JUNIOR LYCEUMS ANNUAL EXAMINATION 2001

Educational Assessment Unit – Education Division

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

NAME: _____ **CLASS:** ____

Answer the questions in Section A in the spaces provided on the Examination Paper. Answer those in Section B on the foolscaps provided.
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)

$v = \frac{s}{t}$ $v = u + at$ $s = \frac{at^2}{2}$ $W = mg$ 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 $F = ma$

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) $= \frac{1}{\text{refractive index}}$

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

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

Section A. Answer the questions in this section in the spaces provided.

1. A plastic container has a mass of 20 g when empty and 60 g when some liquid is poured into it up to a height of 20 cm.
The volume of the liquid is 4×10^{-5} m^3 (0.00004 m^3).

   Calculate:

   a. the height of the liquid in the plastic container in m,

   _____ **(1)**

   b. the mass of the liquid in kg,

   _____ **(1)**

   c. the density of the liquid in kg/m^3,

   _____ **(1)**

   d. the pressure in pascals **of the liquid** on the bottom of the plastic container,

   _____ **(2)**

   e. the **total** pressure in pascals on the bottom of the plastic container, if the atmospheric pressure is 1.0×10^5 Pa (100 000 Pa).

   _____ **(3)**

2. a Assume that when wood burns, 20% of the energy produced is light.

   The remaining energy is mostly changed to _____. **[1]**

   b It is known that when 1 kg. of wood burns completely, 2.0×10^6 kJ of light energy is released.
   What is the **total** amount of energy released?

   _____ **[3]**

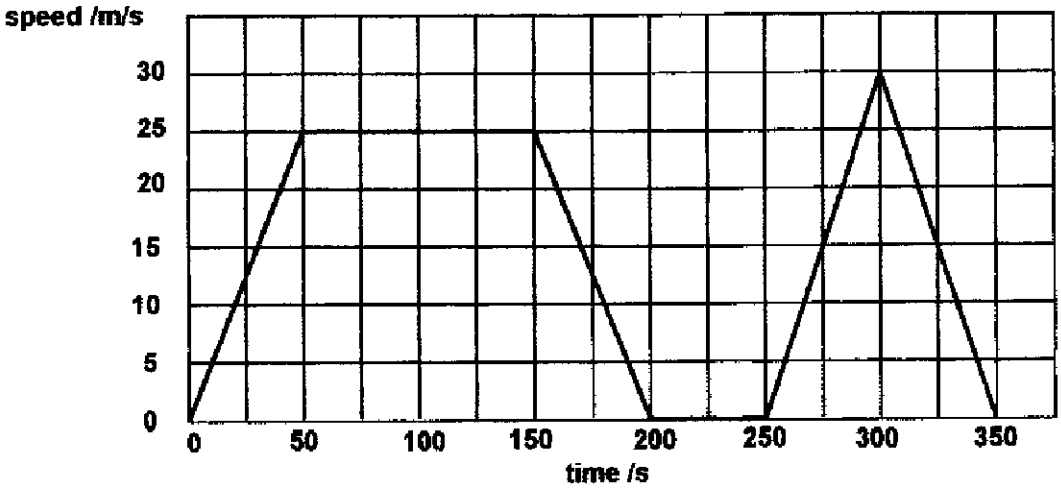
   c. A material which releases energy during burning is called a fuel.
   Give 2 <u>other</u> examples of fuels.

   _____ _____ **[2]**

   d. The fuel energy used by the engine of a car is mostly changed into

   _____ and _____ **[2]**

3. Josephine drives from her home to the local garage. The graph below shows how her speed changes throughout the journey.



a. From the graph find:

i. her **greatest speed** in m/s, **[1]**

_____

ii. the **speed** in m/s while she travels at constant velocity, **[1]**

_____

iii. the **distance** in metres she covers during the **last 100 seconds** of her journey.

_____ **[2]**

_____

b. There is a pedestrian crossing (zebra crossing) on the way from her home to the garage. Sometimes she has to slow down or stop at it.

i. Does she stop at the pedestrian crossing? **[1]**

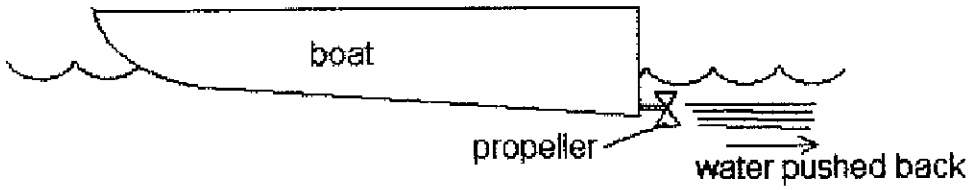
_____

ii. Give a reason for your answer.

_____

_____ **[2]**

4. A toy motor boat has a propeller which pushes 0.3 kg of water backwards with a speed of 4 m/s.



a. What is the momentum of the water?

_____ [2]

b. What is the momentum of the boat?

_____ [2]

c. What is the speed of the boat if the mass of the boat and motor is 2 kg?

_____ [2]

d. What happens to the speed of the boat if a heavy load is placed inside it?

_____ [2]

5. An elastic cord whose unstretched length is 0.8 m is used to secure a bicycle on the roof rack of a car. To do so, the elastic cord is stretched to a length of 1.2 m when a constant pulling force of 100N is applied.

a. What is the force in a stretched elastic cord usually called? _____ [2]

b. What is the extension when this 100N force is applied? _____ [2]

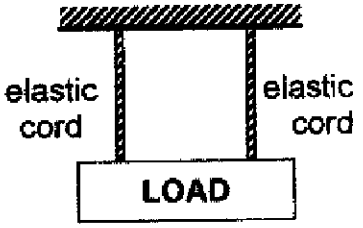
c. If the pull on the elastic is increased to 150N, find:

(i) the new extension _____

(ii) the new length _____ [2]

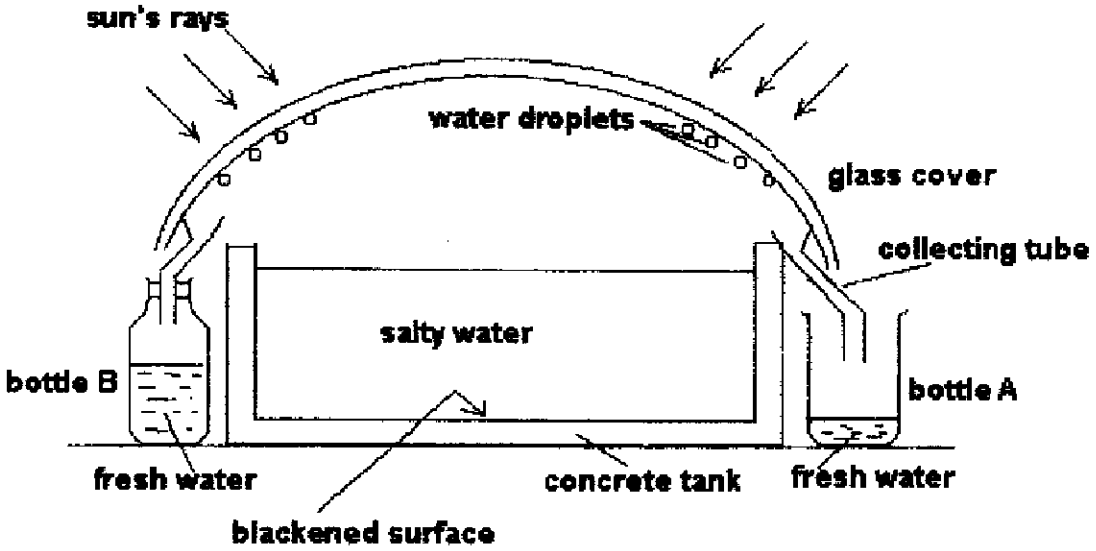
d. Two such cords are used to support a load of 200N. What is the extension in each cord?

_____



[2]

6. A scientist devised an apparatus to change seawater to fresh water by evaporation, using the sun's heat energy. The following is a diagram of his device:



a. By what method is the heat energy transferred from the sun to the salty water?

[1]

b. Why is the inner surface of the concrete tank black?

[2]

c. Explain why the salty water gets hotter if the tank is made of concrete rather than metal.

[2]

d. The evaporated water condenses on the glass roof and falls through collecting tubes into bottles A and B.
Why has less water been collected in bottle A than in bottle B after a few hours have passed?

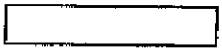
[3]

7. On switching off a computer monitor Paul notices that the screen attracts dust. A possible explanation is that the glass screen has an electrostatic charge. To check the type of charge he rubs a polythene strip and an acetate (perspex) strip, suspends each by a string and brings them in turn close to the sreen.

a. Complete:
   i) When rubbed, polythene gets a _____charge.
   ii) When rubbed, acetate (perspex) gets a _____charge. [2]

b.

cloth 

polythene 

i) Show the sign of the charge using + and - on the polythene and cloth after rubbing. [2]

iii) Mark with an arrow, on the above diagram, the direction of the movement of electrons during rubbing. [1]

b. The monitor attracts the polythene strip but repels the acetate strips. Complete:

i) The screen has a _____charge. [1]

ii) This is because:
like charges _____and unlike charges_____ [2]

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

1. **This question is about converging lenses.**

A pin, 4 cm high is placed at different distances away from a converging (convex) lens.
The table gives object distances **u** and their corresponding image distances **v.**

u (cm)	15.0	16.7	20.0	25.0	30.0
v (cm)	30.0	25.0	20.0	16.7	15.0

a. Plot a graph of image distance **v** on the y-axis against the object distance **u** on the x-axis, on the graph paper provided. [7]

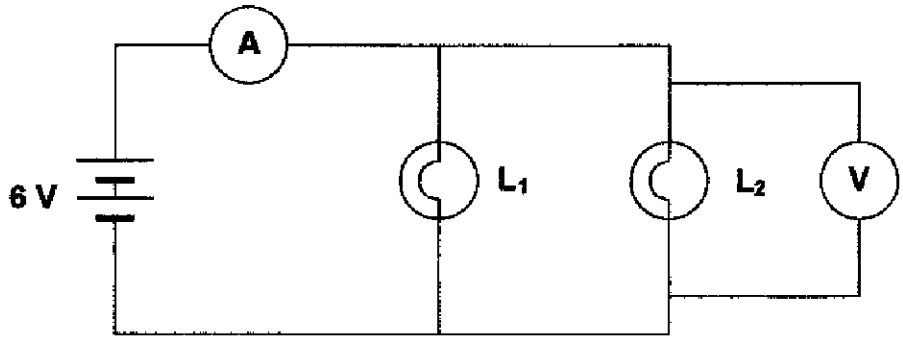
b. From your graph, find the image distance **v** in cm when the object distance **u** is 18 cm. [2]

c. Find the magnification at an object distance of 18.0 cm. [2]

d. From your graph, find the focal length **f** of the lens in cm. [2]

e. Suggest a value for the object distance if the lens is used as a magnifying glass. [2]

2. This question is about a parallel circuit and electricity in the house.



a. i. What is the voltage across L_1? **[1]**

ii. What is the voltmeter reading? **[1]**

iii. What can you say about the resistance of an ideal ammeter? **[1]**

iv. What can you say about the resistance of an ideal voltmeter? **[1]**

b. The resistance of L_1 is 6 Ω and L_2 is 12 Ω.

i. Find the current through each lamp. **[2]**

ii. What is the ammeter reading? **[1]**

c. An electric cooker consists of a hotplate, of 1 kW and an oven of 2 kW connected in parallel. The cooker is connected to a 250 v a.c. supply and both hotplate and oven are switched on.

i. What is the current flowing through the cooker? **[2]**

ii. Select which fuse of 13 A, 10 A, 5 A and 1 A best protects the cooker. **[1]**

d. The hotplate and oven have been accidentally left on for 10 hours.

i. Find the electrical energy in kWh used by the cooker. **[2]**

ii. Find the cost of this energy if one 1 unit (1 kWh) of electrical energy costs 3 c. **[1]**

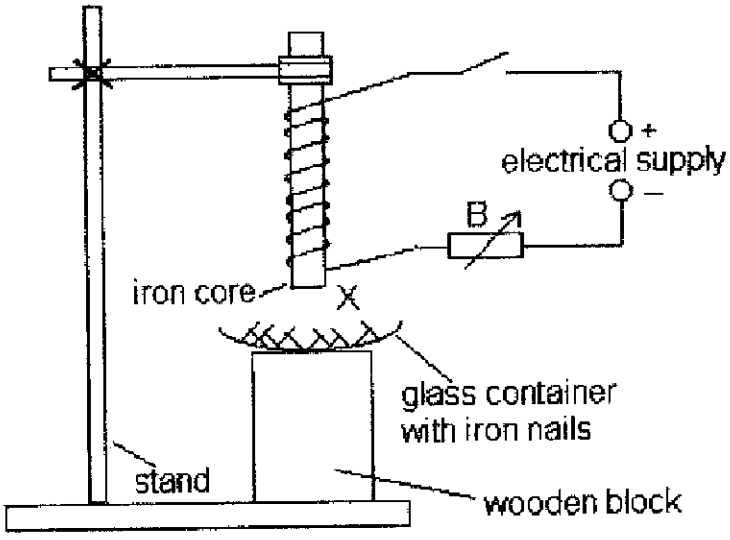
e. If the power station at Delimara is oil fired, state the energy changes taking place at the following stages:

Example: When fuel burns, the energy conversion is: <u>chemical to heat</u>

i. When the generator turns.
ii. When the cooker is switched on. **[2]**

3. This question is about electromagnetism and the magnetic properties of iron and steel.

a. An electromagnet is clamped to a retort stand and it is connected to an electrical supply as shown in the diagram.



What is the polarity of the electromagnet at X? **[2]**

b.
The electromagnet is used to pick up nails from the glass container.

i)
What is the effect on the number of nails picked up if the connections to the d.c. supply are reversed? **[1]**

ii. Name the component labelled B in the circuit. **[1]**

iii. What adjustment to B would enable the electromagnet to pick up more nails? **[1]**

c. An electromagnet has an iron core. A similar electromagnet has a steel one. A student decided to investigate which of the two produces the stronger force for the same current.
Describe the experiment which needs to be carried out.

Your answer should include

i. a labelled diagram of their apparatus set up for the experiment (there is no need to draw the circuit), **[3]**

ii. a description of the method used, **[2]**

iii. a list of measurements taken, **[2]**

iv. two precautions to ensure a reliable result, **[2]**

v. an indication of the final result expected. **[1]**