JUNIOR LYCEUM ANNUAL EXAMINATIONS 2002
EDUCATIONAL ASSESSMENT UNIT - EDUCATION DIVISION

FORM 3 **PHYSICS** **Time: 1h 30min**

NAME: _____ **CLASS:** _____

Answer all questions.
All working must be shown. The use of a calculator is allowed.

Where necessary take 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** $= \frac{\text{h}}{2}$ **(sum of parallel sides)**

$v = s/t$ $v = u + at$ $s = at^2/2$ $W = mg$ **density = mass/volume**

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

moment of a force = Force x perpendicular distance

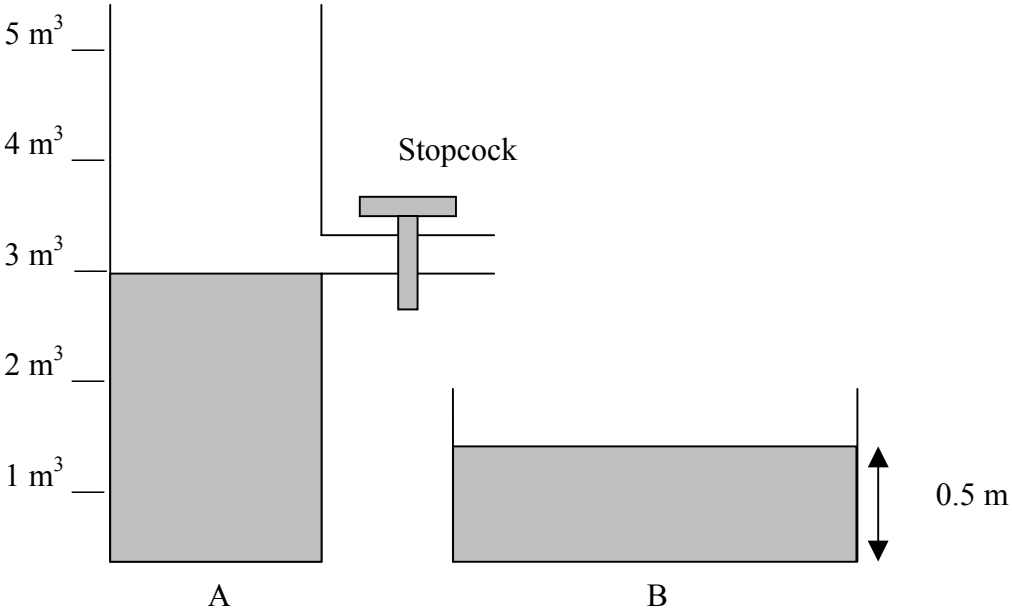
magnification $= \frac{\text{height of image}}{\text{height of object}} = \frac{\text{image distance}}{\text{object distance}}$

refractive index of glass $= \frac{\text{speed of light in air}}{\text{speed of light in glass}}$

frequency $= \frac{\text{number of waves}}{\text{time}}$ $v = f\lambda$

SECTION A. **Answer all questions in the spaces provided.**
This section carries 55 marks.

1.



A large reservoir A contained 5 m^3 of water. When the stopcock was opened, water from reservoir A flowed into the rectangular reservoir B at a constant rate of 0.1 m^3 per minute.

(a). Find the greatest volume of water that flowed from reservoir A to reservoir B.

_____

[1 mark]

(b). If the level of this water in reservoir B is 0.5 m above the base, calculate the surface area of the water in reservoir B.

_____

[3 marks]

(c). If the density of water is 1000 kg/m^3, find the mass of the greatest volume of water in reservoir B.

_____

[4 marks]

(d). Calculate the time taken for this water to flow from reservoir A to reservoir B.

_____

[2 marks]

2. Different known weights were suspended in turn from a vertical spring and in each case, the spring length was measured. The measurements are shown in the table below.

Weight/N	0	1.0	2.0	3.0	4.0	5.0	6.0
Spring Length/mm	300	340	376	423	460	505	540
Extension/mm	0						

(a). What is the length of the unloaded spring?

_____

[1 mark]

(b). Calculate the extension for each weight and write down each answer in the proper space provided in the table.

[3 marks]

(c). When an object of an unknown weight was suspended from the spring, the extension was 100 mm.

(i). What is the length of the spring in this case?

_____

[1 mark]

(ii). Calculate the unknown weight of the object.

_____

[2 marks]

(d). The table above illustrates a law called _____ which states that _____

_____

[3 marks]

3. A wheelchair of mass 140 kg is driven by a motor which delivers a power of 500 W. A person of mass 60 kg, sitting on the wheelchair, drives up a ramp gaining a height of 1.2 m in 8 seconds.

(a). Calculate,

(i). the potential energy gained by the wheelchair and the person sitting on it,

_____

[2 marks]

(ii). the energy supplied by the motor in 8 seconds.

_____

[2 marks]

(b). Give ONE reason why the energy supplied by the motor is larger than that actually used.

_____

[3 marks]

(c). Suggest a way to reduce the difference between answers a(i) and a(ii).

_____

_____

[3 marks]

4. A loudspeaker connected to a signal generator produced a sound note which is picked by a microphone connected to an oscilloscope. The oscilloscope displays a trace as shown below:

(a). What do you understand by a transverse wave?

_____

_____

[2 marks]

(b). The trace seen on the oscilloscope originates from a sound of frequency 200 Hz. On the diagram above, label

(i). the amplitude,
(ii). the wavelength. [2 marks]

(c). Say how the air molecules carry the sound energy from the loudspeaker to the microphone.

_____

_____

[2 marks]

(d). The signal generator which emits the note at 200 Hz, is set at normal volume. Draw the trace that would appear on the oscilloscope if,

(i). sound at 100 Hz is produced at high volume,
(ii). sound at 200 Hz is produced at low volume.

[4 marks]

Loud note at 100 Hz.

Quiet note at 200 Hz.

5.

Gamma Rays	X-Rays	Ultra Violet	Visible Light	Infra Red	Microwaves	Radio waves

(a). Radiation changes progressively from Gamma Rays to Radio waves. Complete the following by selecting the correct word - increases or decreases.

(i). The frequency _____
(ii). The wavelength _____

[2 marks]

(b). What is the speed of Ultra Violet rays if that of visible light is 3×10^8 m/s?

_____

[1 mark]

(c). Which three of the above radiation reaches the Earth's surface?

_____

[3 marks]

The ozone layer blocks the harmful radiation reaching us from the sun and which causes skin cancer in humans.

(d). Why do you think that cases of skin cancer are increasing?

_____

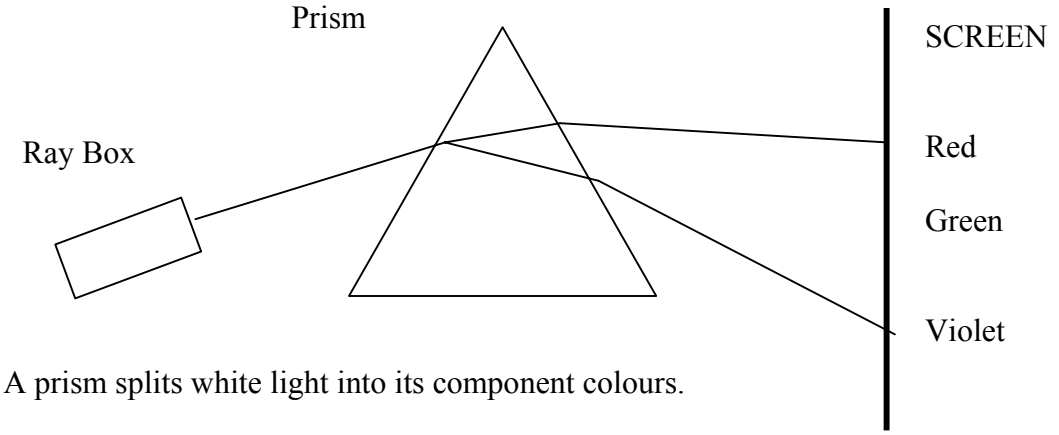
[2 marks]

(e). John stays in the school yard feeling warm as the sun's rays fall on him. As a cloud passes overhead, John immediately feels cold. Complete the following:

This suggests that light and heat from the sun travel at _____

[2 marks]

6.



A prism splits white light into its component colours.

(a). Write down all the colours that appear on the screen on the previous page.

_____

[2 marks]

(b). Which of the two rays, red or violet, slows down more in glass?

_____

[2 marks]

(c). If the frequency of red is less than that of violet, then the frequency of green is _____ than that of red.

[1 mark]

SECTION B: Answer all questions in this on the foolscap provided. This section carries 45 marks.

7. **This question is about motion graphs and a car's stopping distance.**

A racing car is being driven at a constant speed of 60 m/s. The driver has a thinking time of 0.5 seconds. (This means that there is a delay of 0.5 seconds between the driver deciding to stop and pressing the brake pedal) After 0.5 seconds, the driver presses the brake pedal and the car decelerates and stops. The table below shows how the speed of the car changes with time.

Speed (m/s)	60	60	42	30	10
Time (s)	0	0.5	2.0	3.0	4.7

(a). Plot a graph, on the graph paper provided, of the speed (Y-axis) against time (X-axis) to show how the speed of the car changes with time from the moment the driver decides to stop till the car stops.

[4 marks]

(b). How can you calculate the distance moved from your graph?

[2 marks]

(c). Using your graph, calculate the 'thinking distance'. (Thinking distance is the distance travelled during the time the driver takes to react by pressing the brake pedal.)

[2 marks]

(d). Then calculate the 'braking distance' of the car or the distance travelled after the brake pedal has been pressed.

[2 marks]

(e). Finally, find the total stopping distance of the car.

[1 mark]

(f) Besides the ‘reaction time’ of the driver, on which other factor does the thinking distance depend?

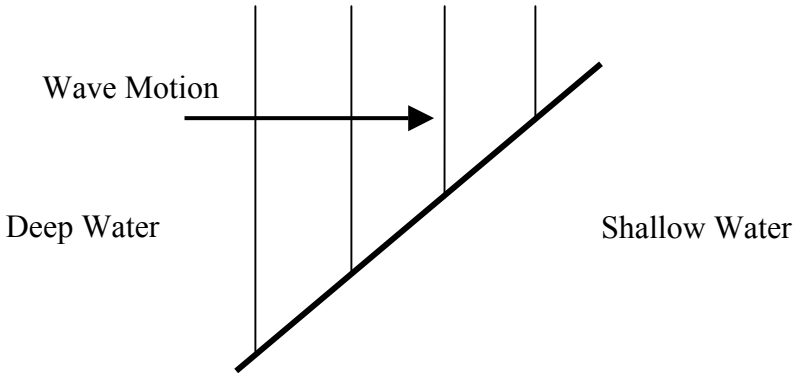
[2 marks]

(g) State 2 factors which can affect the braking distance of a car.

[2 marks]

8. **This question is about refraction and lenses**.

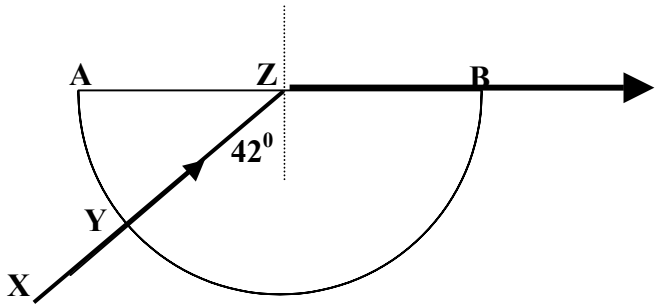
Water waves travel from deep to shallow water in a ripple tank as shown below:



(a) Copy the diagram on your answer book and add the refracted waves. [4 marks]

(b). What is the change, if any, in each of the following:
- (i). wavelength,
- (ii). speed, and
- (iii). frequency? [3 marks]

(c). The diagram shows a semicircular glass block whose critical angle is 42^0. An incident ray XZ enters the block at Y and the refracted ray is exactly on the side AB of the block.



- (i). Why does the refracted ray pass exactly on the side AB of the block?
- (ii). Why is the ray XZ not bent at Y?
- (iii). If the angle of incidence is greater than 42^0, what will happen to the ray XZ? [3 marks]

(d). An object 1 cm high is placed 3.5 cm in front of a convex lens of focal length 2 cm. Draw a ray diagram (full size) to find the position, size and nature of the image. [5 marks]

9. This question is about the turning effect of forces.

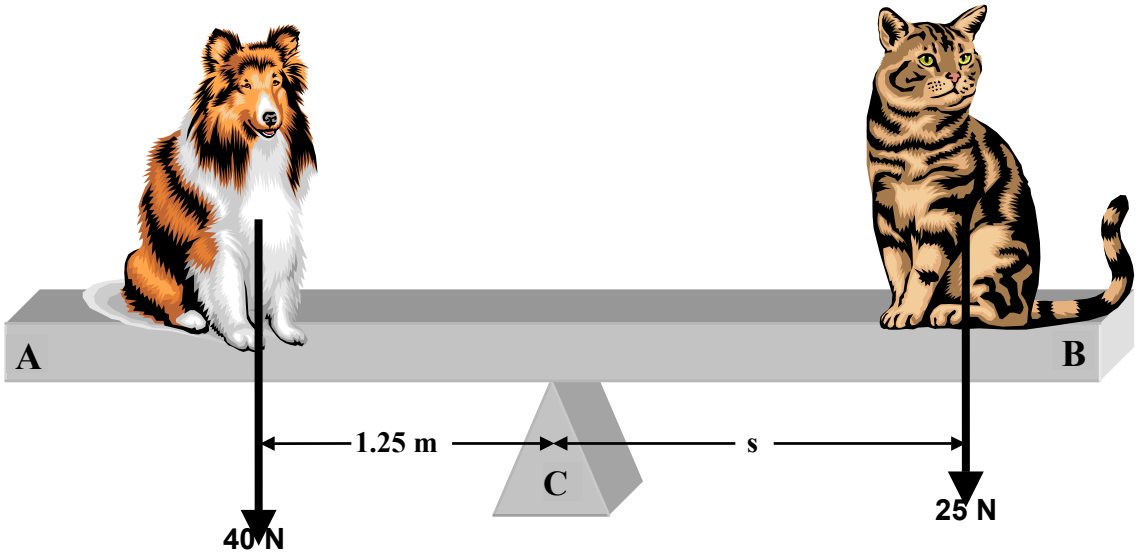
(a). Martha wants to set up an experiment to show the Law of Moments using a meter ruler with a hole drilled at the 50 cm mark.

(i). State the Law of Moments. [2 marks]

(ii). Draw a labelled diagram of the experimental set up. [3 marks]

(iii). State two precautions which Martha must take to carry out the experiment accurately. [2 marks]

(b). Rocky the dog and his friend Ginger the cat are sitting on a see-saw AB at the playing field enjoying the sunshine.
Rocky weighs 40 N, and is sitting 1.25 m away from the pivot C, which is at the **centre** of the see-saw.
Ginger is sitting on the opposite side of Rocky and weighs 25 N.



(i). State the direction of the moment of Rocky's weight about the pivot **C**. [1 mark]

(ii). State the direction of the moment of Ginger's weight about the pivot **C.** [1 mark]

(iii). Calculate the distance **s,** from the pivot **C,** where Ginger must sit so that the see-saw remains balanced. [3 marks]

(iv). The distance between end A of the see-saw and Rocky is 1.0 m.
Calculate the length of the see-saw. [2 marks]

(v). Ginger wants to go down from the see-saw but is afraid to jump.
In what direction must Rocky move so that the see-saw turns slowly.
towards the ground on Ginger's side? [1 mark]