Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4463/01

W16-4463-01

SCIENCE A/PHYSICS

PHYSICS 1
FOUNDATION TIER

A.M. THURSDAY, 14 January 2016

1 hour

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

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}	$\frac{1}{1000}$
k	10^{3}	1000
M	10^{6}	1000000

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Answer **all** *questions.*

1. The three types of nuclear radiations are alpha (α), beta (β) and gamma (γ). [3]

(a) (i) Name the radiation that is the most easily blocked. .....

(ii) Name the radiation that most easily passes through the skin. .....

(iii) Name the one radiation that is a wave. .....

(b) Nuclear power station workers wear a film badge to monitor their exposure to the different types of nuclear radiation. Explain why this is important. [2]

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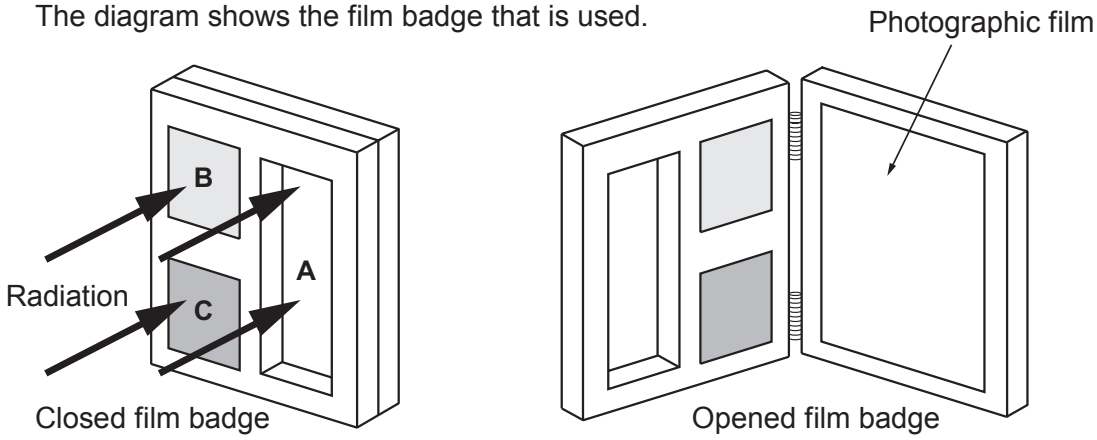
(c) The diagram shows the film badge that is used.



Window A has no absorber.
Window B has a paper absorber.
Window C has an aluminium absorber.

(i) Name a radiation that could penetrate (pass through) window **C**. .....

(ii) Name a radiation that could pass through window **B**. .....

(iii) Name a radiation that could **only** pass through window **A**. .....
[3]

(d) One worker wears a film badge underneath his clothing. [2]

(i) State which window's results would be affected. .....

(ii) Give a reason for your answer.

.....

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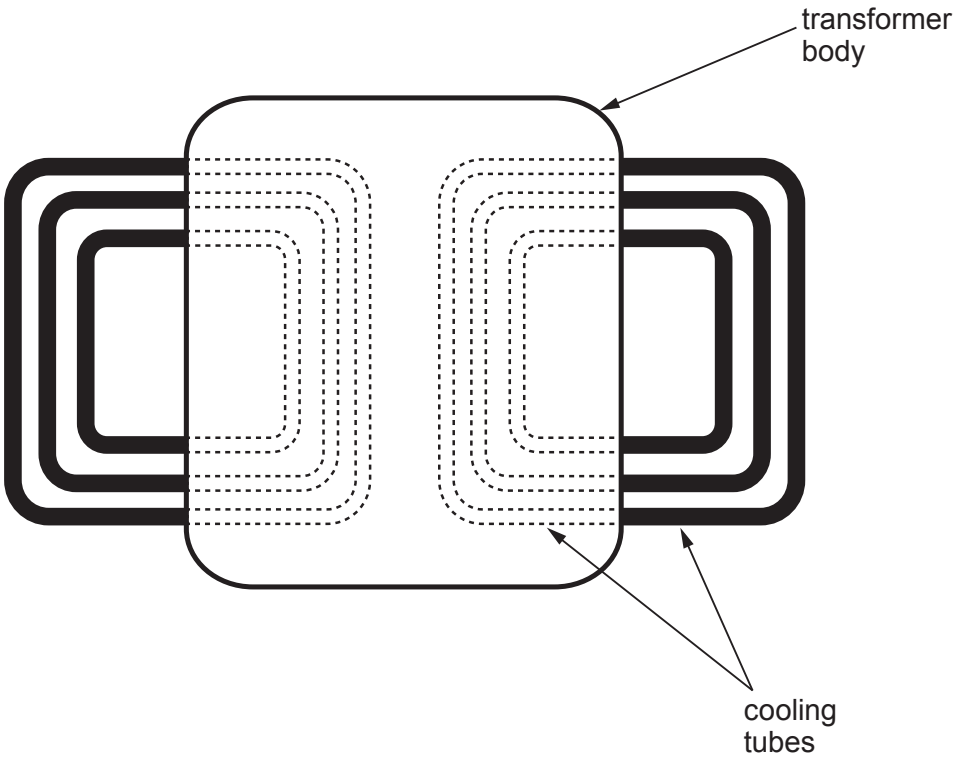
2. *(a)* Complete the following sentences about the National Grid by underlining the correct phrase in each bracket. [3]

(i) An advantage of the National Grid is to **[stop power stations breaking down / get electricity to consumers faster / keep electricity available if some power stations fail]**.

(ii) Step-up transformers are used to **[get the electricity to consumers faster / reduce energy losses in the cables / increase the current in the cables]**.

(iii) Step-down transformers are used to **[make the voltage smaller / reduce energy losses in the cables / reduce the power]**.

(b) Large transformers get hot when they are working. They are cooled by pumping cool oil through them. The oil becomes hot and is pumped to the outside cooling tubes.



(i) Describe why the cooling tubes are painted dull black. [2]

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(ii) If the pump in the tubes breaks down convection then happens. Explain where the hottest oil would be found in the tubes. [2]

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7

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3. The diagram shows gas atoms in the cooler, outer atmosphere of a star in a galaxy that is 20 million light years away.

(a) Write down the time taken for light to get to us from the star. [1]

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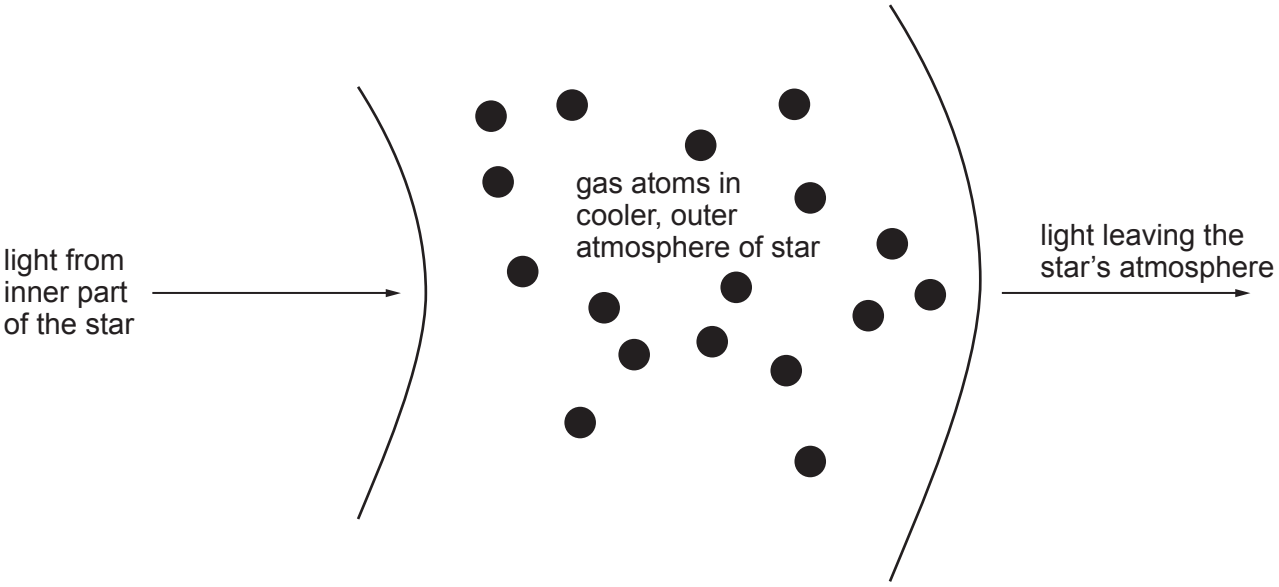
(b) The diagram shows light from the inner part of the star passing through its outer atmosphere. Some of the wavelengths are absorbed.



The diagrams below show three spectra.

Diagram A

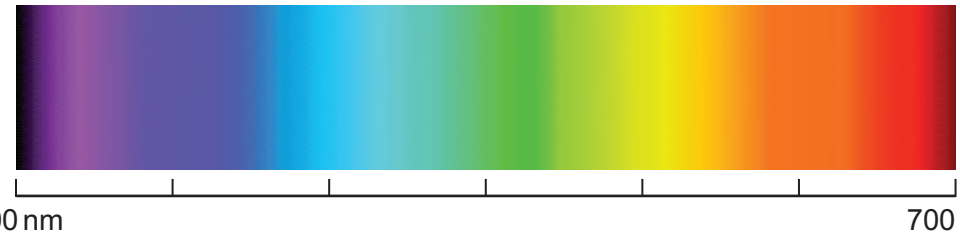


Diagram B

Diagram C

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Put a tick (✓) in the correct column below to show which is the correct diagram for each statement. [2]

	Diagram A	Diagram B	Diagram C
Light leaving the star's atmosphere			
Light from inner part of the star			

(c) The spectrum below is from another star in the same galaxy.

Explain how the lines show that the stars are different. [2]

.....

.....

.....

(d) Lines in spectra from distant galaxies are shifted towards the red end of the spectrum.

(i) State what has happened to the **wavelengths** of those lines. [1]

.....

(ii) The lines in spectra from some other galaxies are further red shifted. State what this tells us about those galaxies. [1]

.....

(e) Cosmological red shift supports the Big Bang theory. Name one other piece of evidence that supports this theory. [1]

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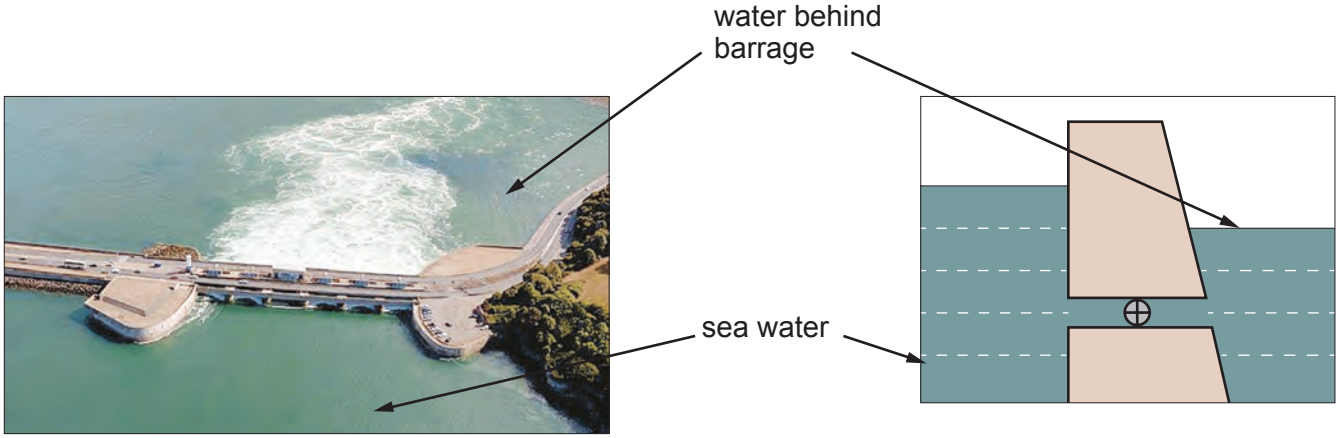
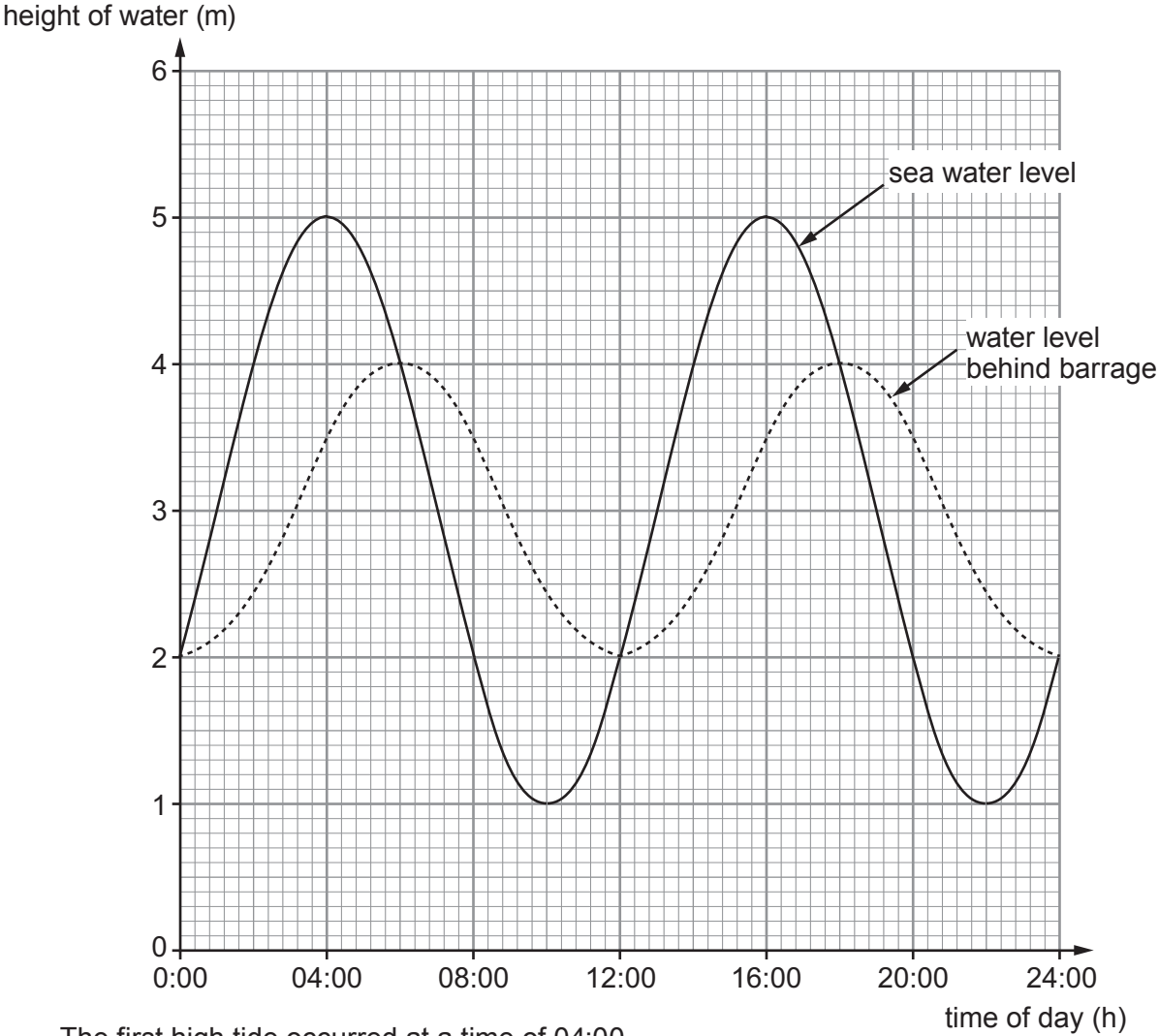
4. The first modern tidal power station was built in 1966 at La Rance in France.

Water flows into the barrage when the sea is at a higher level than the water behind the barrage. The water flows out again when the sea level is lower than the water behind the barrage.



One day in June 2015, the sea water levels each side of the barrage changed in the way shown by the lines on the graph below.



The first high tide occurred at a time of 04:00.

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(a) Use the information from the graph opposite to answer the following questions. [5]

(i) Write down the height of the sea water at high tide. height = ... m

(ii) At what time is the **second high tide** of the day? time= .....

(iii) Write down the time taken to go from one high tide to the next.

time = ... hours

(iv) Write down one time when both water levels are the same.

time = ...

(v) Write down one time when no power is being generated.

time = ...

(b) The table below gives information about a turbine in the barrage at La Rance.

	Power (MW)
Maximum power output	10
Mean power output	2.6
Maximum power input	16

Use the equation:

$$\% \text{ efficiency} = \frac{\text{maximum power output}}{\text{maximum power input}} \times 100$$

to calculate the % efficiency of the turbine at maximum power output. [2]

% efficiency = ...

(c) (i) State **two** advantages to the environment of generating electricity in this way. [2]

.....

.....

(ii) State **one** disadvantage to the environment of generating electricity in this way. [1]

.....

.....

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5. *(a)* The diagram shows the different regions of the electromagnetic (em) spectrum.

gamma radiation

X-rays

.....

visible light

infra-red

.....

radio waves

(i) **Fill in the gaps** above. [2]

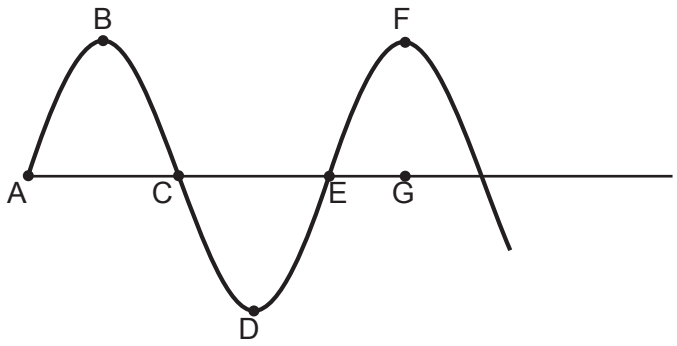
(ii) Complete the sentences below by underlining the correct phrase in each bracket. [3]

Visible light travels **[faster than / at the same speed as / slower than]** radio waves.

The frequency of visible light is **[higher than / the same as / lower than]** the frequency of X-rays.

The wavelength of visible light is **[longer than / the same as / shorter than]** the wavelength of radio waves.

(b) (i) Use letters on the diagram **to complete the sentences** that follow. [2]



The distance between point ..... and point ..... is equal to one wavelength.

The distance between point ..... and point ..... is equal to the amplitude.

(ii) **Draw a new wave** with a smaller amplitude on the diagram above. [1]

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6. A kettle is connected to an energy meter that measures units used in kWh to **1 decimal place**. The energy meter **is not** reset to zero at the start.

4	4	5	·	2	kWh	Start meter reading
4	6	3	·	9	kWh	Meter reading after 1 week

(a) What does the abbreviation kWh stand for? ..... [1]

(b) (i) Calculate the number of units used by the kettle during the week. [1]

units used = ... kWh

(ii) During the week the kettle is used for a total of 8.5 hours.
Use the equation:

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

to calculate the power of the kettle **in watts**. [3]

..... W

(iii) Each unit (kWh) of electricity costs 20 p. Use an equation from page 2 to calculate the cost **in pounds** of using the kettle for the week. [2]

£ .....

Turn over.

Examiner only

(c) A smaller kettle for use in a caravan has a power rating that is a quarter ($\frac{1}{4}$) of the original kettle but it is used for **double** the amount of time. How much would it cost to use this kettle instead? [2]

cost = ...

(d) The European Union is considering banning high powered kettles. Explain whether banning high powered kettles will help reduce our energy use. (It takes 0.1 kWh to boil 1 kg of water.) [2]

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7. **Compare** the use of different types of electromagnetic (em) radiation in long distance communication between the UK and USA by optical fibres and satellites. [6 QWC]

Include in your answer:

- the types of em radiation used;
- a comparison of time delay, using the information below and the equation: $\text{time} = \frac{\text{distance}}{\text{speed}}$;

Length of optic cable between UK and USA	7 200 km
Height of geosynchronous satellite above Earth	36 000 km
Speed of em waves in glass	200 000 km/s
Speed of em waves in space	300 000 km/s

- any other advantages or disadvantages of either method.

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