RWANDA NATIONAL EXAMINATIONS COUNCIL

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**141**

# NATIONAL EXAMINATION COUNCIL 2002/2003

**SUBJECT : PHYSICS IV**

**LEVEL : TRONC COMMUM**

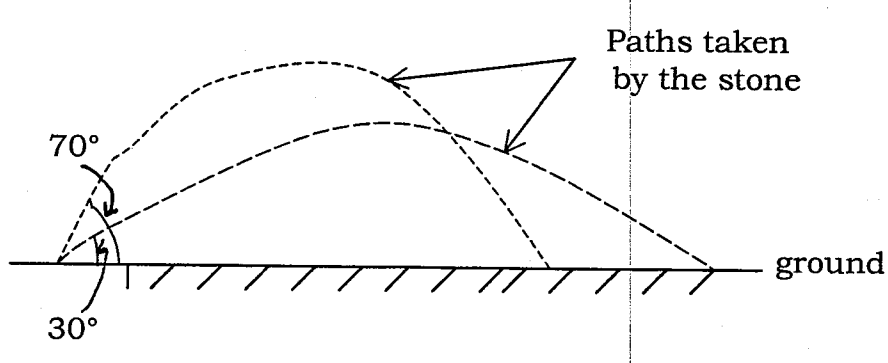
**DURATION : 3 HOURS**

**INSTRUCTIONS :**

- This paper consists of three Sections **A**, **B** and **C**.
- Answer **ALL** the questions in Section **A**, 3 questions in Section **B** and 1 question in Section **C**.
- Calculators and mathematical instruments may be used.

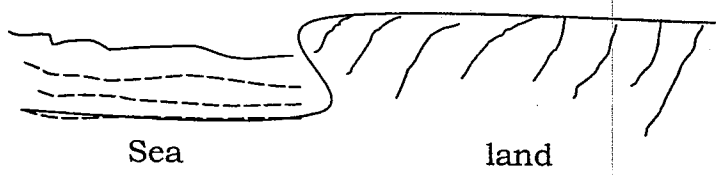
## SECTION A : /55 Marks

1. A stone is thrown into the air at an angle of 70° as shown in the figure below. The same stone is again thrown with the same force and speed at an angle of 30°.




(a) For which angle does the stone travel the farthest ? **(1mark)**
(b) Why does the stone fall to the ground each time ? **(1mark)**
(c) At which of the two angles should a high jumper leave the ground in order to jump the highest ? **(1mark)**

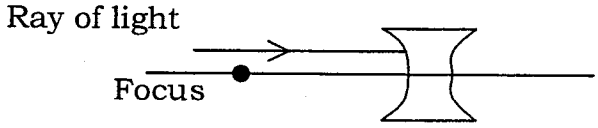
2. By mid-day, land can get much hotter than water in the sea.
(a) Copy the diagram below and show how the air will move between the land and the sea at that time. **(2marks)**




(b) What is the name given to the process in 2(a) above by which the air moves ? **(1mark)**

(c) A piece of iron of mass 200g and specific heat capacity 460J/KgK cools down from 120°C to 70°C. Calculate the heat lost. **(2marks)**

3. (a) (i) What kind of lens is shown below ? **(1mark)**



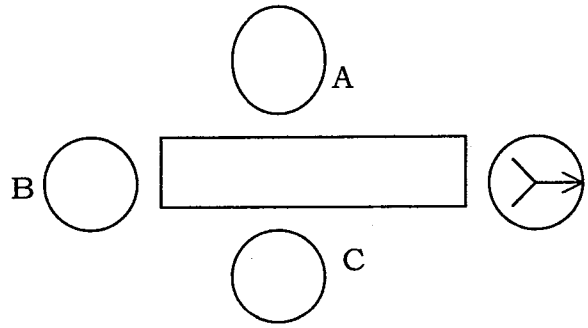
(ii) Copy the diagram in your answer book and complete the ray of light as it travels through the lens. **(1mark)**

(b) An object is placed 4cm in front of the above lens. A virtual image is produced 1cm from the lens.

(i) What is the magnification produced by the lens? **(1mark)**
(ii) If the image is 1.5cm tall, how tall is the object? **(2marks)**

4. (a) Draw a diagram to illustrate how one may magnetize iron nail by using a bar magnet. **(1½marks)**

(b) Copy the diagram below and insert arrows in the magnetic compasses A, B and C around the bar magnet and hence label the poles of the magnet.

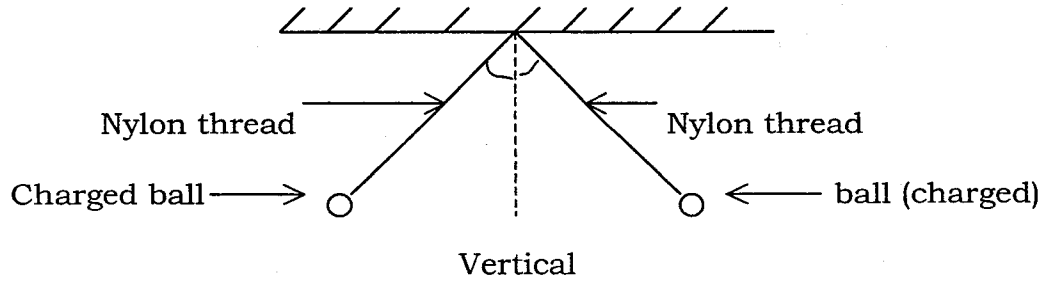



**(2marks)**

5. (a) A boy raises a hammer and then hits the nail. State the energy changes which occur. **(2marks)**

(b) The potential energy of a 5kg mass is 100 Joules. Calculate how high the mass is from the ground. Take g = 10m/s² **(2marks)**

6. Two light charged balls are suspended on nylon threads and then released. Immediately the balls come to rest with the threads making equal angles with the vertical as shown in the diagram below.



(a) What can you say about the charges on the balls? **(1mark)**

(b) What would happen to the balls if somebody touches one of the balls? **(1mark)**

(d) A steady current of 2A flows passing a point. Find the charges which pass the point in 3 seconds. **(1½marks)**

7. (a) Name the simple machine that can be used to lift small masses in a laboratory. **(1mark)**

(b) State why the efficiency of the machine in 7(a) is less than 100%. **(1mark)**

(c) A machine lifts a mass of 150g through a vertical height of 8cm. Calculate the work done. **(2marks)**

8. (a) The density of sea water is greater than the density of pure water. Why? **(1½marks)**

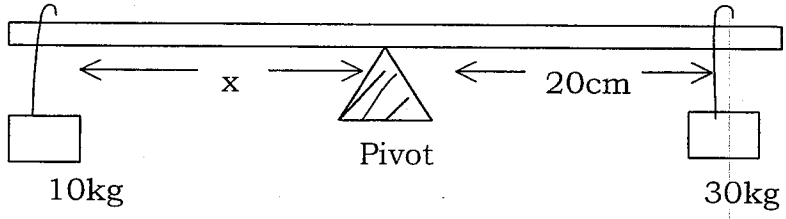
(b) The volume of a substance is 280cm$^3$ and its mass is 336g. Calculate the density of the substance. **(1mark)**

(c) State the differences between density and relative density of a substance? **(1½marks)**

9. (a) A tall person is more likely to fall down than a short person if the two persons are climbing the same hill. Why? **(2marks)**

(b) Draw a cone seated on a plane surface in unstable equilibrium position. **(1mark)**

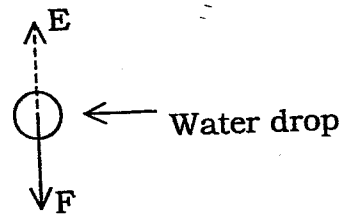
(c) Calculate the distance x when the figure below balances. **(2marks)**



10. (a) Name the unit that is the same as a watt. **(1mark)**

(b) A person takes 1 minute 15 seconds to run a distance of 100m. Calculate the person's power if his weight is 600N. **(2marks)**

11. The figure below shows forces E and F acting on a falling drop of water to the ground.




(a) Name force (i) E **(½mark)**
(ii) F **(½mark)**

(b) State what causes force E. **(1mark)**

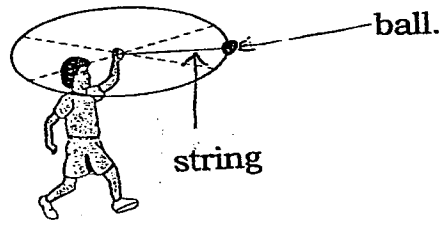
(c) What would happen to the drop of water if forces E and F are equal? **(1mark)**

12. (a) Methylated spirit is said to be a volatile liquid. What does this mean? **(1mark)**

(b) When a drop of methylated spirit is put on the skin, the skin feels cold and the drop disappears. Explain this effect. **(2marks)**

(c) In which domestic electrical appliance is a volatile liquid used? **(1mark)**

13. A boy swings a ball attached to the end of a string in horizontal circle above his head as shown in the diagram below.

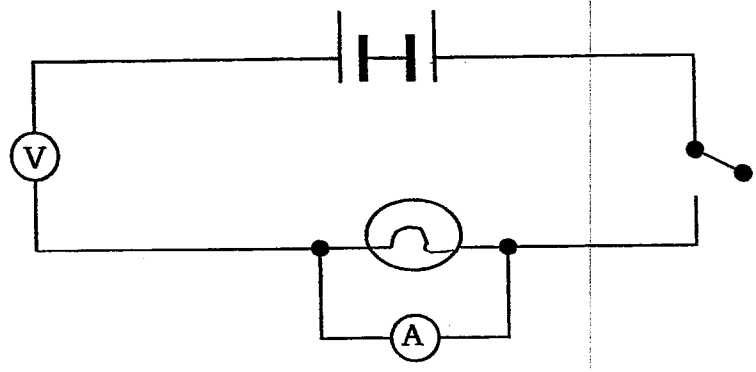


(a) Name the force in the string pulling inwards on the ball. **(1mark)**

(b) What happens to the force in the string when the speed of the ball increases? **(1mark)**

(c) In which direction does the ball move when the string breaks? **(1mark)**

14.



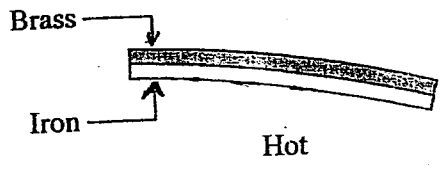

(a) From the electric circuit above there are three mistakes. Which are the mistakes? **(1½marks)**

(b) Draw the electric circuit above correctly so that the voltmeter reads the potential difference across the cells and the ammeter reads the current flowing in the circuit. The switch should be on. **(2marks)**

(c) Electric lamps in houses are connected in parallel and not in series. Why? **(1½marks)**

**SECTION B:** **/30 Marks**

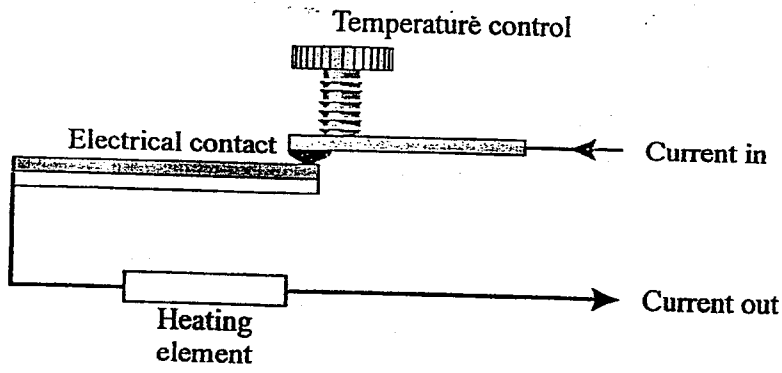
15. (a) Below is a bimetallic strip made from brass and iron joined together. When heated, the metals expand but by different amounts as shown in the diagram.




(i) Which of the two metals expands faster ? **(1mark)**

(ii) Draw the bimetallic strip when it has cooled down. **(1mark)**

(b) A bimetallic strip is used to control the operating of an electric iron. See a simple diagram below.

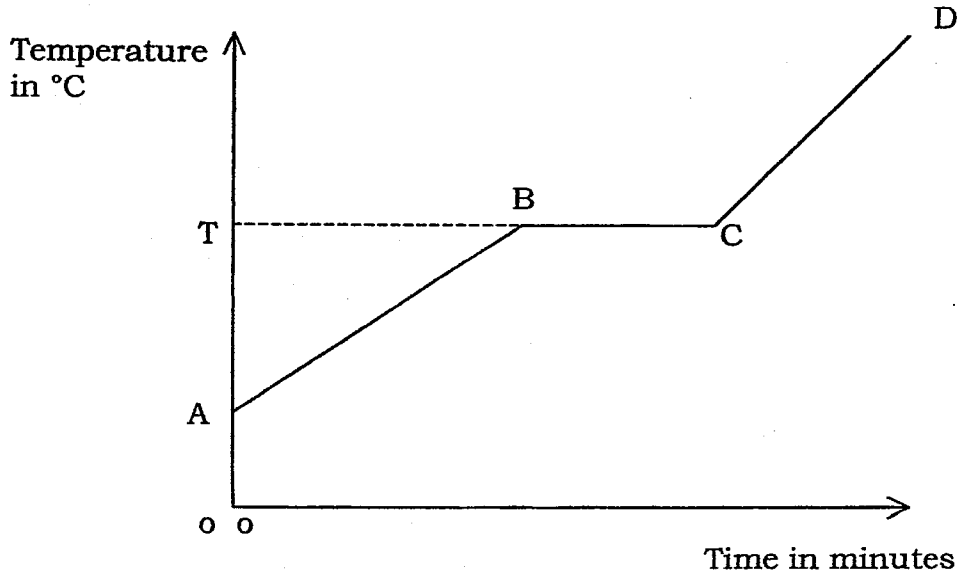



From diagram above

(i) What is the use of electric current? **(1mark)**

(ii) How does the bimetallic strip work? **(3marks)**

(c) A solid substance was heated and the graph below shows how the temperature of the substance changed as the heat was given to it.




(i) What does the temperature A represent? **(1mark)**

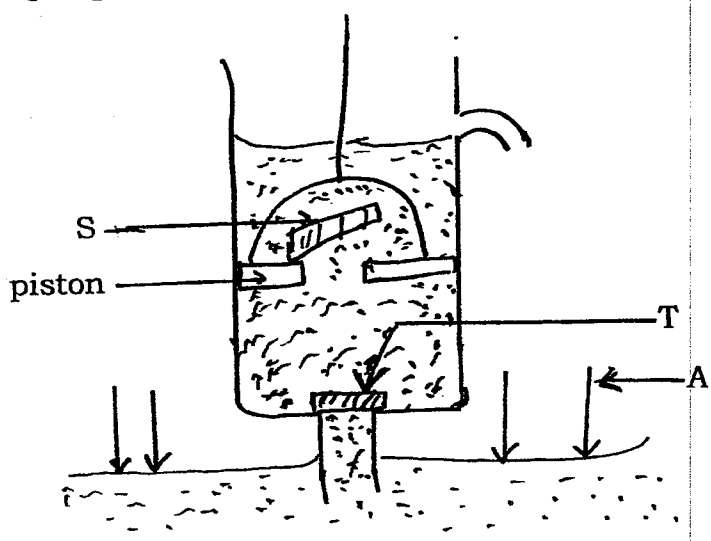
(ii) Why does the temperature from B to C not change while the substance is being heated? **(1mark)**

(iii) What is the temperature T of the substance called? **(1mark)**

(iv) What is the state of the substance from C to D? **(1mark)**

16. (a) Given a drinking glass, a piece of paper and some water, draw well labelled diagrams to show that the air of the atmosphere exerts pressure in all directions. Give a brief explanation. **(3marks)**

(b) Below is a diagram of a simple lift pump. The piston is going down.




(i) Name parts A, T and S. **(1½marks)**

(ii) Explain what is happening to the water as the piston moves down. **(2marks)**

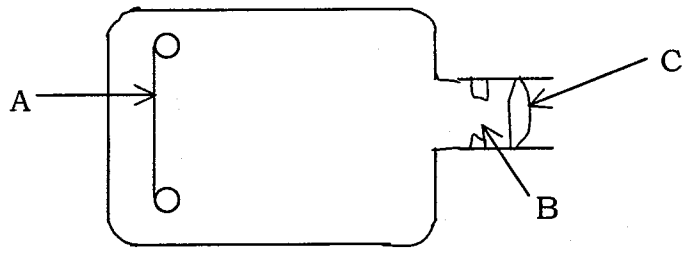
(iii) Briefly explain what happens when the piston moves up. **(2½marks)**

(c) A mass of 20kg rests on a square surface measuring 0.2m by 0.2m. Calculate the pressure exerted by the mass on the surface. Take $g = 10m/s^2$. **(2marks)**

17. (a) What is meant by an annular eclipse? **(1mark)**

(b) With an aid of a well labeled diagram show how umbra and penumbra shadows form. **(4marks)**

(c) The figure below shows a simple camera.




(i) Name parts labelled A, B and C. **(½mark)**

(ii) What is the use of part B? **(½mark)**

(iii) Which part of the camera is similar in action to the iris of the eye? **(½mark)**

(iv) What part of the eye is similar in action to part A of the camera? **(½mark)**

(d) (i) An oblique ray of light travels from air and continues through the water. State the relationship between the ray of light in the air, the normal and the ray of light in water. **(1½marks)**

(ii) Draw a diagram to show this relation in 18(d)(i) above. **(1½marks)**

18. (a) What is meant by a uniform velocity? **(1mark)**

(b) Sketch a graph of a body moving with a uniform velocity. Label distance on y-axis and time on x-axis. **(2marks)**

(c) Write the standard unit of acceleration. **(1mark)**

(d) The initial velocity of a moving body is 10m/s. In 5 seconds time, the velocity of the body reaches 30m/s. The body maintains the velocity.

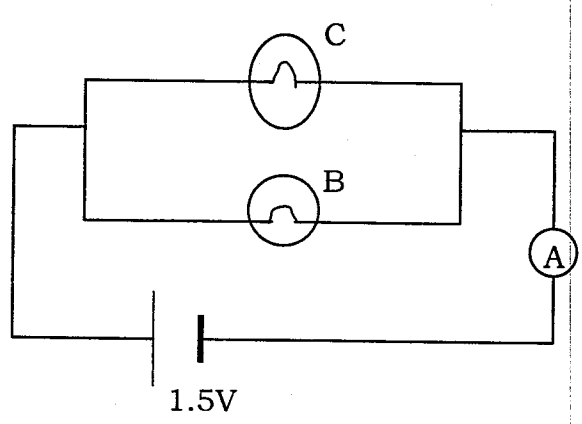
(i) Calculate the acceleration of this body. **(2marks)**

(ii) Calculate the distance moved by the body during the 5 seconds. **(2marks)**

(iii) What distance does the body travel in 45 minutes time? **(2marks)**

19. (a) State Ohm's Law. **(2marks)**

(b) Copy the simple circuit below and insert
(i) a switch, $s_1$, to control current flow through lamp C
(ii) a voltmeter to measure voltage across lamp B.
**(2marks)**




(c) Calculate the electric current flow recorded by the ammeter, -Ⓐ-, in the circuit if resistance of lamp C is 2 Ohms and that of lamp B is 3 Ohms. **(2marks)**

(d) Draw a simple electric bulb and describe briefly how it gives off light. **(4marks)**

**SECTION C:** **/15 Marks**

20. Describe an experiment to demonstrate that light travels in a straight line. Use any necessary diagram to make your answer clear.

21. You are provided with the following apparatus:
Eureka can, 2 beakers, water, balance, Newton balance and metal.
Describe an experiment to verify Archimedes' Principle for a metal in water.

22. You are provided with dilute Sulphuric acid in a beaker, Copper plate (electrode), Zinc plate (electrode), connecting wire and a bulb.

(a) With an aid of a well labelled diagram explain how an electric current is produced by a simple cell.

(b) How do you show that the electric current is produced by the simple cell.

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