SECONDARY SCHOOLS 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:

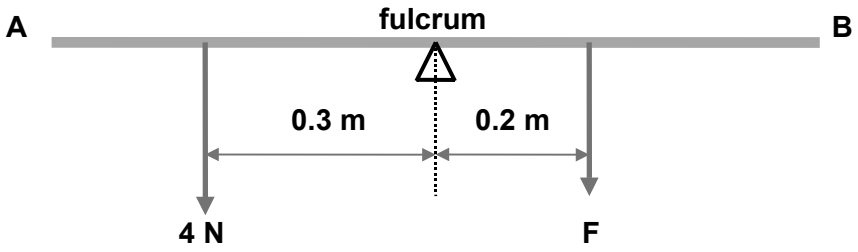
a. the width of the box in metres, **[1]**

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:

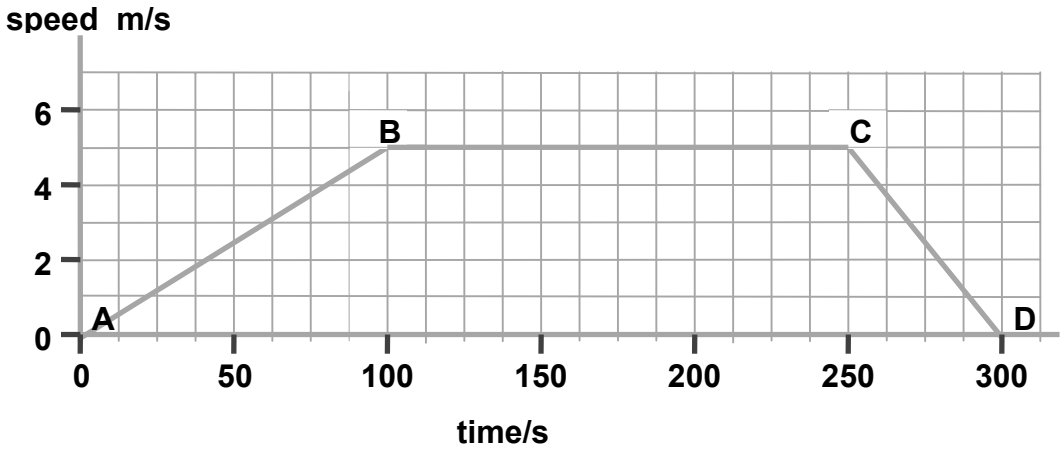
a. the total weight of Andrew and the ball, **[1]**

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.



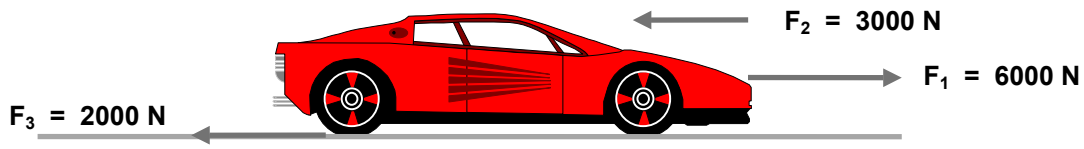
a. The graph shows that Martha accelerates uniformly during the first _____ seconds and decelerates uniformly during the last _____ seconds. **[2]**

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.



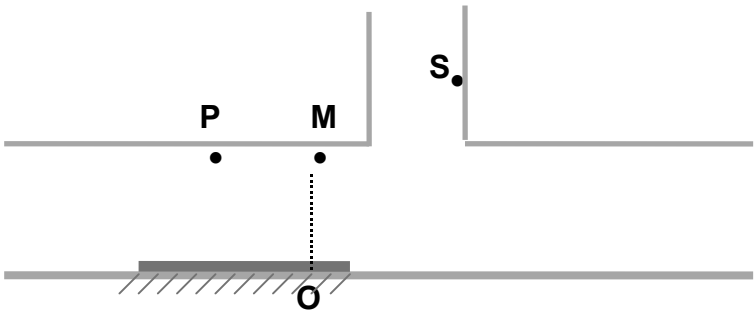
a. Name the three forces acting. **[3]**

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]**

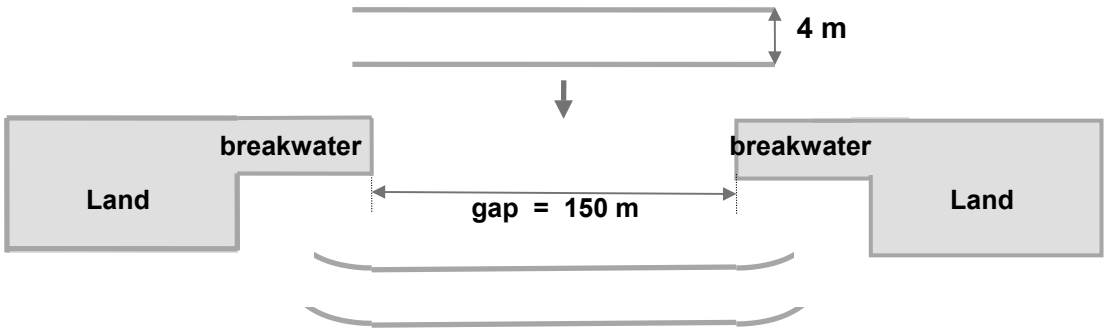
b. Is the image real or virtual? **[1]**

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.

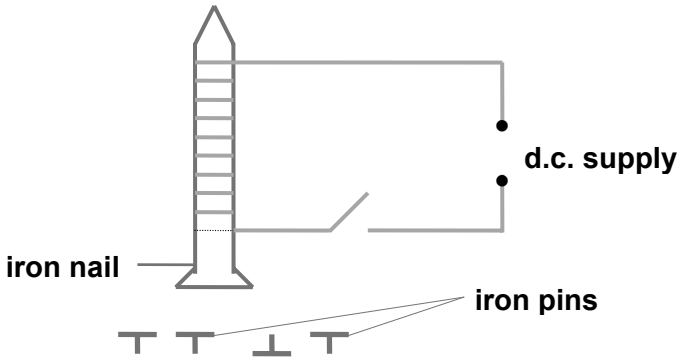
a. The bar magnet shown below has a magnetic field around it.

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? **[2]**

_____

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 and some iron pins are placed near the electromagnet as shown.



i. What happens to the iron pins when the current is switched on ? **[2]**

_____

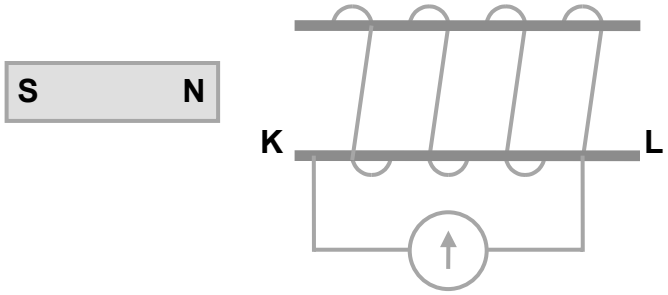
ii. Suggest two ways which could increase the strength of the electromagnet. **[2]**

_____

_____

iii. When small pieces of copper are placed close to a the large nail, it does not attract them because copper is a _____ material. **[2]**

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.**

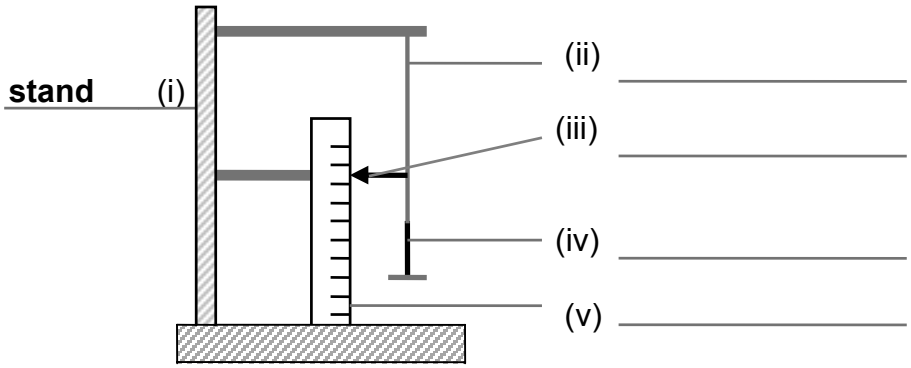
i. State the direction of motion, if any, of the **galvanometer pointer** when the magnet is pulled out of the coil. _____ **[2]**

ii. When the magnetic polarity induced at the end **K** of the coil is north, end L is a _____ pole. **[1]**

iii. State what happens to the **size** of the induced current if the magnet is moved faster in or out of the coil. _____ **[2]**

2. This question is about an experiment to find the elastic limit of a steel wire.

a. Complete the missing labels from the diagram of the experimental set-up .



(ii) _____ **[2]**

(iii) _____ **[2]**

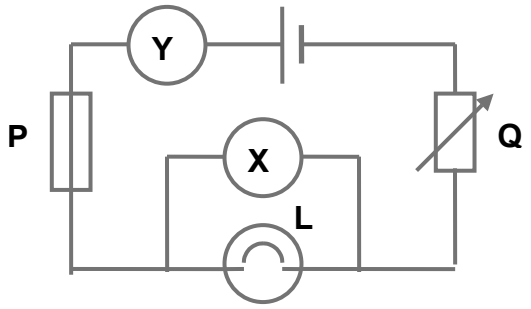
(iv) _____ **[2]**

(v) _____ **[2]**

b. On the axes provided below, sketch the graph of extension [y-axis] against load [x-axis] you expect when the steel wire is loaded beyond its elastic limit. On your graph mark the elastic limit with the letter 'E'. **[7]**

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. X is the voltmeter measuring the potential difference across the _____ in volts. **[1]**

iv. Y is the _____ measuring the current flowing through the circuit. **[1]**

v. State what happens to the lighted lamp L if P melts. **[1]**

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

pd. / V	0	4	8	12	16	20
I / A	0	2	4	6	8	10

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 is 10 V. **[2]**

iii. Find the resistance of the resistor. **[2]**

iv. Does the resistor obey Ohm's Law? **[1]**