JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2001
Educational Assessment Unit - Education Division

FORM 3 | PHYSICS | TIME: 1 hr 30 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.

You may find some of these formulae useful.

acceleration due to gravity $g = 10\ m/s^2$

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

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

work done $= Fs$ $PE = mgh$ $P = \frac{\text{work done}}{\text{time}}$ $KE = \frac{mv^2}{2}$

moment of a force = Force x perpendicular distance

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

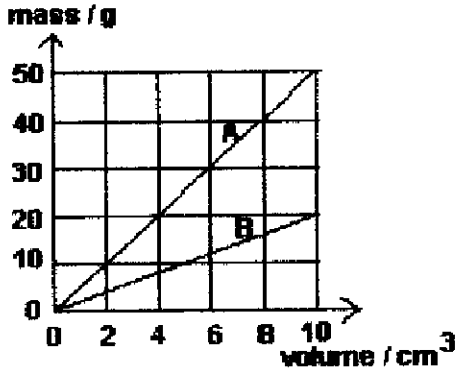
refractive index of glass $= \frac{\text{Speed of light in air}}{\text{Speed of light in glass}}$

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

$v = f\lambda$

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

1. A student plotted a graph of the mass of a given liquid A, against the volume of the same liquid, while another plotted a graph on the same sheet for a liquid B.



(a). Which has the greater mass, 10 cm^3 of liquid A or 10 cm^3 of liquid B?

_____

[2]

(b). What is the density of each liquid?

Liquid A: _____ [3]

Liquid B:

_____ [3]

(c). Liquids A and B do not mix and they are poured in the same beaker.

Which of these two diagrams is correct?

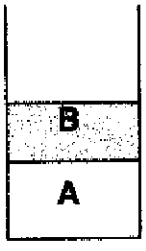


Diagram 1

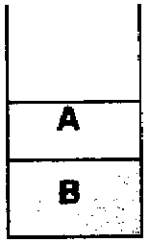


Diagram 2

Diagram : _____ [2]

2.(a). The table below lists some renewable and non-renewable energy resources.

Resource	Renewable or non-renewable.
Coal	
Oil	
Waves	
Hydroelectricity	
Uranium	
Wind	

Complete the table to show which resource is renewable or not. [6]

(b). The power output from a wind generator is 100 kW when the wind speed is 8 m/s.

(i). How many of these generators are needed to provide a total power output of 10 MW at a wind speed of 8 m/s?

_____ [2]

[1 kW = 1000 W and 1 MW = 1 000 000 W]

(ii). State one advantage and one disadvantage that wind power has over power from fossil fuels like coal.

Advantage: _____ [1]

Disadvantage: _____ [1]

3. (a). Light forms part of the spectrum of electromagnetic radiation.

(i). State one type of electromagnetic wave which has a wavelength longer than that of light.

_____ [2]

(ii). State one type of electromagnetic wave which has a wavelength shorter than that of light.

_____ [2]

(iii). Complete the following table by choosing the correct type of electromagnetic wave used for each application.

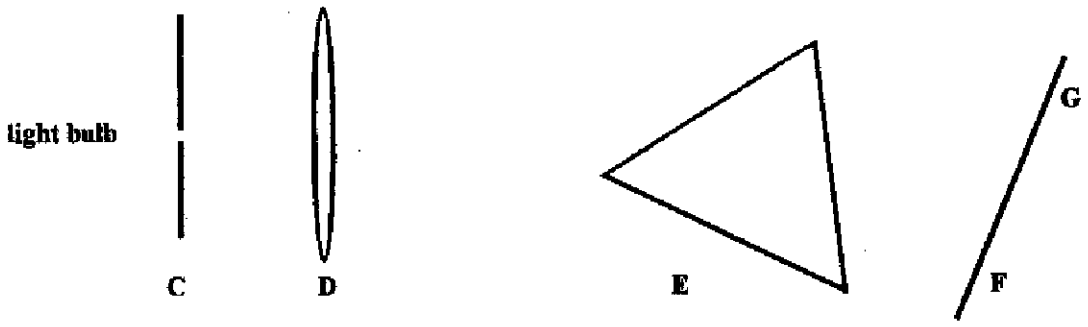
Application	Type of electromagnetic wave.
Sending information via satellite	
Remote control of a TV set	
Forming an image of a fractured bone	

[3]

(b). A radio programme is transmitted using electromagnetic waves of frequency of 1 MHz (1 000 000 Hz). Calculate the wavelength of these radio waves in air. The speed of electromagnetic waves in air is 3×10^{8} m/s (300 000 000 m/s).

_____ [3]

4. The apparatus below is set up in the laboratory to show the spectrum of white light on a screen. The visible spectrum is found in the region FG.



(a). Label the parts D and E in the above diagram. [2]

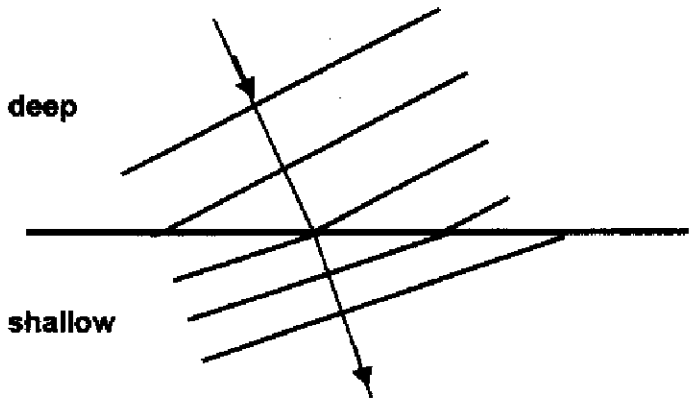
(b). Which colour is seen in each of the regions F and G?

F: _____ G: _____ [2]

(c). Taking the speed of light to be 3×10^{8} m/s (300 000 000 m/s), calculate the frequency of light of wavelength 6×10^{-7} m (0.000 000 6m).

_____ [1]

5. The diagram represents wave crests on the surface of water. The waves are in deep water travelling towards a straight boundary where the water becomes shallow.



(a) (i). Measure and write down the wavelength of the waves in deep water using your ruler.

_____ [2]

(ii). The waves are produced at a frequency of 2 Hz. Calculate the speed of the waves in the deep water.

_____ [2]

(b (i). The waves travel more slowly in the shallow water. Complete the diagram above to show two more wave crests that have passed into the shallow water. [2]

(ii). Measure and write down the wavelength of the waves you have drawn in the shallow water.

_____ [2]

(c). Calculate the speed of the waves in the shallow water.

_____ [2]

6. The table shows how the stopping distance of a vehicle on a dry level road varies with the speed.

Speed (m/s)	Thinking Distance (m)	Reaction Time (s)	Braking Distance (m)	Stopping Distance (m)
5	4		3	7
10	8		12	20
15	12		27	39
20	16		48	64

(i). Reaction Time = $\frac{\text{Thinking Distance}}{\text{Speed}}$

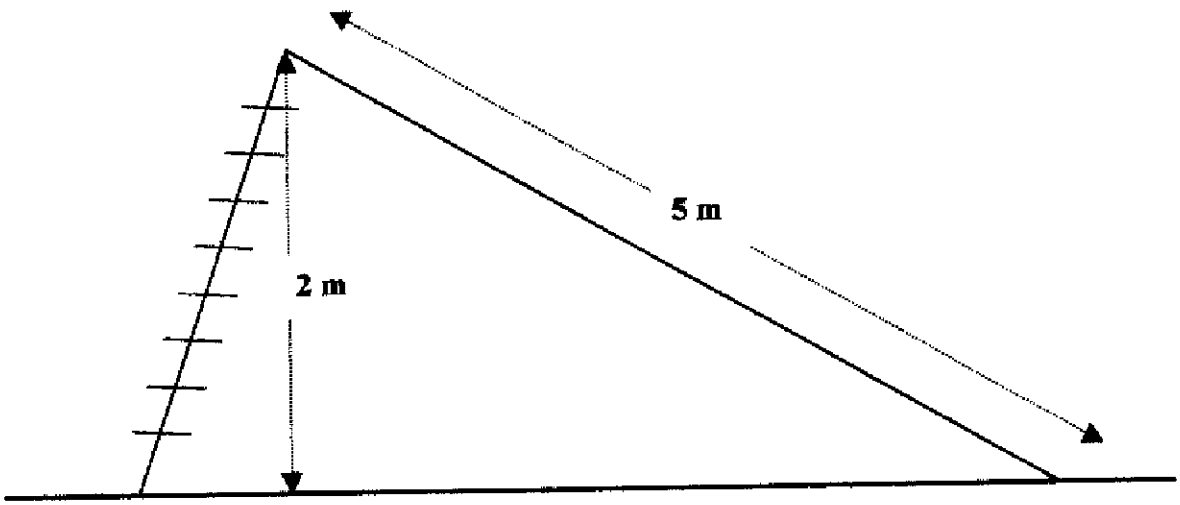
Calculate the reaction time of the driver for each speed shown in the first column. Write down the answers in the third column. [8]

(ii). What can you conclude about the reaction time and speed?

_____ [2]

SECTION B. Answer all questions on the foolscaps provided.
This section carries 45 marks.

7. **This question is about Work and Energy.**



A child of mass 25 kg climbs up the ladder, 2 m high, to slide down a shute.

(a). What is the weight of the child. [2]

(b). (i). What is the size of the upward force he must use to climb up the ladder? [1]

(ii). What are the units of this force. [1]

(c). How much work must he do in climbing to the top? [2]

(d). Where does the child obtain the energy from? [1]

(e). If he takes 5 seconds to climb to the top, calculate his power [2]

(f). As the child slides down the shute, a force F opposes his downward motion.

(i). What is this force called? [1]

(ii). If the work done by the force F is 200 J as the child slides 5 m down, calculate the size of this force. [2]

(g). The work done by the child in climbing up the ladder (see answer to c above) has become gravitational potential energy. Of this energy, 200 J are used against the force F. the rest appears as kinetic energy of the child.

(i). How much is the kinetic energy of the child? [1]

(ii). Calculate the velocity of the child just before landing. [2]

8. A toy car of mass 1 kg moves down an inclined plane while a student records the distance covered by the car every 0.2 s. The distance, d in cm of the toy car from its rest position after a time t in seconds is given in the table below.

d/cm	0	3	12	27	48	75	108
t/s	0	0.2	0.4	0.6	0.8	1.0	1.2

(a). Draw a graph of the distance travelled, d on the y-axis against time t on the x-axis on the graph paper provided. Draw the best smooth curve. [8]

(b). Use your graph to find the values of:

(i). the distance, in cm, covered by the toy car in 0.7 s. [1]

(ii). the time taken to travel the first 90 cm. [1]

(c). The velocity of the trolley after 0.4 seconds is 60 cm/s and after 0.8 seconds it is 120 cm/s. Calculate,

(i). the time interval for this change of velocity [1]

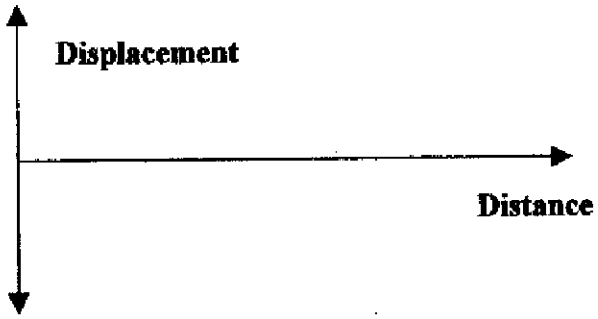
(ii). the average acceleration of the toy car in cm/s^2. [2]

(d). Find the average velocity of the toy car in cm/s. [2]

9. **This question is about light waves and fibre optics.**

(a). Light is an example of a transverse wave. What do you understand by a transverse wave? [2]

(b).

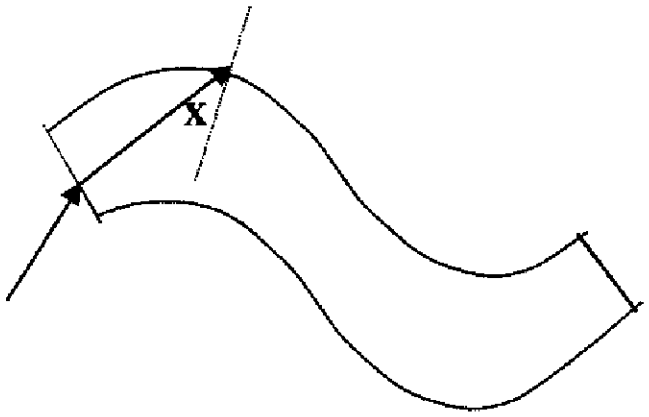


(i). Copy the two axis on your foolscap. Then, on these two axes, draw a light wave travelling through air. (Show two whole waves and label the waves A). [2]

(ii). Mark on your diagram a distance equal to one wavelength. [1]

(iii). Explain what happens to the speed of light as it goes from air to glass. [2]

(iv). On the same graph, draw the light waves as they will be in the glass. Mark these waves with a letter B. [2]



(c). The diagram shows a single ray of light entering a short glass fibre at one end.

(i). Copy the diagram on your foolscap and complete it to show how the ray travels along the fibre to reach the other end and emerge from the glass. [2]

(ii). The angle X must be greater than a certain angle. What do we call this angle. [2]

(iii). Why does the light not escape from the sides of the glass fibre? [2]