



## 2017 SCHOLARSHIP EXAMINATION

### PHYSICS

Time: 30 minutes

Name: \_\_\_\_\_

School: \_\_\_\_\_

### INSTRUCTIONS

Complete **ALL** questions (**32 marks** in total)

Remember and add your name to graph paper used in Question 2

Use separate sheets if more space is required.

**1** A skier weighs 400 N and uses a pair of skis that are 1.60 m long. The area of each ski that is in contact with the snow when she stands still is 1.55 m long and 12 cm wide.

a) State the equation which links the area, force and pressure exerted on the snow. (1)

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b) Calculate the pressure exerted on the snow, in  $\text{N/cm}^2$ , when she stands still on both skis. (4)

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c) What happens to the pressure when she lifts one ski off the ground? (1)

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**2** You are given a box which has two terminals and contains an unknown device. You also have a 6 V battery, connecting wires an ammeter a voltmeter and a variable resistor. This can be adjusted to give resistances of 0 to  $10 \Omega$  and can be adjusted in  $1 \Omega$  increments.

You are to investigate how the current through the device in the box varies as the resistance of the variable resistance is changed.

a) Draw a circuit diagram (4)

- b) Add a voltmeter to the circuit which would allow you to measure the voltage between the terminals on the box. (1)

The table below shows the results of the investigation.

| Resistance ( $\Omega$ ) | Current through the box (A) |
|-------------------------|-----------------------------|
| 0.0                     | 1.00                        |
| 2.0                     | 0.74                        |
| 4.0                     | 0.59                        |
| 6.0                     | 0.53                        |
| 8.0                     | 0.43                        |
| 10.0                    | 0.38                        |
|                         |                             |

- c) Use the graph paper to plot a graph showing the current flowing on the vertical axis plotted against the resistance of the variable resistor on the horizontal axis. (5)

- d) Add a best fit curve to your graph (1)

- e) Put a ring around the reading which you suspect may have been incorrectly recorded and use your graph to predict what you think the reading should have been. (2)

- f) How could the pupil have ensured that the data collected was more reliable? (2)

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- 3 The International Space Station follows a circular orbit around the earth and is 320km above the earths' surface.

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a) What force holds the station in this orbit? (1)

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The circumference of a circle is calculated using the formula

Circumference =  $2 \times \pi \times$  radius of circle

$\pi$  has a value of 3.142

The radius of the earth is 6480km

b) Calculate the distance travelled by the Space Station in each orbit. (2)

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c) If the orbit takes 90 minutes show that the speed of the station is about 8 km/s (3)

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d) Visiting space craft carry replacement crew, food and oxygen but they do not deliver any energy supplies. For about 50% of each orbit the station is in the shadow of the earth. How does the Space Station get its energy and how do the engineers make sure that the electrical equipment can operate continuously? (2)

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4 a) Insulated wire is wrapped around an iron nail and connected to a battery.  
Describe two ways in which the electromagnet can be made stronger. (2)

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b) The electromagnet is moved close to a metal bar which is then attracted to it.  
What does this tell you about the metal? (1)

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d) When the battery is connected to the wire in the other direction the metal bar is repelled. What does this tell you about the metal bar? (1)

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