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

13+ Entrance Examination 2016

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	4	4	4	3	7	5	2
Mark							

Leave blank

1. Three bulbs are connected to a battery so that they are all lit normally. The filament in one of the bulbs breaks and all three bulbs go out.

   Draw the circuit diagram for the bulbs in this case and use it to explain why the two working bulbs are no longer lit.

   (4)

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maximum 4 marks

Leave blank

2. The sun is the source of almost all of the energy that we use. Solar (or photovoltaic) cells use the Sun's energy directly to generate electricity.

   Describe another way in which we can generate electricity and explain how this energy originates from the Sun.

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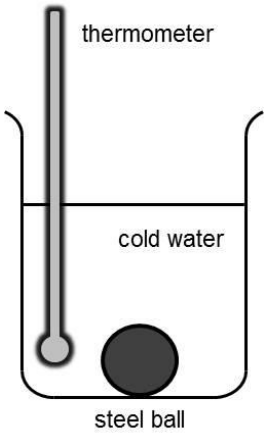
(4)

maximum 4 marks

Leave blank

3. Omar heats a hot steel ball until it is glowing and then lowers it into a beaker of cold water.



(a) Describe and explain what happens to the reading on the thermometer in the next few minutes after he has lowered the ball into the water.

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(3)

(b) From his results, he calculates that:

(i) the thermal energy stored in the steel ball has fallen by 3770 J;

(ii) the thermal energy stored in the water has risen by 2940 J.

The energy stored in the water rose by less than 3770 J. What has happened to the other 830 J?

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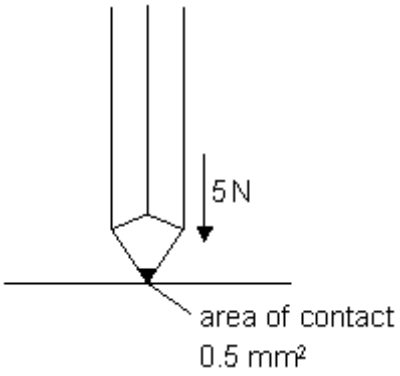
(1)

Maximum 4 marks

Leave blank

4. Calculate the pressure that your pencil exerts on this paper assuming that your pencil exerts a force of 5 N on the paper and that the area of the pencil in contact with the paper is 0.5 mm^2.

Diagram not to scale



Show full working in your calculation and include a unit.

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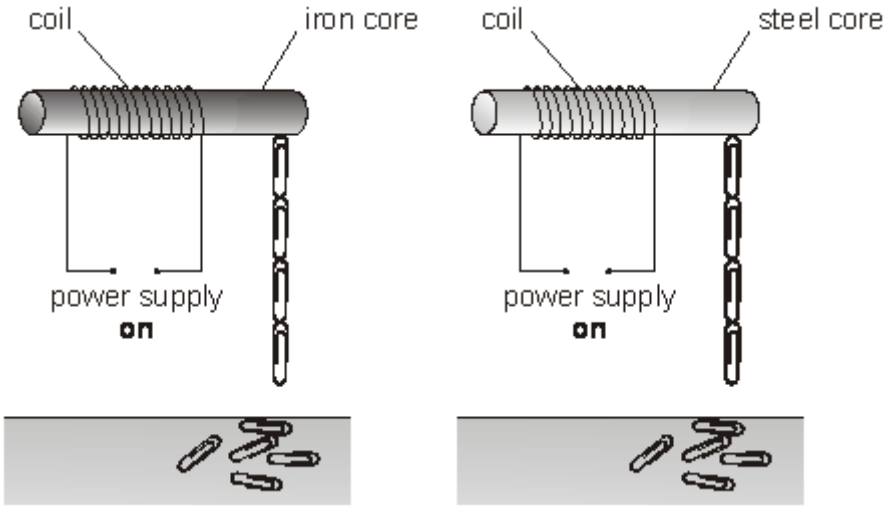
(3)

Maximum 3 marks

Leave blank

5. David made two electromagnets and the diagram shows the number of paper-clips each could support.



(a) (i) What should David conclude from this?

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(2)

(ii) State and explain what happened when David switched off the power supply in each of the circuits.

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(2)

Leave blank

(b) David used a sensor to measure the strength of an electromagnet. He placed the sensor 50 mm from the electromagnet and increased the current in the coil.

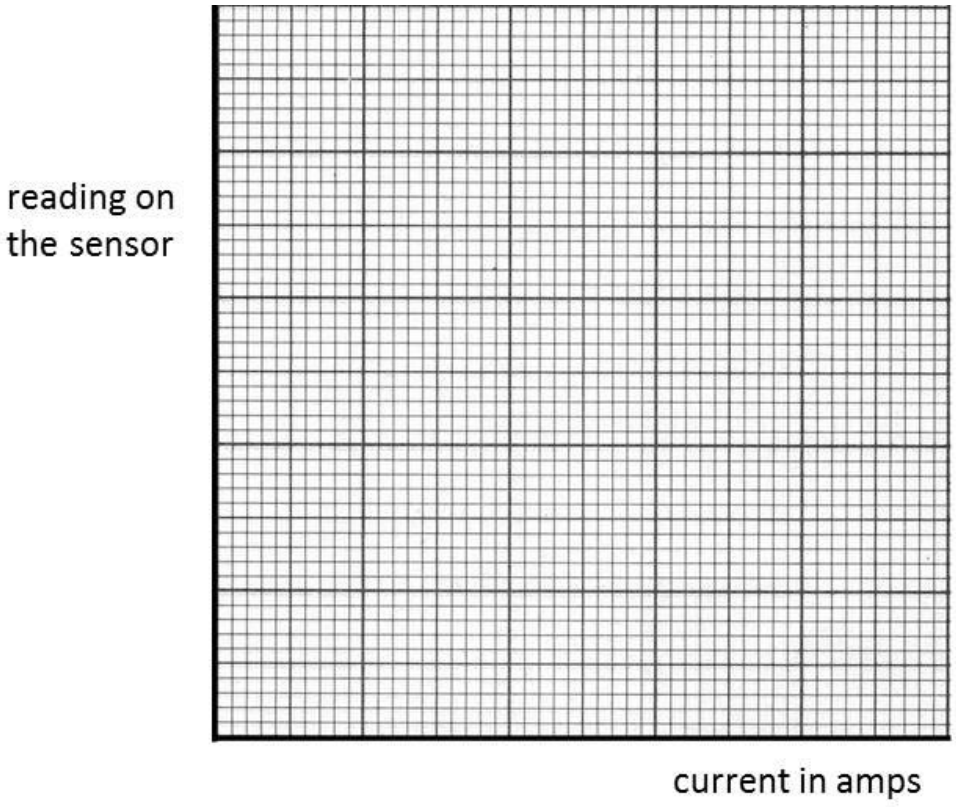
(i) On the axes below sketch how the reading on the sensor changed as the current was increased, label your line as "50 mm distance"

(1)

He then repeated the experiment with the sensor 25 mm from the electromagnet.

(ii) On the axes below sketch how the reading on the sensor changed as the current was increased. Label your line as "25 mm distance"

(1)



(c) What else could David change to affect the electromagnet strength?

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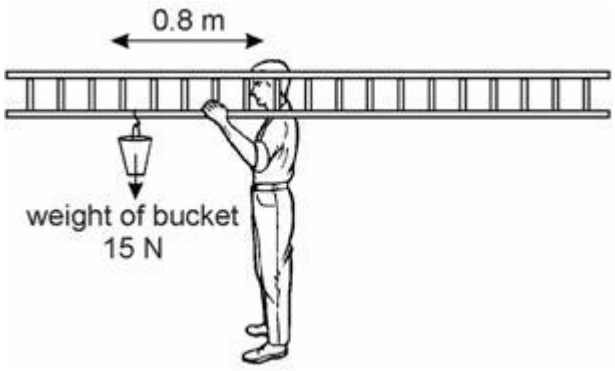
(1)

maximum 7 marks

Leave blank

6. A window cleaner hooks his bucket onto the ladder and balances it as shown in the diagram.

The bucket weighs 15 N and is 0.8 m from his shoulder.



(a) Calculate the turning effect, or moment, about his shoulder due to the weight of the bucket.

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(2)

(b) The weight of the ladder is 60 N and it causes a turning effect about his shoulder that balances the weight of the bucket.

Use this information to identify on the diagram above the position of the centre of gravity (or mass) of the ladder, include the distance from his shoulder.

Show all of your working out below.

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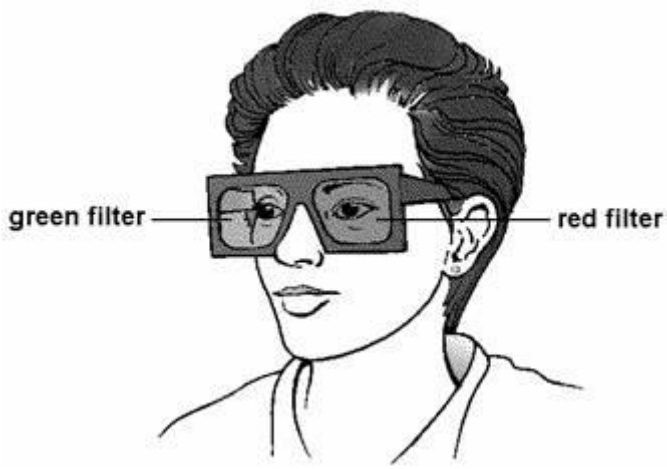
(3)

Maximum 5 marks

Leave blank

7. Sunita puts on a pair of glasses with filters in them coloured as shown below. She uses them to look at a red lamp and then at a white lamp with one eye at a time.



Complete the table below to show the colour that Sunita sees through each of the filters.

	When Sunita looks through the red filter	When Sunita looks through the green filter
When Sunita looks at the red lamp		
When Sunita looks at the white lamp		

(2)

Maximum 2 marks

Leave blank

8. In 1610, the Italian scientist, Galileo, observed four bright moons near Jupiter. Each night the moons moved.

(a) Explain how we can see the moons of Jupiter.

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(2)

(b) The four moons are approximately the same distance from the Earth. However, they do not have the same brightness.

Suggest one reason for this.

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(1)

(c) Galileo realised that Jupiter and its moons formed a model of our Solar System. In this model:

what did Jupiter represent?

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what did the moons represent?

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(1)

Maximum 4 marks