SECONDARY SCHOOL ANNUAL EXAMINATIONS 2008
Educational Assessment Unit - Education Division

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

NAME: _____ 　　　　　　　　**CLASS:** _____

Answer ALL questions in the spaces provided on the Exam Paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity, $g = 10 \text{ m/s}^2$.

Equations for Annual Exam Physics

Density	$m = \rho V$	
Pressure	$P = h \rho g$	$P = F/A$
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$
	$E \text{ (or } W) = P t$	$W \text{ (or } WD) = F s$
Force	$F = m a$	$W = m g$
Motion	$\text{average speed} = \dfrac{\text{total distance}}{\text{total time}}$	$v = u + a t$
	$s = \dfrac{(u + v) t}{2}$	$s = \frac{1}{2} a t^2$
	$\text{momentum} = m v$	$h = \frac{1}{2} g t^2$
Electricity	$Q = I t$	$W = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$P = I V = I^2 R = \dfrac{V^2}{R}$	$R \, \alpha \, \dfrac{\text{length}}{\text{area}}$
Electromagnetism	$\dfrac{N_1}{N_2} = \dfrac{V_1}{V_2}$	
Heat	$H = m c \Delta\theta$	
Waves and Optics	$c = f \lambda$	$m = \dfrac{h_i}{h_o} = \dfrac{\text{image distance}}{\text{object distance}}$

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	Theory	Practical	Total
Max. Mark	8	8	8	8	8	15	15	15	85	15	100
Score											

Section A.   **This Section carries 40 marks**

1.   a.   Complete the table by choosing **four** appropriate types of forces from the list:

weight; electrical; magnetic; electrostatic; elastic; frictional; gravitational

No.	Event	Type of force	
i.	A satellite orbiting Earth		**1**
ii.	A compass pointing towards the North pole of a magnet		**1**
iii.	Dust particles attracted to a clean dry glass window		**1**
iv.	The brake pads of a car becoming warm during braking		**1**

b**.**   An apple of mass 200 grams falls from a tree on to the ground.

i.   Calculate the mass of the apple in kg.   **1**

ii.   Calculate the weight of the apple on Mars in newtons given that the force of gravity on Mars is 4 N/kg.   **1**

iii.   Give a reason to explain why the force of gravity on Mars is less than that on Earth.   **1**

iv.   Name the natural satellite, which orbits Earth once every 28 days. _____   **1**

2.   During a football game**,** Andrew of mass 72 kg runs after the ball at 2 m/s for 6 s.

a.   Calculate:

i.   Andrew's kinetic energy in joules,   **1**

ii.   the power generated by Andrew.   **2**

b. The graph below shows how the potential energy of the ball changes as Andrew kicks it vertically upwards.

Graph of Potential Energy against Height
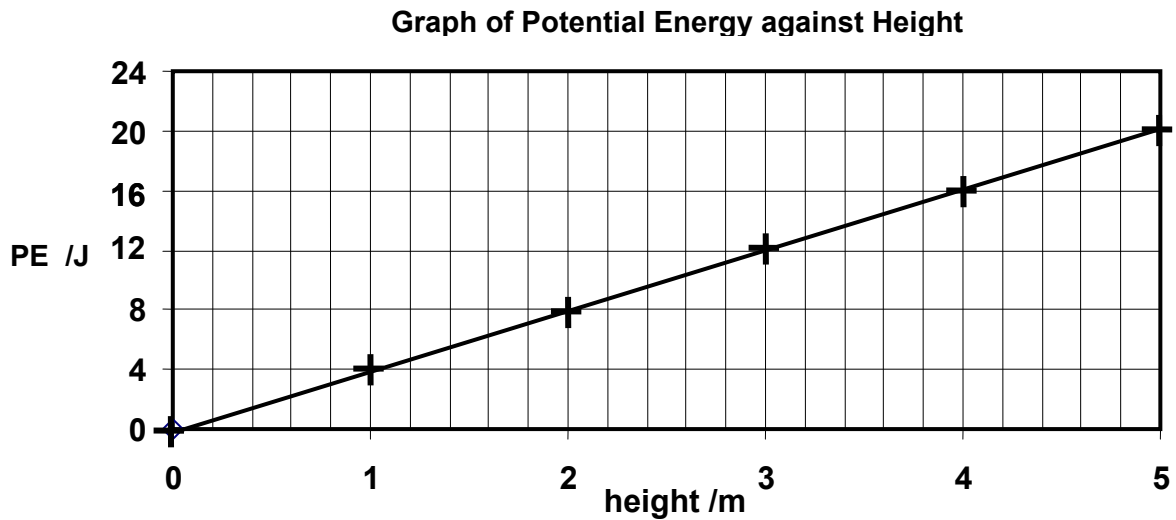
Use the graph to find the:

i. greatest height reached by the ball in meters,   1

ii. potential energy in joules of the ball when it reaches its greatest height above the ground,   1

iii. the mass of the ball in kg.   1

c. On the grid below, draw a graph to show how the KE of the same ball changes as it is kicked to the same height.   2

Graph of Kinetic Energy against Height
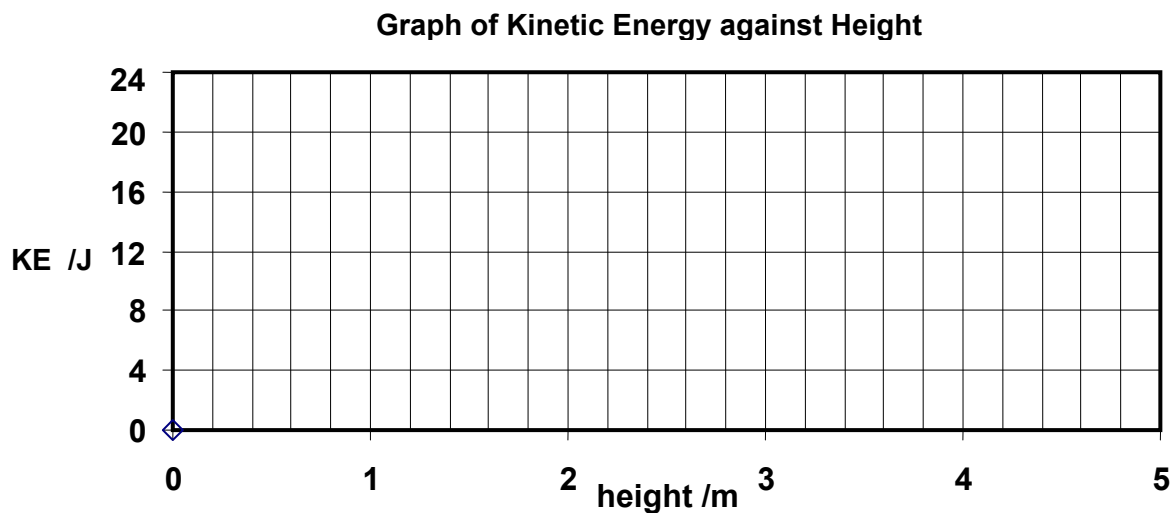
3. Figure 1 below shows Maria standing on a platform of a climbing frame in a children's playground. Maria steps off the platform and falls freely to the ground in 0.4 s.
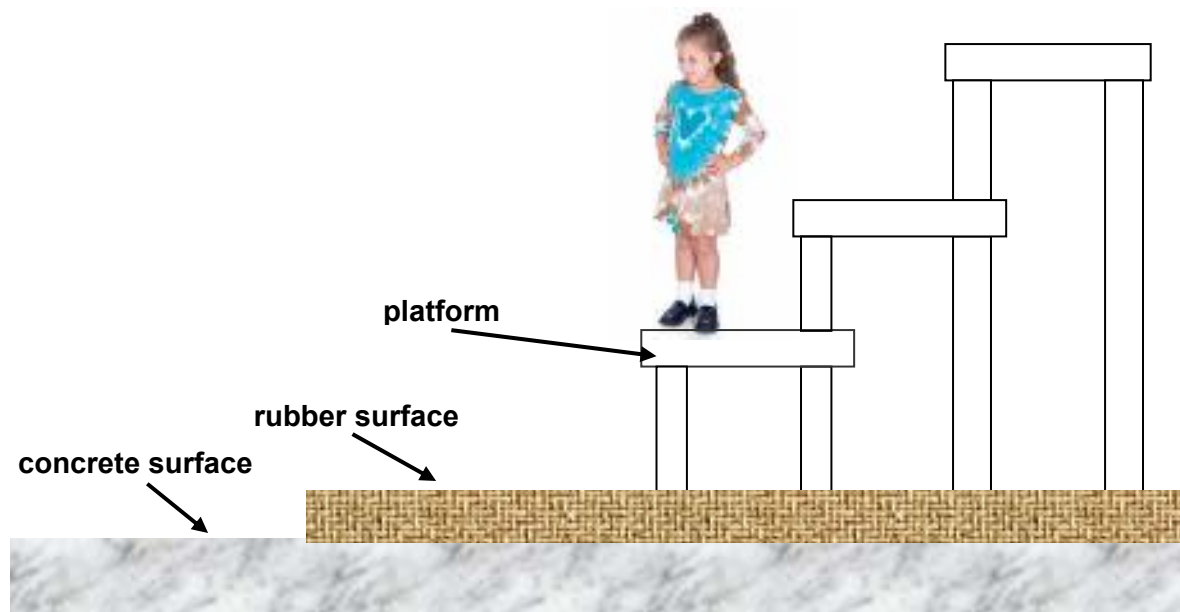

Figure 1

a. Find:

i. Maria's initial velocity is _____ m/s,   **1**

ii. the distance fallen by Maria in m,   **1**

iii. the velocity at which her feet hit the rubber surface in m/s   **1**

b. For safety, the ground around the climbing frame is covered by a layer of soft rubber as shown in figure 1. The time interval between Maria hitting the rubber surface and coming to a stop is 0.5 s.

i. Calculate Maria's momentum in kgm/s as she hits the rubber surface given that her mass is 50 kg.   **1**

ii. What is Maria's momentum 0.5 s after impact? _____ kgm/s

1

iii. Calculate the force with which Maria hits the rubber surface.

1

c. The soft rubber is removed so that it could be replaced. Maria ignores the sign not to use the climbing frame. She steps off the platform and falls freely on to the concrete ground below.

i. Does the time interval between Maria hitting the concrete ground and coming to a stop decrease, increase or remains the same? _____ **1**

ii. What effect could this have on Maria? **1**

4. A uniform metal bar 1 m long is balanced at the 0.3 m mark when a load of 5 N is placed at the 0 m mark as shown in figure 1.
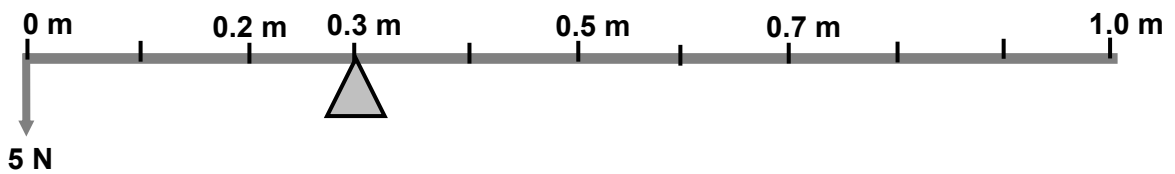
Figure 2

a. On figure 2:

i. Mark with a 'C' the position of the centre gravity of the metal bar. **1**

ii. Draw an arrow to show the position of the weight W of the metal bar. **1**

b. Calculate the:

i. weight of the metal bar in N, using the Law of Moments **2**

ii. total downward force acting on the pivot, **1**

iii. upward reaction force by the pivot, **1**

iv. the mass of the metal bar in kg, **1**

v. the density in kg/m^3 of the metal bar given that its volume is 0.0001 m^3. **1**

5. The figure below shows the experimental set-up to find the specific heat capacity **c** of aluminium. The immersion heater is inserted in an aluminium block, which holds a thermometer as shown in figure 3 below.
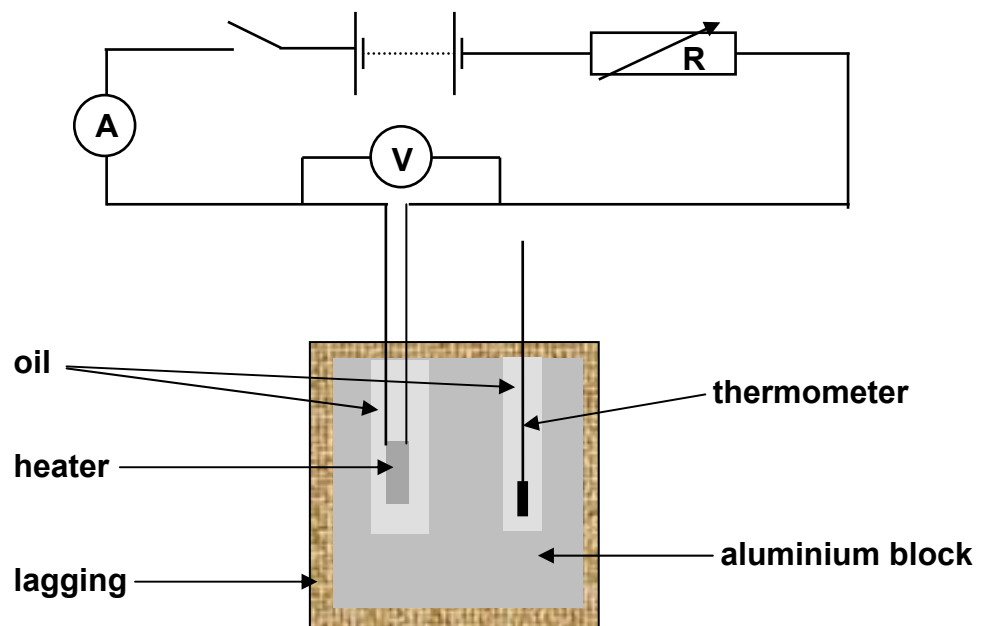

Figure 3

a. In figure 3:
i. The heater and the rheostat **R** are connected in _____.   **1**
ii. The ammeter **A** is connected in _____ with the heater and the rheostat.   **1**
iii. The voltmeter is connected in _____ with the _____.   **2**

b. The ammeter reads 2 A during the experiment while the voltmeter reads 25 V. Calculate the:
i. power of the heater in watts,   **1**

ii. energy supplied by the heater in 5 minutes in Joules   **1**

iii. specific heat capacity **c** of aluminium in J/kg°C, given that the temperature of the aluminium block of mass 2 kg, rises by 8 °C in 5 minutes.   **2**
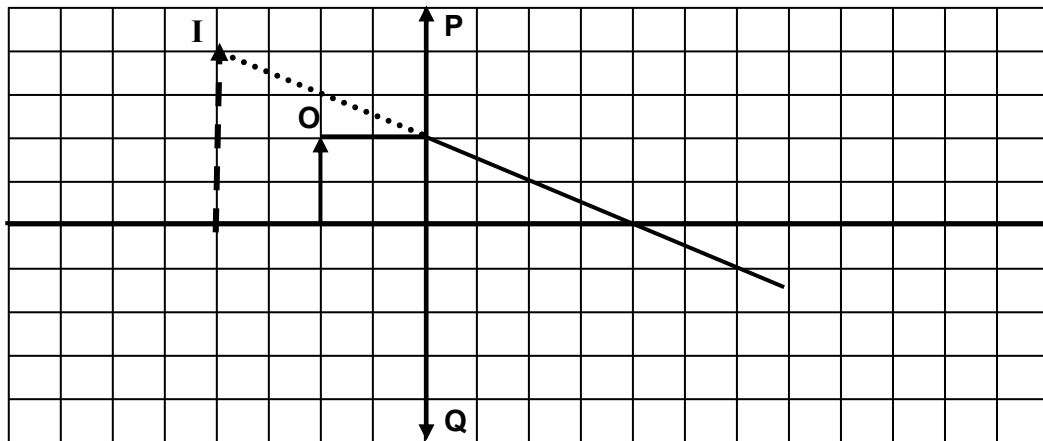
Section B.   **This section carries 45 marks**

6. This question is about Converging Lenses.

a. The figure represents an object O placed in front of a converging lens PQ. A ray of light from the top of the object O is drawn to indicate the position of the image I.

      Note: 1 square represents 1 cm.

i. Draw **another** ray of light from the top of the object O to show how the position of the image I has been located.   **2**

ii. Why is the image I of the object O represented in broken lines?   **1**

iii. List two **other** properties of the image I.   **2**

iv. The ray diagram shows the converging lens PQ being used as a

    _____   **1**

b. Use the ray diagram to determine:

i. the magnification of the converging lens PQ.   **2**

ii. the focal length of the lens PQ.   **2**

c. The graph below shows the image distances obtained when a pin is placed at different object distances from the optical centre of a converging lens RS.
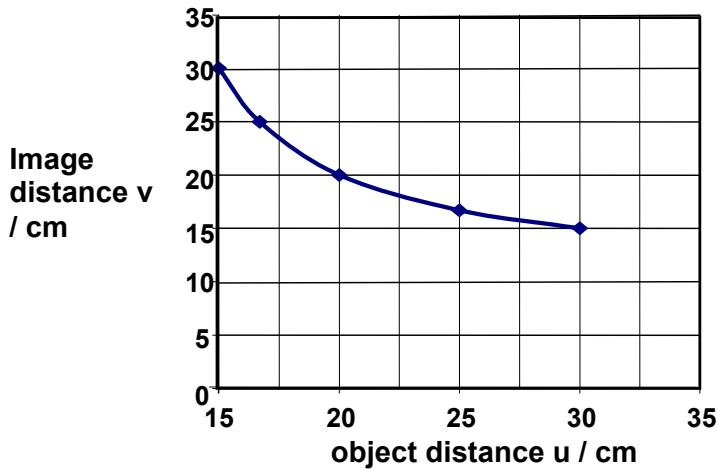

From the graph find the:

i. image distance **v** in cm when the object distance **u** is 15 cm,   _____   **1**

ii. magnification at an object distance of 15 cm given that magnification m = v/u,   **2**

d. Fill in the missing words in the following statements:

i. A diminished image is an image which is _____ than the object.   **1**

ii. A _____ image is an image which is bigger than the object.   **1**

7.   This question is about static electricity.

a. David rubs a polythene strip with a duster. Both the polythene strip and the duster become charged.

i. What kind of charge does the polythene strip acquire? _____   **1**

ii. What is the charge on the duster?   _____   **1**

iii. Name the force causing the polythene strip and the duster to become charged.

_____   **1**

b. Complete the following sentences using **two** words from the following list:

conductors, electrode, diodes, insulator, sphere.

i. David then holds the charged polythene strip from one of its ends. The polythene strip does not lose its charge since polythene is an _____   **1**

ii. A charged copper strip loses its charge when David touches it because both copper and the human body are _____.   **1**

c. Two identical **polythene** balls A and B are equally charged and placed at a distance **s** away from each other as show in the figure below:

s

A   B
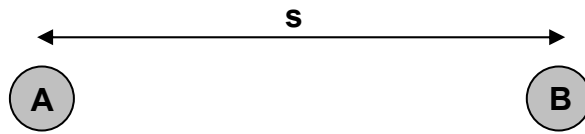
Each of the charged polythene balls A and B experience a force. Is this force experienced by both balls a force of attraction or a force of repulsion? _____

2

d. The distance **s** between the equally charged balls A and B in the figure above is changed, and the force **F** between them is measured each time. The results obtained are shown in the following table.

s /m	4	6	8	10	12	14	16	18
F /N	11	7.5	5.5	4.0	2.8	2.2	1.6	1.2

i. Plot a graph of the force F (y-axis) against the distance s (x-axis) on the graph paper provided.

5

ii. Use your graph to find the size of the force F when the distance s is 7 m.

1

iii. Underline the correct words in the following sentence:

As the distance between the two similarly charged balls gets (bigger/smaller), the size of the force between them gets (bigger/smaller).

2

8. **This question is about magnets, electromagnets and magnetic materials.**

a. The figure below shows a bar magnet.

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

2

N   S

ii. Which 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.
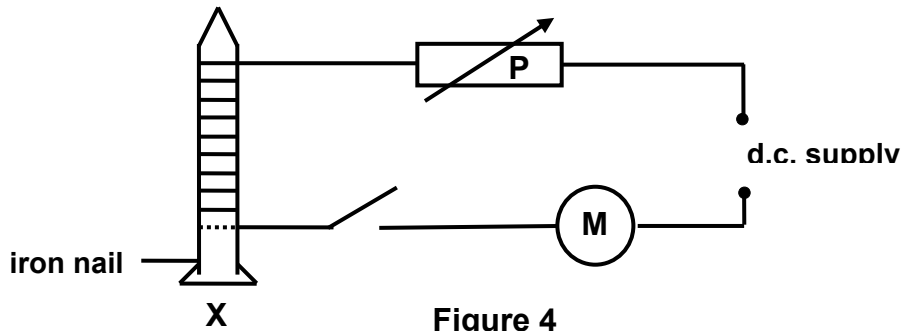

Figure 4

Complete the following sentences by choosing **four** appropriate words from the following list: *battery, voltmeter, ohmmeter, ammeter, voltage, current, variable resistor (rheostat).*   **1**

i.   A _____ is an example of a d.c. supply   **1**

ii.   M is an _____.   **1**

iii.   M measures _____ in amperes.   **1**

iv.   P is a _____.

c. Some small iron paper clips are placed near the **end X** of the nail (see figure 4 above):   **1**

i.   State what happens to the iron paper clips when the switch is turned **ON.**

1

ii.   State what happens to the iron paper clips when the switch is turned **OFF.**

2

iii.   State **two ways** of increasing the strength of the electromagnet.

d. Underline the **two magnetic materials** in the list below.   **2**
    silver, iron, wood, gold, steel, glass, lead, aluminium.

e. Copper nails are neither attracted nor _____ by the electromagnet   **2**
    since copper is a _____ material.