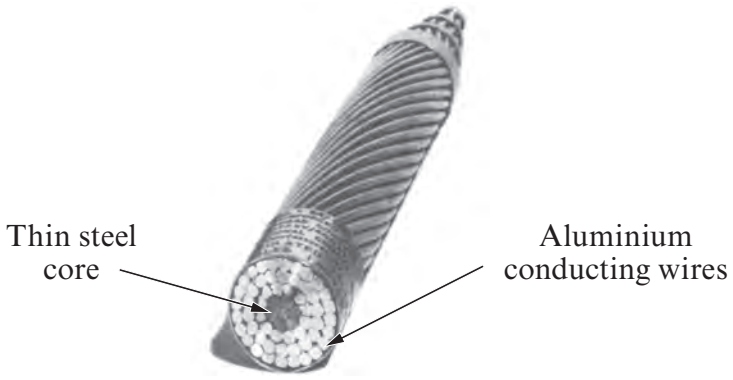
(iii) Explain why actual overhead cables are made from a thin steel core surrounded by aluminium conducting wires. [3]



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(b) The aluminium used in a 100 m length of cable has a volume of 0.12 m^3. Use the equation

mass = density × volume

and information from the table on the opposite page to calculate the mass of aluminium in this cable. [2]

mass = ... kg

7

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9. Read the following passage.

Its official now! Radiation from your mobile phone may be killing you.

(Freely adapted from an article from EMRstop.org)

Source: DNA India

Professor Kumar, of Bombay University has done extensive research on mobile phone radiation and its effects.

The major health hazards of non-ionising radiation from mobile phones and masts are given below.

Excessive use of mobile phones can cause cancer. Use of mobile phones for more than 30 minutes per day for 10 years increases the risk of brain cancer.

There is a 400% increase in the risk of brain cancer among teenagers using mobile phones. The younger the child, the deeper the penetration of electromagnetic radiation because the skull is thinner.

Mobile phone radiation causes irreversible damage to male fertility. Studies have found a 30% lower sperm count in intensive male users of mobile phones.

People who often use mobile phones can suffer damage to their vision. Mobile phones that work at 900 and 1 800 MHz have outputs of 0.25 W and 0.125 W respectively and increase the temperature within the eye by 0.1 °C.

Exposure to electromagnetic waves can cause sleep disorders.

(a) Use information in the passage to answer the following questions.

(i) Give **one** frequency at which mobile phones operate. ..... [1]

(ii) It is suggested that the output power is directly proportional to the frequency of mobile phones.
Use evidence from the passage to show whether or not this is correct. [2]

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Examiner only

(iii) Explain what needs to be done for the claims in the passage to be accepted by the wider scientific community. [2]

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(b) Name the region of the electromagnetic spectrum used by mobile phones to communicate with their masts. [1]

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6

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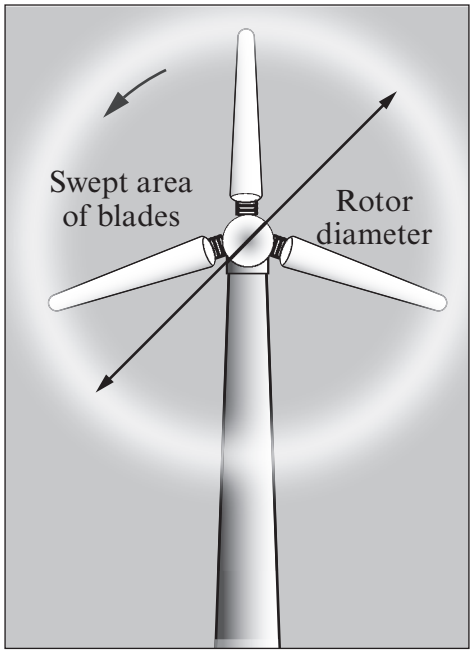
Examiner only

10. The table below gives information about generating electricity from wind and nuclear power.

How they compare		
	A wind turbine	A nuclear power station
Overall cost of generating electricity (p/kWh)	5.6	2.8
Maximum power output (MW)	2	3 600
Lifetime (years)	15	45
Waste produced	None	Radioactive waste
Lifetime carbon footprint (g of CO_2/kWh)	4.64/5.25 (onshore/offshore)	5
Commissioning cost (£ million)	3	4 000

(a) Use your knowledge and information from the table to **compare** the **cost-effectiveness** and **environmental** impact of the two methods of generating electricity. [6 QWC]

(b) The maximum power output from a wind turbine depends on the rotor diameter as shown in the table.



Rotor diameter (m)	Maximum power output (MW)
40	0.5
60	1.1
80	2.0
90	3.0
110	4.5

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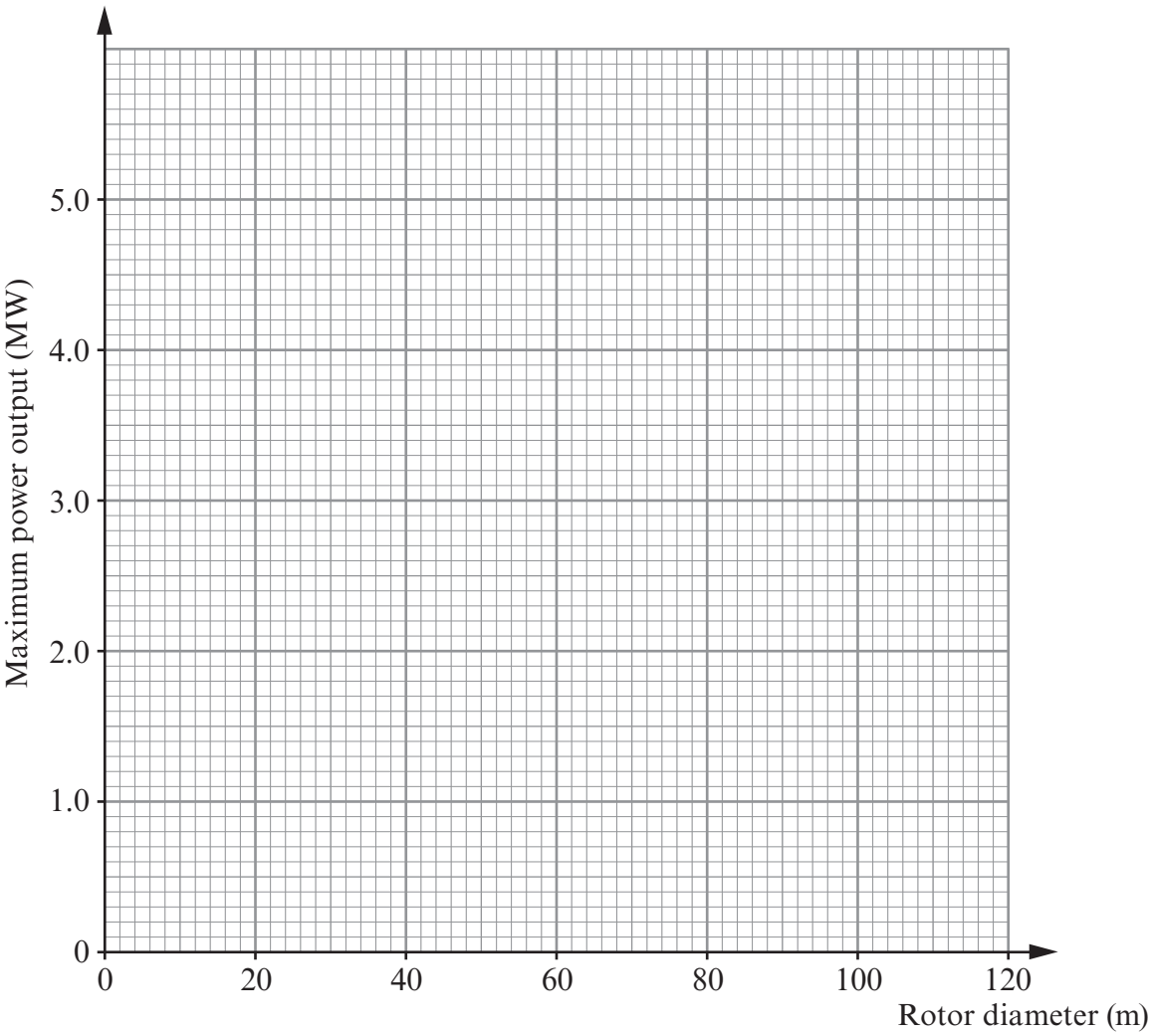
(i) Plot the data on the grid below and draw a suitable line. [3]



(ii) Describe the relationship between rotor diameter and maximum power output. [2]

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(c) Use an equation from page 2 to calculate the efficiency of the wind turbine when the useful power transfer is 3.0 MW and the input power is 5.0 MW. [2]

efficiency = ... %

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