The Haberdashers' Aske's Boys' School
Elstree, Herts

13+ Entrance Examination 2015

PHYSICS

Please follow these instructions

- The Science paper is divided into three sections (Biology, Chemistry and Physics). The time for the Science paper is 1 hour. You should spend no more than 20 minutes on each section.
- Answer the questions in the spaces provided. Long answers are not expected.
- You may use your calculator in any of the numerical questions.
- Rough work should be done on the paper but do not write in the margins.
- Write your name and school in the box below.

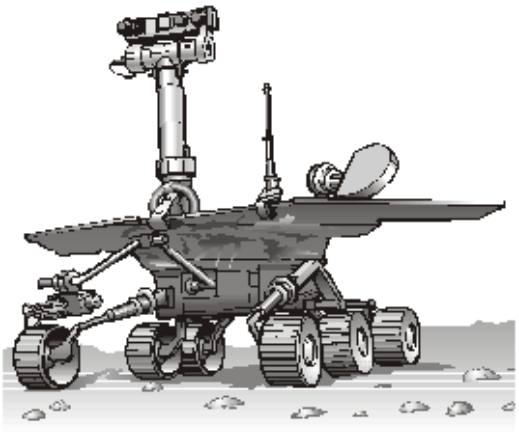
Name	
School	
Exam number	

For the examiner's use only

Question	1	2	3	4	5	6	Total
Max	6	8	5	4	6	4	33
Mark							

Leave blank

1. The drawing below shows a space buggy on the surface of Mars.



(a) The distance between Earth and Mars is 192 000 000 km.

It took a spacecraft 200 days to take the buggy from Earth to Mars.

Calculate the speed at which the spacecraft travelled.

Give the unit.

.....

.....

(2)

(b) The weight of the buggy was 105 N on Earth and 40 N on Mars.

Why was the weight of the buggy less on Mars than on Earth?

.....

.....

(1)

(c) The buggy uses solar panels to generate electrical energy.

The solar panels generate less electrical energy on Mars than on Earth.

Give a reason why.

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(1)

Leave blank

(d) The weight of the buggy was 40 N on Mars.

When the buggy landed on Mars it rested on an area of 0.025 m^2.

Calculate the pressure exerted by the buggy on the surface of Mars.

Give the unit.

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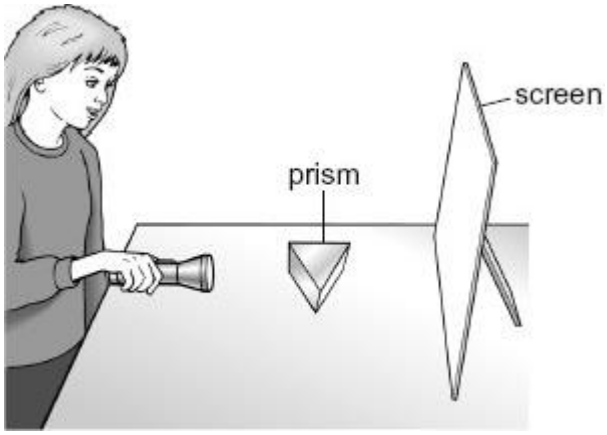
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(2)

Maximum 6 marks

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2. Ann shines a ray of white light at a glass prism.



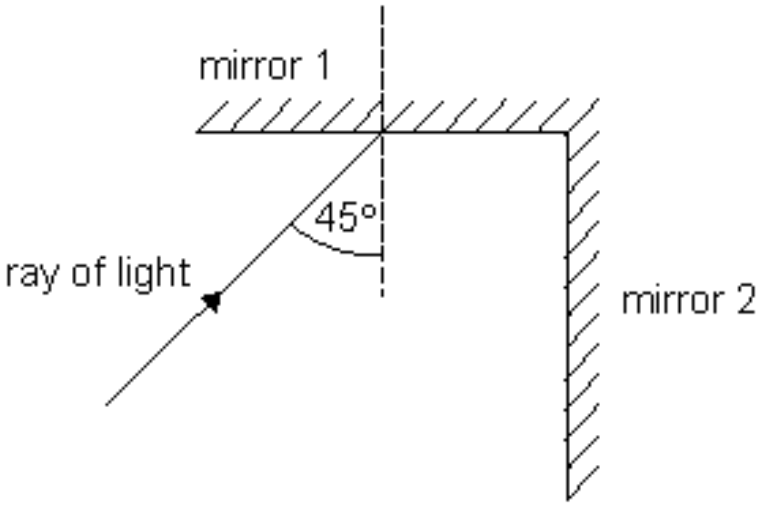
(a) Tick one box in each row to show if each sentence is true or false.

	true	**false**
The light refracts as it enters the prism.	☐	☐
The light refracts as it travels through the prism.	☐	☐
The light disperses as it leaves the prism.	☐	☐
The light forms a spectrum of colours on the screen.	☐	☐

(2)

Leave blank

(b) Ann places two mirrors at 90° and shines a ray of light at mirror 1.



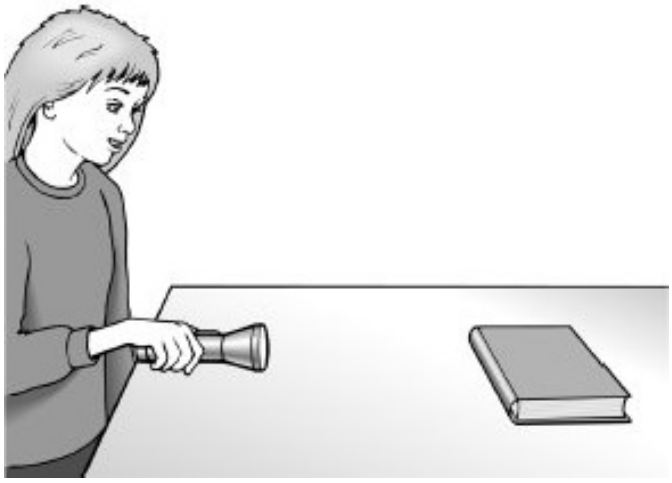
(i) On the diagram above continue the ray of light to show how it is reflected by both mirrors. Use a ruler.

(2)

(ii) On the diagram above label the incident ray (i) and the reflected ray (r) for the light striking mirror 2.

(1)

(c) Ann shines the torch at a red book.



Explain why the object looks red in white light.

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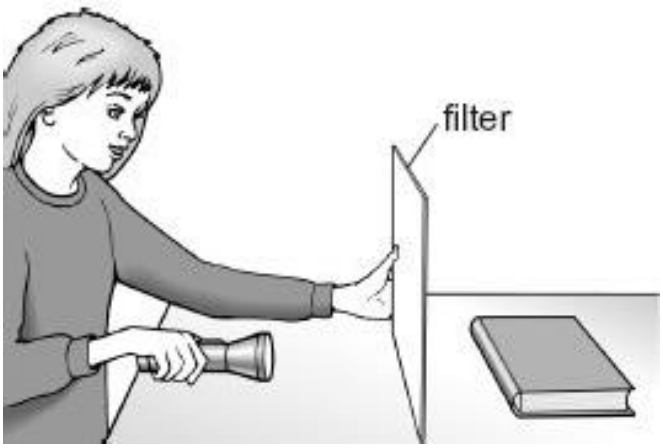
.....

(2)

Leave blank

(d) In a dark room, Ann puts different coloured filters in front of the torch.

She records the colour the book appears.



Complete the table below to show the colour that the book would appear.

Tick one box in each row. The first one has been done for you.

colour of filter	**What colour does the red book appear?**		
	red	**green**	**black**
no filter			
red filter			
green filter			

(1)

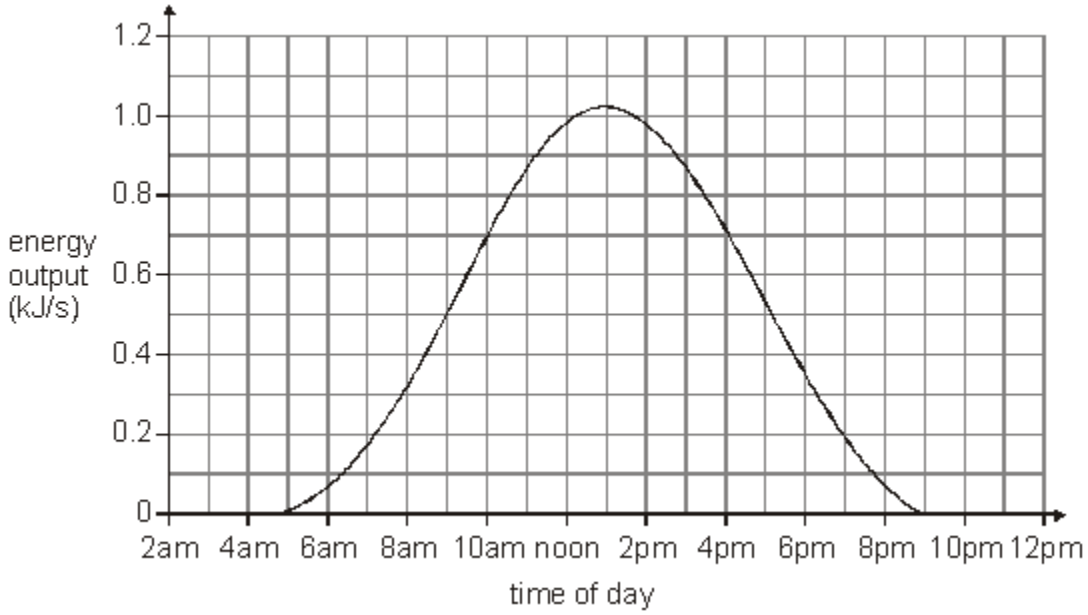
Maximum 8 marks

Leave blank

3. The drawing below shows a solar panel fixed to the roof of a house in Britain.



(a) Daniel measured the energy output from this solar panel during one day in June. The graph below shows his results.



(i) Why does the energy output from the solar panel vary during the day?

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(1)

(ii) Daniel used the solar panel to run a motor.

The motor needs 0.7 kJ/s to run at full speed.

Use the graph to find out how long Daniel's motor would run at full speed.

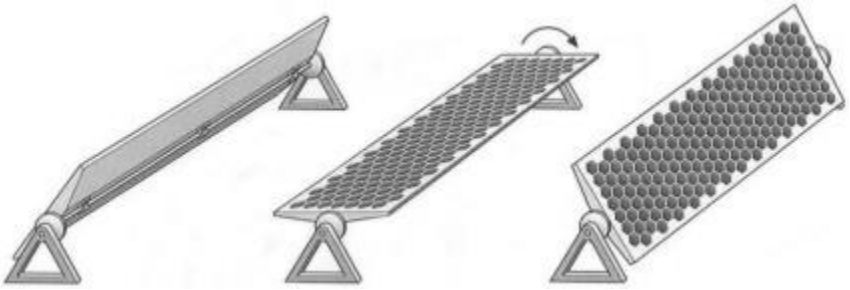
..... hours

(1)

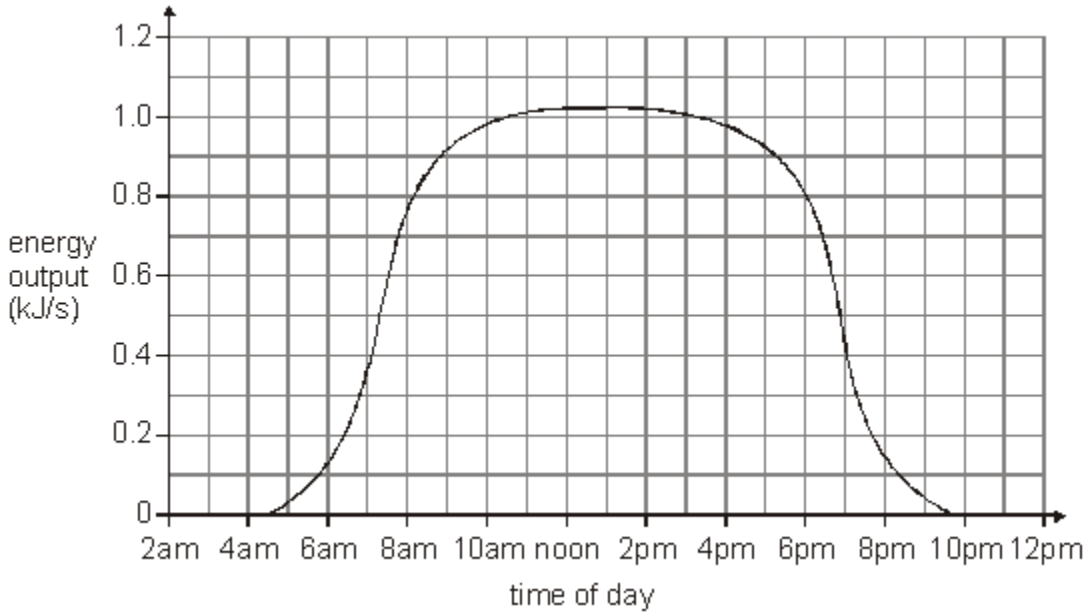
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(b) Daniel measured the energy output from a different solar panel.

This type of solar panel turns so that it always faces the Sun.



The graph below shows the energy output for this panel during one day in mid-summer.



(i) On the graph above draw another curve to show how the energy output for this solar panel might vary on a day in mid-winter.

(2)

(ii) Between 7am and 7pm the solar panel turns through an angle of 180°.

Calculate the angle the solar panel turns through each hour.

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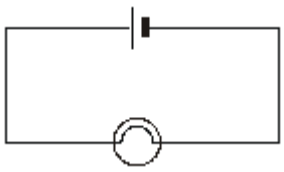
..... degrees

(1)

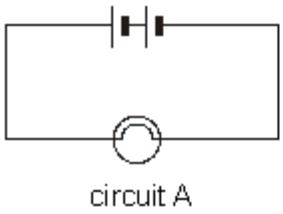
Maximum 5 marks

Leave blank

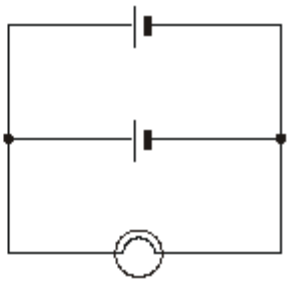
4. John connects up the circuit shown below.



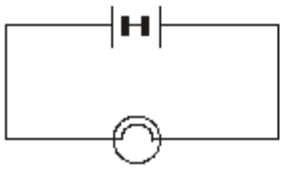
The bulb is not bright enough. His friend suggests four circuits which could be used to make the bulb brighter.



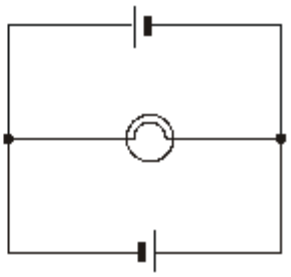
circuit A



circuit B



circuit D

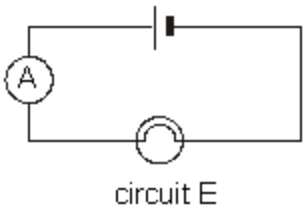


circuit C

(a) Which is the correct circuit to use: A, B, C or D? .....

(1)

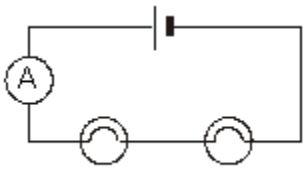
Next John sets up circuit E and notes the reading on the ammeter.



circuit E

He then places another bulb in the circuit, to make circuit F. He notes the ammeter reading in circuit F.

Leave blank



circuit F

(b) How will the ammeter reading in circuit F compare with that in circuit E?

The reading in F is .....

(1)

Explain your answer. .....

.....

(1)

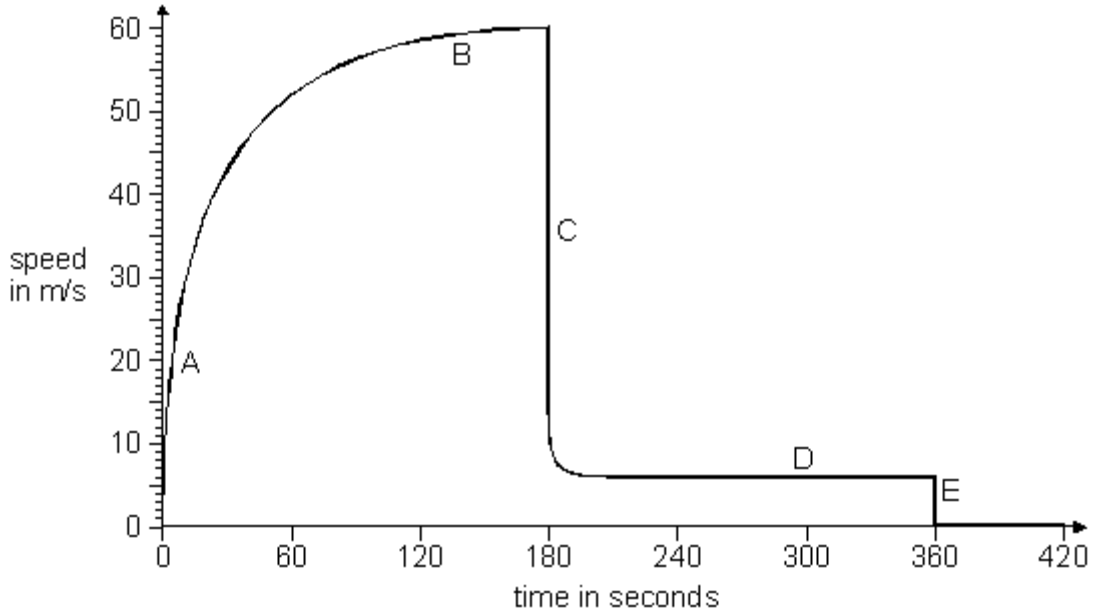
(c) Draw a circuit diagram in which two bulbs are lit as brightly as the bulb in circuit E, and the ammeter reading is the same as in circuit E.

(1)

Maximum 4 marks

Leave blank

5. A sky-diver jumped out of an aeroplane. After falling for some time she opened her parachute. The graph below shows how the speed of the sky-diver changed from the moment she jumped out of the aeroplane until she landed on the ground.



(a) What happened at 180 seconds and at 360 seconds after the sky-diver jumped out of the aeroplane?

180 seconds .....

360 seconds .....

(2)

(b) There was an increase in air resistance on the sky-diver as her speed increased.

Explain how the graph shows this.

.....

.....

(1)

(c) Two sections of the graph show where the air resistance was equal and opposite to the sky-diver's weight. Which sections are they?

Give the letters.

…… and …… .

(1)

(d) (i) Use the graph to estimate how far the sky-diver fell between 180 s and 360 s.

Leave blank

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(1)

(ii) Why can this only be an approximate figure?

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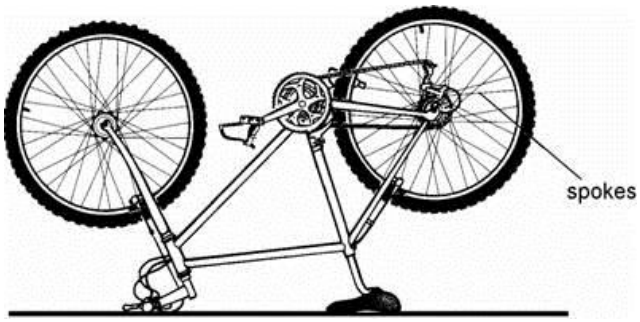
(1)

Maximum 6 marks

TURN OVER FOR THE LAST QUESTION

Leave blank

6. Sam turns his bicycle upside down and turns the pedals fast so that the back wheel spins.



Sam holds a piece of card close to the back wheel.

The spokes hit the piece of card and Sam hears a 'musical' tone.

(a) Explain why the card produces a 'musical' tone.

.....

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(1)

(b) When the spokes hit the piece of card, the wheel slows down

(i) Describe the energy change which occurs as the wheel slows down.

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(1)

(ii) Describe and explain what will happen to the pitch of the 'musical' tone as the wheel slows down.

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(2)

Maximum 4 marks

END OF PAPER

Go back and check your work carefully.