Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4463/01

S16-4463-01

SCIENCE A/PHYSICS

PHYSICS 1
FOUNDATION TIER

A.M. MONDAY, 20 June 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**11**	
3.	**8**	
4.	**7**	
5.	**6**	
6.	**10**	
7.	**14**	
Total	**60**	

4463 010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

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 **7***(d)*.

Equations

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

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\frac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

Examiner only

Answer **all** *questions.*

1. An absorption spectrum from a star is a pattern of black lines on a coloured background.

The boxes in the left column list four features of the spectrum.
The boxes in the right column list the causes of these features.

(i) **Draw a line** from each feature to its correct cause on the right. [3]

Feature	Cause
A single black line	Due to wavelengths of visible light emitted by the star
The black lines move towards the red end of the spectrum	Due to the gas elements in the star
Pattern of black lines	Due to cosmological red shift
Coloured background	Due to one wavelength of light being absorbed

(ii) Name the theory that is supported by cosmological red shift. [1]

.....

4

Examiner only

2. The diagram shows apparatus that was used to investigate transformers.

www.indosaw.com

The same input coil was used throughout the investigation.

Different output coils (**A**, **B**, **C** and **D**) were used.

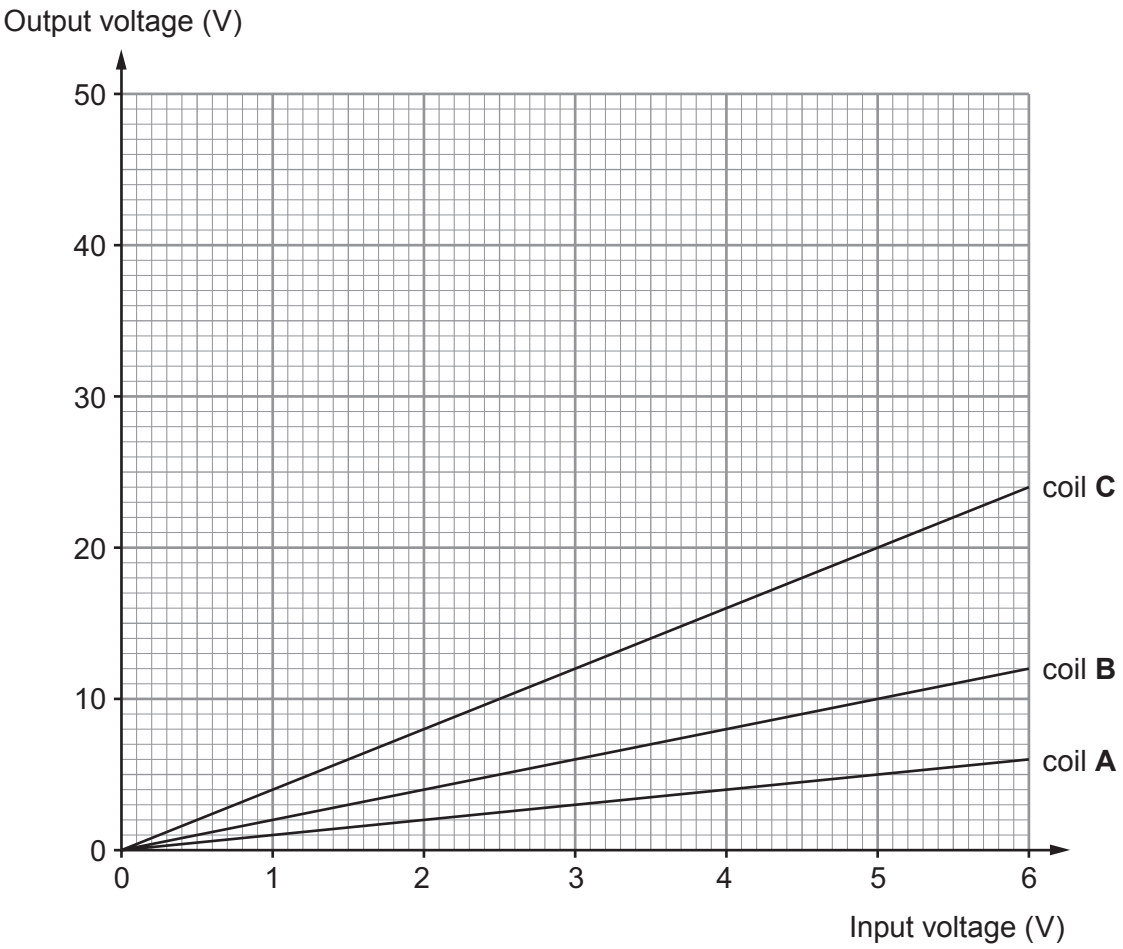
The results are shown below.

	Output voltage (V) from			
Input voltage (V) to coil	coil **A**	coil **B**	coil **C**	coil **D**
1	1	2	4	8
2	2	4	8	16
.....	4	8	16	32
5	5	10	.....	40
6	6	12	24	48

(a) (i) **Complete** the table. [2]

Examiner only

Some of the results have been plotted on the grid below.



(ii) Use the information in the table **to plot a graph** for coil **D**. [3]

(iii) Describe the relationship between the input voltage and the output voltage for coil **B**. [2]

.....

.....

(iv) Select the output coil which would be used to operate a 12 V lamp at normal brightness from a 3 V input voltage.

..... [1]

(v) Which of the output coils does not step-up the voltage? ..... [1]

(b) Explain the use of step-down transformers in the National Grid. [2]

.....

.....

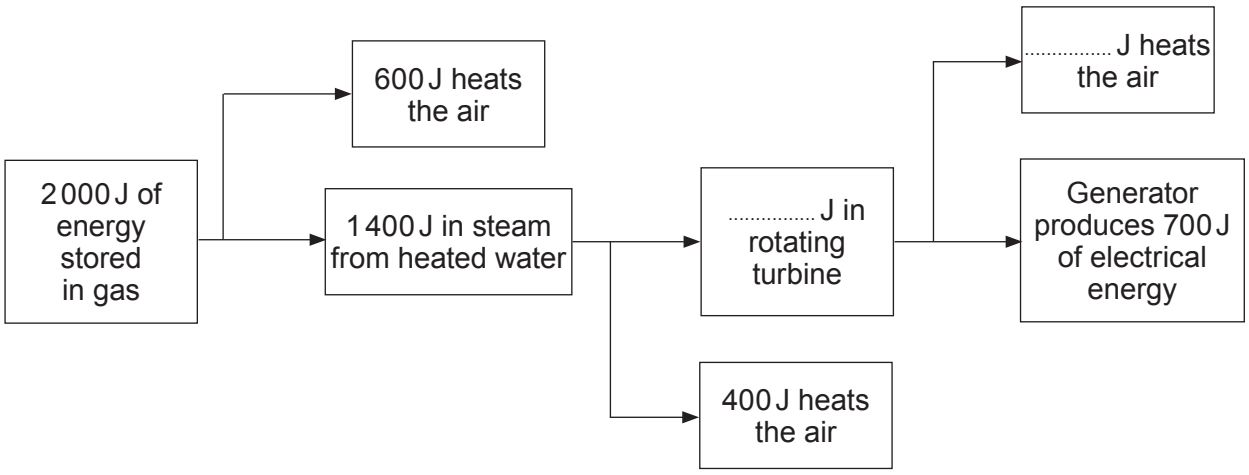
.....

4463 010005

Examiner only

3. Some power companies produce electricity by using gas.
Not all the energy stored in the gas is converted into electrical energy.

(a) The diagram below shows the energy flow in the process of producing electricity from gas.



(i) **Complete the flow diagram** above. [2]

(ii) State the amount of useful energy output from an input of 2 000 J. ..... J [1]

(iii) Use an equation from page 2 to calculate the % efficiency of producing electricity from gas. [2]

% efficiency = ...

(iv) Find the percentage of energy wasted in the process. [1]

% wasted energy = ...

(b) Give **two** reasons why power companies should look for other methods of producing electricity instead of using gas. [2]

1. .....

.....

2. .....

.....

8

Examiner only

4. The diagram shows an earthquake's shock wave that was detected under the Indian Ocean.

4463 010007

(a) (i) Write down the maximum amplitude of the shock wave. [1]

maximum amplitude = ... units

(ii) How many complete waves are shown? ..... [1]

(b) The frequency of the shock wave is 40 Hz and its wavelength is 120 m.

(i) State what a frequency of 40 Hz means. [1]

.....

(ii) Use an equation from page 2 to calculate the wave speed of the shock wave. [2]

wave speed = ... m/s

(c) The shock wave caused a tsunami which travelled 150 000 m in 750 s. Use an equation from page 2 to calculate its speed. [2]

speed = ... m/s

7

Examiner only

5. *(a)* The table below lists **most** of the regions of the electromagnetic spectrum.

Tick (✓) the boxes next to the regions that are ionising radiations. [2]

Region	Ionising radiation
radio waves	
microwaves	
infra-red	
visible	
ultraviolet	
X-rays	

(b) Three other types of ionising radiation are **alpha**, **beta** and **gamma** radiation.

(i) Which of these is the most penetrating radiation? ..... [1]

(ii) Which of these is the least ionising radiation? ..... [1]

(c) Nuclear waste emits ionising radiations.

State **two** reasons why the storage of nuclear waste is difficult. [2]

1. .....

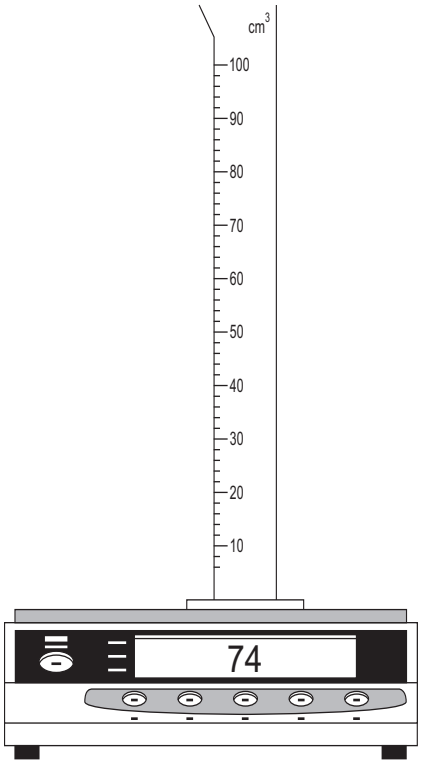
2. .....

6

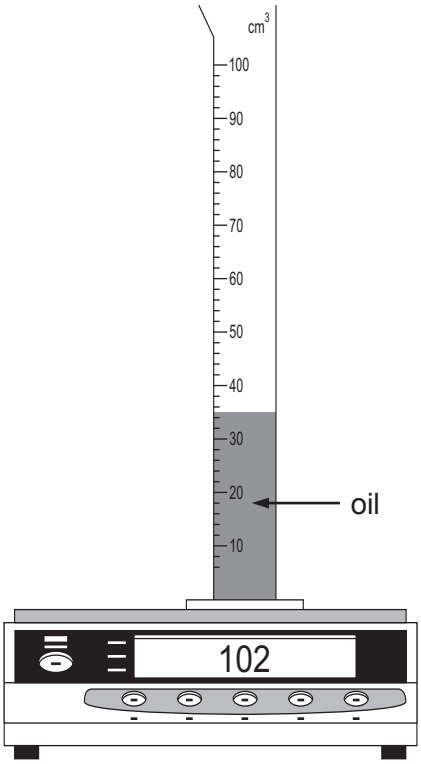
BLANK PAGE

6. A pupil wants to compare the densities of oil and water. Oil floats on water.
She uses a **measuring cylinder that has a mass of 74 g** and an electronic balance that measures to the nearest gram (g).

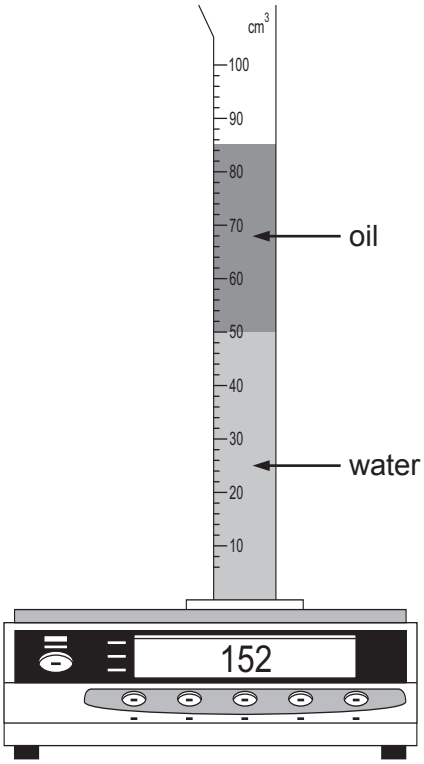
She places the empty measuring cylinder on to the balance.



She places the measuring cylinder containing some oil on to the balance.

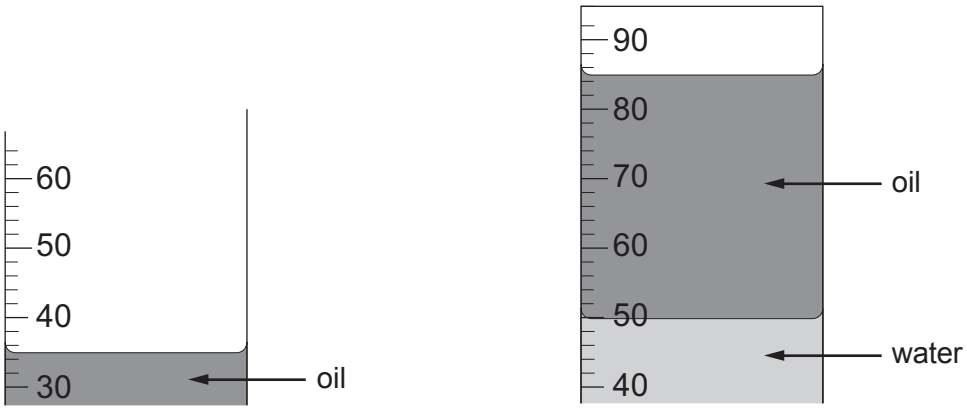


Some water was then added to the cylinder.



Examiner only

The liquid levels in the measuring cylinder are shown below.



(a) (i) Use the diagrams **to complete the table** below. [3]

	Volume (cm^3)	Mass (g)
oil	35	.....
water	.....	.....

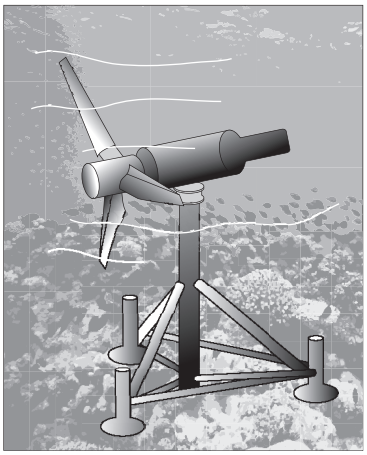
(ii) Use the data above and an equation from page 2 to calculate the density of oil and give its unit in this experiment. [3]

density of oil = ...

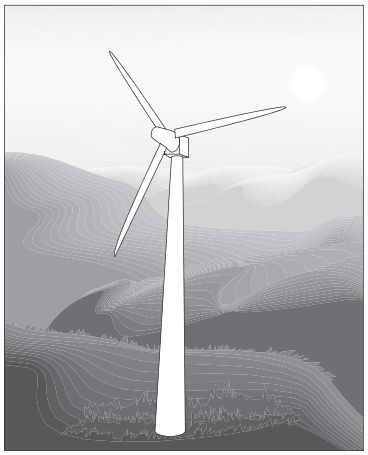
unit = ...

Examiner only

(b) Electrical energy can be generated from wind and from moving water. The density of air is 1.3 kg/m^3 and the density of water is 1 000 kg/m^3.



TIDAL WATER TURBINE



WIND TURBINE

(i) Give two **advantages** of producing electricity by using tidal water turbines compared to wind turbines sited on land. [2]

.....

.....

.....

.....

(ii) Give two **disadvantages** of producing electricity by using tidal water turbines compared to wind turbines sited on land. [2]

.....

.....

.....

.....

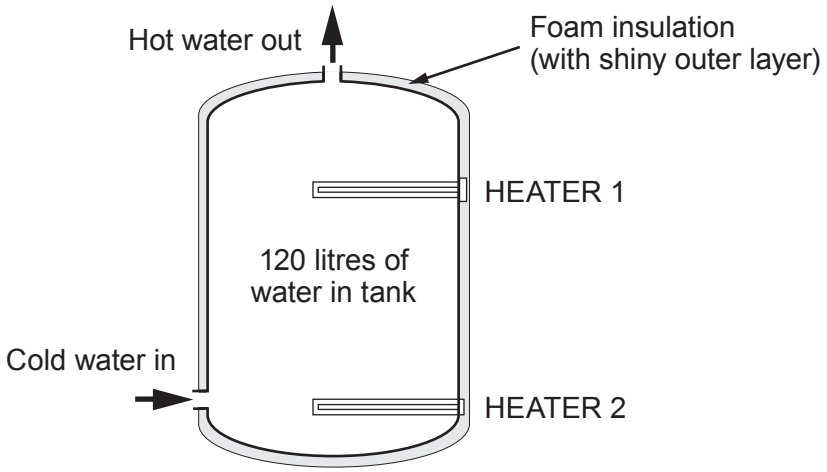
10

BLANK PAGE

TURN OVER FOR THE LAST QUESTION.

Examiner only

7. A hot water tank that is covered in foam insulation contains a total of 120 litres of water. It has two electric heaters, either of which may be used to heat water to the same final temperature. Heater **1** is used during the day and heater **2** is used during the night. A simplified diagram is shown below.



(a) Explain why heater **1** does not heat all of the water in the tank. [2]

.....

.....

(b) (i) Explain why foam is used to cover the hot water tank to reduce heat loss. [2]

.....

.....

.....

(ii) State how the shiny outer surface of the foam reduces heat loss. [2]

.....

.....

.....

(c) Explain how the foam covering benefits the environment. [2]

.....

.....

.....

Examiner only

(d) The following table gives information about heating water by either of the two heaters.

	Electric heater **1**	Electric heater **2**
Volume of water that is heated by the heater (litres)	40	120
Time to heat this volume of water (hours)	0.5	3
Power (kW)	4	2
Cost per unit (p)	16	5

A householder has to decide which heater (**1** or **2**) to use. She will need to use 30 litres of hot water.
Use data from the table and equations from page 2 to compare the two methods of heating in terms of: [6 QWC]

- the number of units used to heat the water;
- the cost of electricity used;
- the impact on the environment;
- advice that should be given to the householder.

Assume the water in the tank is initially cold.

.....

.....

.....

.....

.....

.....

MORE SPACE OVER THE PAGE IF REQUIRED

Examiner only

.....

.....

.....

.....

.....

.....

14

END OF PAPER