JUNIOR LYCEUM ANNUAL EXAMINATIONS 2002
Educational Assessment Unit - Education Division

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

NAME: _____ **CLASS:** ____

Answer all questions. 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 $= \frac{\text{height of image}}{\text{height of object}} = \frac{\text{image distance}}{\text{object distance}}$

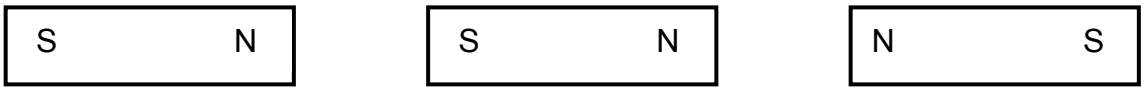
$v = f \lambda$

$V = I R$ $P = V I = I^2 R$ $R = R_1 + R_2 + R_3$

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

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

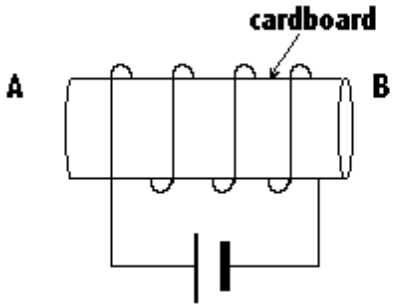
1. (a). Three bar magnets are placed on a table as shown. Draw magnetic lines of force in the spaces between the poles of the magnets. (2)



(b). Mark on the diagram below,

(i). the direction of the current, (1)

(ii). the polarity of the ends A and B. (1)

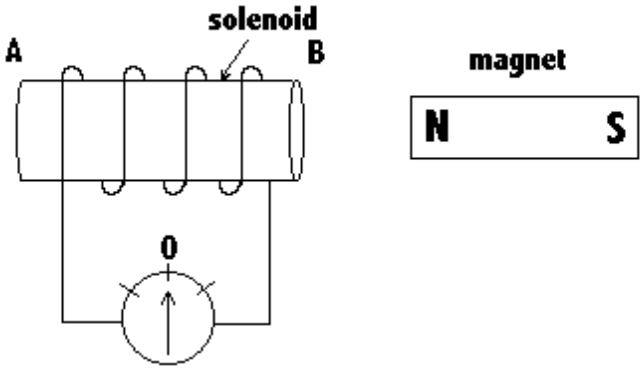


(iii) Three ways to increase the strength of the magnetic field are:

_____

_____ (3)

2. When the magnet in the diagram below is moved towards side B of the solenoid, the pointer of the galvanometer deflects momentarily <u>to the right.</u>



(a). Explain why this happens.

_____

_____ (1)

(b). What is the process called?

_____ (1)

(c). Without moving the magnet, how can you produce another momentary deflection of the pointer?

_____ (1)

(d). State two ways of increasing the size of the deflection of the pointer.

_____ (2)

(e). Name the main energy change taking place when the magnet is moved into the coil.

_____ (2)

3. A man of mass 70 kg sits on a high stool of mass 4 kg. The stool has 4 legs each of area 0.004 m^2 in contact with the floor.

(i). The total weight of man and stool is _____ (1)

(ii). The force acting on the ground by the four legs is _____ (1)

(iii). The total area of the four legs is _____ (1)

(iv). The pressure exerted on the ground when the man sits on the stool is: _____ (3)

(v). How will the pressure exerted on the ground by the stool change if a child instead of a man sits on the stool?

_____ (1)

4. A shiny metal electric kettle contains 1 kg of water at 20^0 C.

(a). If the specific heat capacity of water is 4200 J/kg.K, the heat required to bring the water to the boil is,

_____ (2)

(b). It takes 5 minutes to bring the water to the boil. The power of the heater is,

_____ (2)

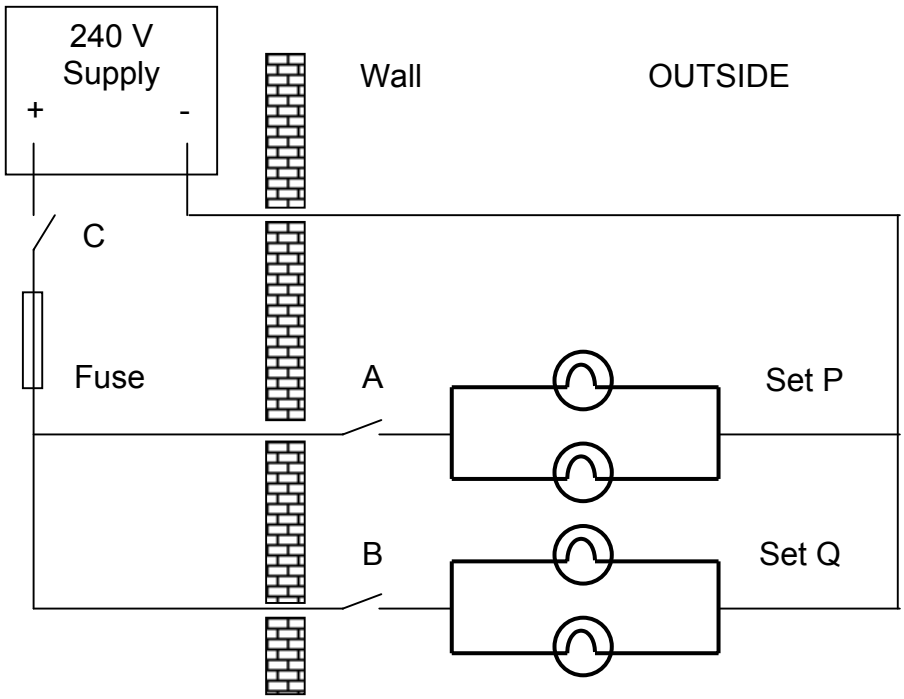
(c). The energy of the heater which is absorbed by the water, travels through the metal to the outside of the kettle by

_____ (1)

(d). It is an advantage for electric kettles to be highly polished because,

_____ (2)

5.



An outdoor lighting device consists of two sets of identical lamps. Each set contains 2 lamps in parallel. Each lamp is rated 240V, 60W.

(a). What happens to each set of lamps when:

(i). only switch A is closed, _____
(ii). only switches A and C are closed _____
(iii). only switches A and B are closed _____
(iv). All three switches are closed _____

(2)

(b). What is the consumption in kWh if lamps in set P are switched on for 10 hours?

_____ (2)

(c). With ALL lamps switched on, what is the current through the fuse?

_____ (2)

(d). Which of the following is the best fuse for this circuit?

0.2 A 1.5 A 3.0 A 5.0 A 13.0 A (1)

6. (a) Name 2 properties common to electromagnetic waves.

(i) _____

(ii) _____ (2)

(b)

γ -rays	A	ultra-violet	Visible light	B	radio waves

The diagram shows the types of radiation in the electromagnetic spectrum. Name radiation A and radiation B.

A : _____

B: _____ (2)

(c) Five radio stations transmit waves with the following frequencies:

500 kHz 550 kHz 600 kHz 850 kHz 1000 kHz

(i) Which station transmits waves of the smallest wavelength?

_____ (1)

(ii) Find the wavelength of the waves whose frequency is 600 kHz, if the speed of radio waves in air is 3×10^8 m/s. (1 kHz = 1 000 Hz)

_____ (2)

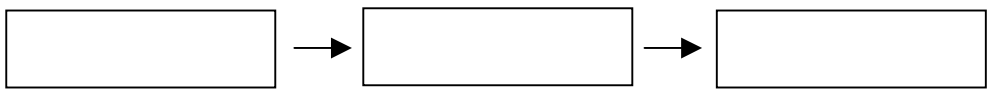
7. In mountainous regions, rivers are blocked by dams to create lakes. Water is then allowed to fall through pipes to a power station several metres below, which then produces electrical energy.
In one such hydroelectric power station, 1 000 kg of water fall a vertical height of 100 metres <u>every second</u> to drive the turbines which then produce electricity.

(a) (i) Calculate the gravitational potential energy of this mass of water.

_____

_____(2)

(ii) Trace the energy changes that occur in the process.



(1)

(iii) If the power station is 40% efficient, calculate the electrical power produced.

_____

_____ (1)

(b) This method of producing energy is environmentally friendly and an example of a renewable energy resource.

(i) Why is this method environmentally friendly?

_____

_____ (1)

(ii) Give ONE example of each energy resource.

Renewable resource _____ (1)

Non-renewable resource _____ (1)

8. (a) The time taken by Earth to make one complete rotation about its axis is one _____. (1)

(b) The time taken by Earth to orbit the _____is one year. (1)

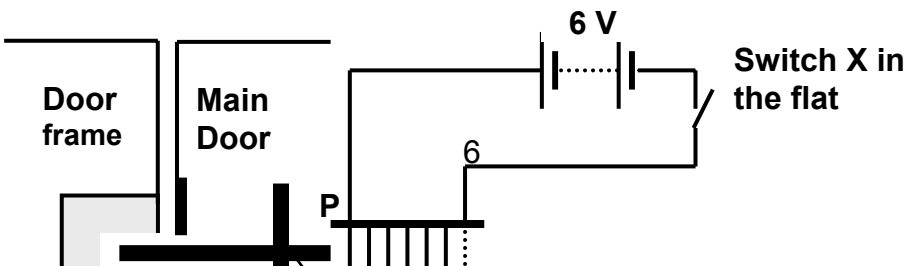
(c) The moon is a natural _____of Earth. The moon can be seen because it _____light falling on it from the Sun. (2)

(d) A communication satellite orbits Earth above the Equator once every _____hours. (1)

(e) A _____ is a group of stars. (1)

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

9. The diagram below shows a type of electromagnetic lock of the main door of a block of flats which can be opened from each flat by a switch X.



When switch X in the flat is closed, the iron bar moves towards end P of the solenoid and out of the door frame, allowing the main door to be opened.

a. When switch X in the flat is closed a current flows through the solenoid PQ:

   i. State the polarity of end P of the solenoid PQ of the door lock when switch X is closed. (2)
   ii. Explain why the iron bar moves into the solenoid when switch X in the flat is closed allowing the door to be opened. (2)
   iii. Why does the iron bar move back into the door frame when switch X in the flat is switched off. (2)

b. The 6V battery is now connected the other way round, so that current enters the solenoid from end Q and leaves the solenoid through end P.

   i. What effect does this have on the polarities of the solenoid PQ when switch X is closed? (1)
   ii. Will the door lock function correctly with the battery connected in this way? Explain. (2)

c. When the battery has been used for some time, its voltage falls to 4.0 V. Explain why the lock may now not work correctly. (2)

d. The battery is now replaced by a 6 V a.c. supply.
   i. Name the device used to step down a 240 V a.c. supply to a 6 V a.c. supply. (2)
   ii. Give **one advantage** of using a 6 V a.c. supply rather than a 6 V battery. (1)
   iii. Give **one disadvantage** of using a 6 V a.c. supply rather than a 6 V battery. (1)

10. A student is asked to investigate how the resistance of a thermistor varies with temperature.

   (a). Draw a diagram for a circuit suitable for such an investigation. Label all instruments on your diagram. (3)

   (b).(i). The thermistor is immersed in a beaker of water. Explain how its temperature may be changed. (2)

(ii). Name one precaution which needs to be taken to ensure that the temperature is recorded accurately. (1)

(c). The student records the resistance of the thermistor at various temperatures and obtains the following results

Resistance, R/kΩ	7000	5000	3500	2500	1500	1000
Temperature, $t/^0C$	15	20	30	40	60	80

(i). Plot a graph of the resistance (on Y-axis) against temperature (on X-axis). (5)

(ii). The student then places the thermistor in the room for some time. The resistance is then taken and found to be 5500 kΩ. Use your graph to find the temperature of the room. (2)

(iii). Explain how the thermistor and the graph may be used as a thermometer. (2)

11. When a moving lorry hits a parked car on level ground, they continue to move in the same straight line.

(a). Momentum can be found using: Momentum = m v

(i). State the units of momentum. (2)

(ii). Write down the Principle of Conservation of Momentum. (2)

(b). The mass of the lorry is 4000 kg and is travelling at 10 m/s. The mass of the parked car is 1000 kg.

(i). What is the initial velocity of the combined vehicles immediately after collision? (2)

(ii). Name the force that is responsible for the two vehicles to come to a stop. State its direction. (2)

(iii). If the vehicles take 4 s to come to a stop, calculate the deceleration. (2)

(iv). Calculate the size of the force required to stop the vehicles. (2)

(c). As a car crashes into a wall, the driver continues to move forward at the speed of the car. On hitting the dashboard the driver comes to rest almost instantly getting injured in the process.

Since, Force = change in momentum/time,
Explain why a seat belt, being slightly elastic, helps reduce injury. (3)