JUNIOR LYCEUMS FINAL EXAMINATIONS 2000
Educational Assessment Unit - Education Division

FORM 5 **PHYSICS** **TIME: 1 hr 45 min**

NAME: _____ **CLASS:** ____

Answer **ALL** questions in the spaces provided on the Examination Paper. All working must be shown. The use of a calculator is allowed.

Where necessary take the acceleration due to gravity, $g = 10\ m/s^2$.

You may find some of these formulae useful.

area of triangle $= \frac{\text{base x height}}{2}$ area of trapezium $= \frac{h}{2}$ (sum of parallel sides)

$v = \frac{s}{t}$ $v = u + at$ $s = \frac{at^2}{2}$ $W = m g$ density $= \frac{\text{mass}}{\text{volume}}$

work done $= F s$ $PE = m g h$ $P = \frac{\text{work done}}{\text{time}}$ $KE = \frac{mv^2}{2}$

moment of a force = Force x perpendicular distance $F = m a$

momentum = mass x velocity Pressure $= \frac{\text{Force}}{\text{area}}$ $P = h \rho g$

heat energy = mass x specific heat capacity x temperature change

magnification $= \frac{\text{height of image}}{\text{height of object}} = \frac{\text{image distance}}{\text{object distance}}$

refractive index $= \frac{\text{sine (angle in air)}}{\text{sine (angle in medium)}}$ $v = f \lambda$

sine (critical angle) $= \frac{1}{\text{refractive index}}$

$V = I R$ $P = V I = I^2 R$ $R = R_1 + R_2 + R_3$ $R = \frac{R_1 R_2}{R_1 + R_2}$

$\frac{N_p}{N_s} = \frac{V_p}{V_s}$ $V_p I_p = V_s I_s$

Section A. Answer All Questions. This Section carries 55 marks.

1. The inside measurements of an empty box are, 1.0 m long, 75 cm wide and 0.2 m high. Calculate:

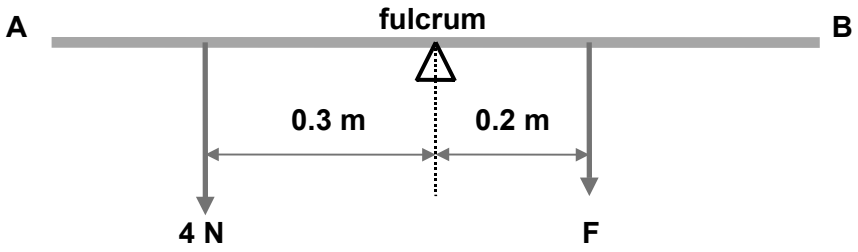
a. the width of the box in metres, **[1]**

b. the volume in m^3 of the air inside the box, **[2]**

c. the mass of the air inside the box given that the density of air is 1.1 kg/m^3, **[2]**

d. the weight of the air inside the box. **[2]**

2. The diagram below shows a metre rule AB resting at its centre on a fulcrum . A weight of 4 N is placed 0.3 m away from the fulcrum. Another force F is placed on the opposite side of the fulcrum to keep the rule horizontal.



a. State the direction of the force F. _____ **[1]**

b. State the direction of the moment of the force F. _____ **[1]**

c. Calculate the size of force F. **[2]**

d. Calculate the total weight supported by the fulcrum given that the weight of the rule is 1 N. **[2]**

e. State the direction of the reaction at the fulcrum. **[1]**

3. Andrew carries a ball weighing 5 N up a flight of 20 steps each 0.15 m high, in 5 s. Given that Andrew weighs 595 N calculate:

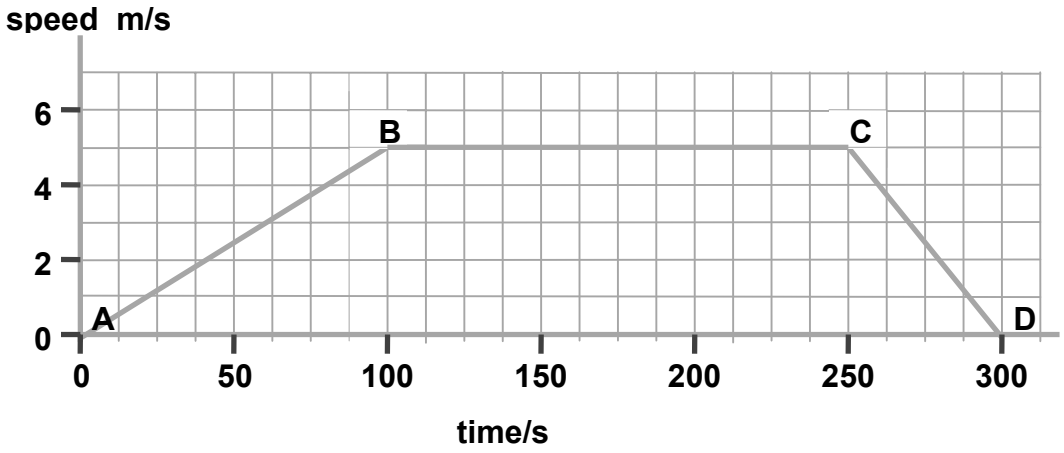
a. the total weight of Andrew and the ball, **[1]**

b. the work done by Andrew on reaching the top of the stairs, **[2]**

c. the power developed by Andrew, **[2]**

d. the potential energy **gained by the ball** at the top of the stairs. **[2]**

4. Martha cycles from her house to the supermarket each day. On a particular day her speed changes in the way shown on the graph.



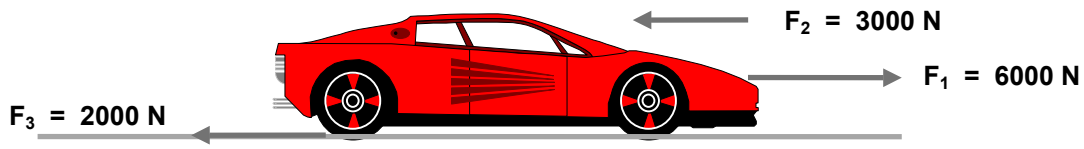
a. The graph shows that Martha accelerates uniformly during the first _____ seconds and decelerates uniformly during the last _____ seconds. **[2]**

b. Martha's velocity along BC = _____ m/s. **[1]**

c. Calculate the **distance** between Martha's house and the supermarket. **[2]**

d. Calculate the **average velocity** over the whole journey **[2]**

5. The diagram below shows the forces acting on a car travelling along a level road.



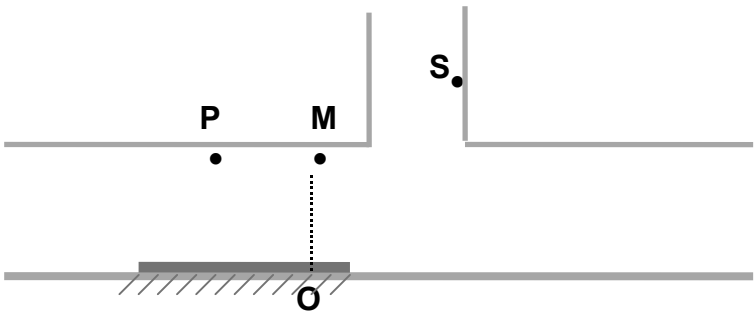
a. Name the three forces acting. **[3]**

F_1: _____
F_2: _____
F_3: _____

b. Calculate the resultant force acting on the car and state its direction. **[2]**

c. Describe the motion of the car. **[1]**

6. The image of a car parked at S is seen through the plane mirror by Paul standing at P but **not** by Maria standing at M.



a. Draw a ray from S which reaches P after reflection at the mirror. Include in your diagram the incident ray and the reflected ray. **[2]**

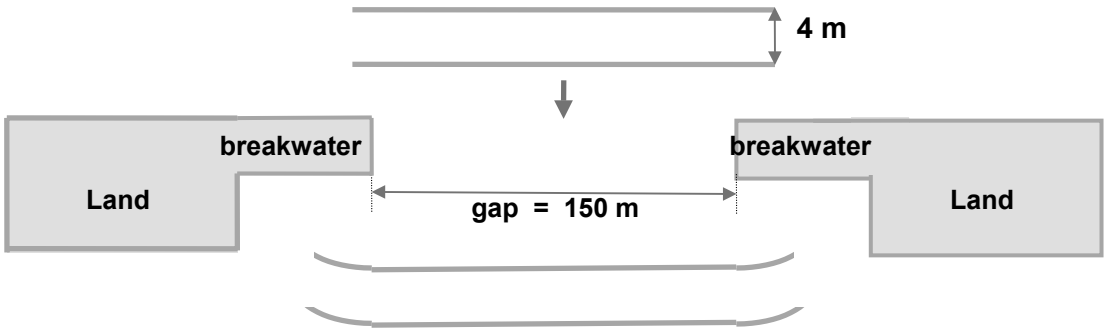
b. Is the image real or virtual? **[1]**

c. What can be said about the image distance and the object distance? **[1]**

d. Explain why Paul finds it difficult to read the letters and the numbers on the number plate of the car even though he can see their image clearly. **[1]**

e. Explain why Maria standing at M cannot see the image of the car. **[2]**

7. The diagram below shows what happens to large water waves after they enter the harbour through the gap in the breakwater.



a. Water waves are _____ waves. **[1]**

b. This spreading of the water waves when they pass through the gap is referred to as _____. **[1]**

c. The wavelength of the water waves is ____ m. **[1]**

d. Calculate the frequency of the water waves when 30 waves hit the break water every minute. **[2]**

e. Calculate the velocity of the waves. **[2]**

8. A 50 W immersion heater is placed in a container containing 0.21 kg of water. The heater is switched on for 3 minutes and the temperature of the water rises from 15 °C to 25 °C. Assuming that all of the heat energy supplied is absorbed by the water, calculate:

a. the temperature rise after 3 minutes, _____ **[1]**

b the heat energy supplied every second, _____ **[1]**

c. the total heat energy supplied after 3 minutes, **[2]**

d. the total heat energy absorbed by the water, _____ **[1]**

e. the specific heat capacity of water. **[2]**

Section B. Answer All Questions. This Section carries 45 marks.

1. This question is about magnetic fields, electromagnets and electromagnetic induction.

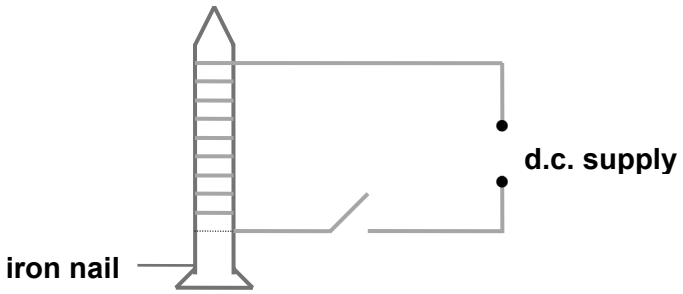
a. The bar magnet shown below has a magnetic field around it.

i. Draw the magnetic field of the bar magnet, showing clearly its **direction.** **[2]**

ii What item of apparatus can be used to determine the direction of the field? **[1]**

_____

b. An electromagnet is made by winding several turns of insulated wire round an iron nail . The ends of the wire are then connected to a d.c. supply as shown. When the current is switched on, the nail will attract several small iron pins but the pins fall off when the current is switched off.



i. Explain why the nail attracts the pins while the current is switched on . **[2]**

_____

ii. The polarity of the supply is now reversed. **[1]**
Would there be a change in the number of pins supported?

_____

iii. Suggest two ways which could increase the strength of the electromagnet. **[2]**

_____

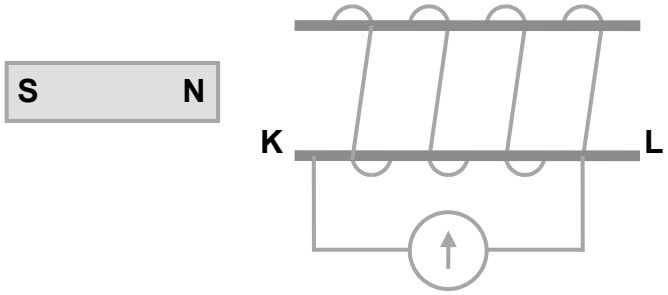
_____

iv. Small pieces of copper are not attracted by the electromagnet even though a current flows. Explain. **[1]**

_____

_____

c. The diagram shows an apparatus that can be used to show that a current is induced in a coil when it cuts a magnetic field.



When the magnet is pushed into the coil, the **galvanometer pointer** deflects **clockwise.**

i. While the magnet is at rest inside the coil, there is no deflection of the **galvanometer pointer**. Explain. **[2]**

_____

_____

[1]

ii. State the direction of motion, if any, of the **galvanometer pointer** when the magnet is pulled **out** of the coil.

_____ **[2]**

iii. State the magnetic polarity induced at the end **K** of the coil while the magnet is pushed inside the coil.

_____ **[1]**

iv. State what happens to the size of the induced current if the magnet is moved faster in or out of the coil.

_____

2. This question is about the design of an experiment.

Answer this question on the foolscap provided.

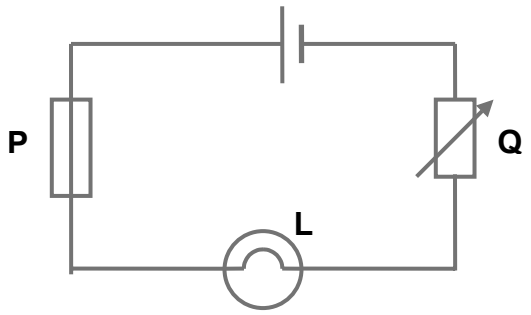
The greatest weight supported by a metal wire is known to depend on its diameter. Describe an experiment to investigate the relationship. You are supplied with equal lengths of the **same** metal wire of **different diameters.**

Your answer should include:

i. a list of the apparatus required, **[2]**
ii. a labelled diagram of the set-up, **[3]**
iii. the measurements which need to be taken, **[2]**
iv. a description of the method you would use, **[7]**
v. one precaution required to ensure an accurate result. **[1]**

3. This question is about current electricity.

a. The diagram below represents a simple circuit in which the filament lamp L lights .



i. P is a _____ . **[1]**

ii. Q is a _____ . **[1]**

iii. What is the purpose of Q in the circuit? _____ **[1]**

_____

iv. On increasing the current in the circuit, the lamp suddenly goes out. Suggest two possible reasons for this. **[2]**

_____

_____

b. The table below shows how the current **I** through the filament lamp varies when the potential difference **p.d.** across it changes.

pd. / V	0	2	4	6	8	10
I / A	0	1.75	2.50	3.00	3.30	3.50

i. Plot a graph of current [y-axis] against potential difference [x-axis] on the graph paper provided. **[5]**

ii. From the graph find the value for the current when the potential difference across the filament lamp is 1V. **[1]**

_____

iii. Find the resistance of the filament lamp when the pd. across it is 4 V. **[2]**

_____

_____

iv. Does the filament lamp obey Ohm's Law? Give a reason for your answer. **[2]**

_____

_____