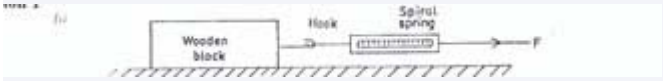
Physics Paper 1, May/June. 2011

Alternative a
Question 1
(a) Diagram



You are provided with a wooden block to which a hook is fixed, set of masses, spring balance and other necessary materials.

Using the diagram above as a guide, carry out the following instructions.

1. Record the mass mo indicated on the wooden block
2. Place the block on the table.
3. Attach the spring balance to the hook
4. Pull the spring balance horizontally with a gradual increase in force until the block just starts to move. Record the spring balance reading F.
5. Repeat the procedure by placing in turn mass m = 200, 400, 600 and 800 g on top of the block. In each case, read and record the corresponding value of F.
6. Evaluate M = mo + m and R = in each case.
7. Tabulate your readings.
8. Plot a graph with F on the vertical axis and R on the horizontal axis.
9. Determine the slope, s, of the graph.
10. State two precautions taken to ensure accurate results.

(b) (i) Define *coefficient of static friction*. [2 marks]

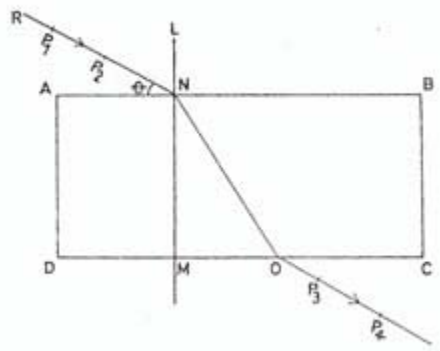
(ii) A block of wood of mass 0.5 kg is pulled horizontally on a table by a force of 2.5 N Calculate the coefficient of static friction between the two surfaces. (g = 10ms-2) [2 marks]

This question on the laws of solid friction was very

Question 2
(a) Diagram

= 0.5

Question 2 (a)



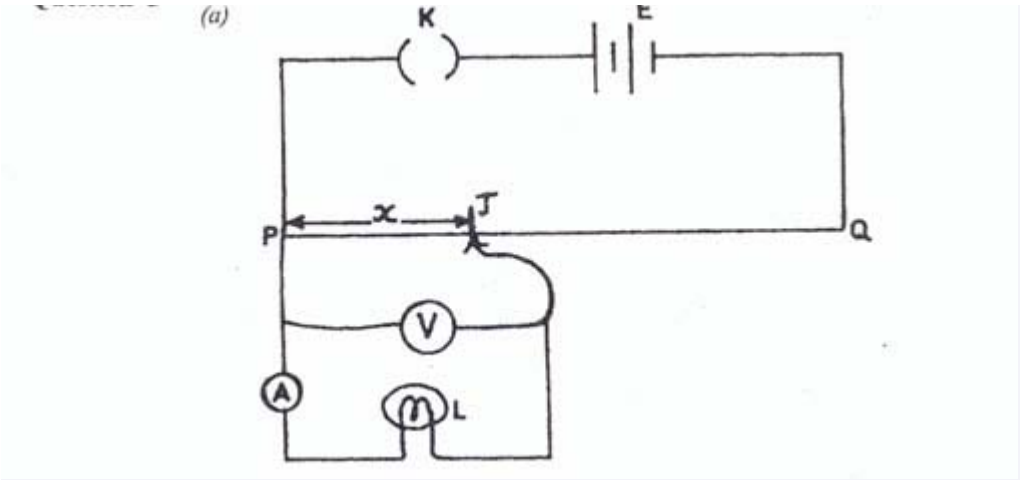
Use the diagram above as a guide to carry out the following experiment.

1. Trace the outline ABCD of the rectangular glass prism on the drawing paper provided.
2. Remove the prism. Select a point N on AB such that AN is about one quarter of AB.
3. Draw the normal LNM. Also draw a line RN to make an angle θ = 75o with AB at N
4. Fix two pins at P1 and P2 on line RN. Replace the prism on its outline.
5. Fix two other pins at P3 and P4 such that they appear to be in a straight line with the images of the pins at P1 and P2 when viewed through the prism from side DC.
6. Remove the prism and the pins at P3 and P4 Draw a line to join P3 and P4.
7. Produce line P4P3 to meet the line DC at O. Draw a line to join NO.
8. Measure and record the values of MO and NO.
9. Evaluate ϕ = and cos θ.
10. Repeat the procedure for four other values of θ - 65o, 55o, 45o and 35o. In each case, evaluate ϕ and cos θ
11. Tabulate your reading
12. Plot a graph with cos θ on the vertical axis and ϕ on the horizontal axis.
13. Determine the slope, s, of the graph.
14. Sate two precautions taken to ensure accurate results.

(Attach your traces to your answer booklet.)

(i) State Snell's law of refraction.
(ii) Calculate the critical angle for the glass prism used in the experiment above if its refractive index is 1.5.

Question 3
(a) Diagram



You are provided with cells, a potentiometer, an ammeter, a voltmeter, a bulb, a key, a jockey and other necessary materials.

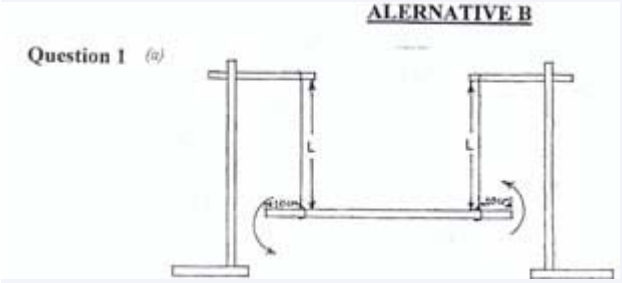
1. Measure and record the emf E of the battery.
2. Set-up a circuit as shown in the diagram above.
3. Close the key K and use jockey to make a firm contact at J on the potentiometer wire such such that PJ = x = 10 cm.
4. Take and record the voltmeter reading and the corresponding ammeter reading .
5. Evaluate log V and log I
6. Repeat the procedure for other values of x = 20, 30, 40, 50 and 60cm.
7. Tabulate your readings.
8. Plot a graph with log I on the vertical axis and log V on the horizontal axis.
9. Determine the slope, s, of the graph.
10. Determine the intercept, c, on the vertical axis.
11. State two precautions taken to ensure accurate results.

(b) (i) How is the brightness of the bulb affected as x increases? Give a reason for your answer.

(ii) List two electrical devices whose actions do not obey Ohm's law

Question 4

(a) Diagram



You are provided with two retort stands, two metre rules, pieces of thread and other

necessary apparatus.

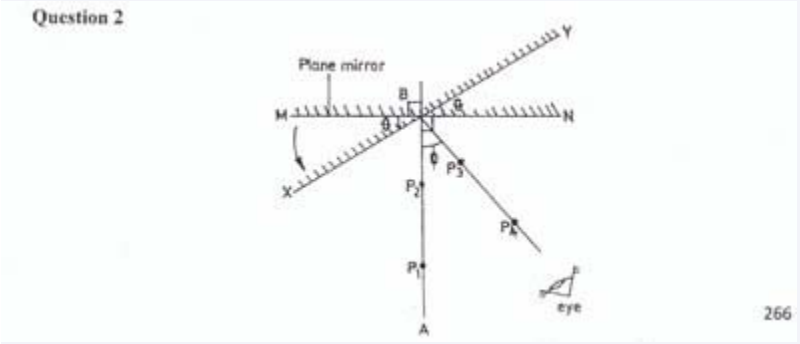
1. Set-up the apparatus as illustrated above ensuring that the strings are permanently 10 cm from either end of the rule.
2. Measure and record the length L = 80 cm of the two strings.
3. Hold both ends of the rule and displace the rule slightly, then release so that it oscillates about a vertical axis through its centre.
4. Determine and record the time t for 10 complete oscillations.
5. Determine the period T of oscillations
6. Evaluate log T and log L,
7. Repeat the procedure for four other values of L = 70, 60, 50 and 40 cm.
8. Tabulate your readings.
9. Plot a graph with log T on the vertical axis and log L on the horizontal axis.
10. Determine the slope, s, and the intercept, c on the vertical axis.
11. State two precautions taken to ensure accurateresults.

b (i) Define simple harmonic motion

(ii) Determine the value of L corresponding to t = 12s from the graph in (a) above.

Question 5

(a) Diagram



1. Fix the drawing paper provided on the cellotex board.
2. Place the plane mirror vertically, along its breadth, on the drawing paper. Trace its outline MN, Remove the mirror
3. Mark the middle, B of the outline. Draw a normal AB to meet the outline at B.
4. Draw another line XY through B such that it makes an angle i = 10o at B, with the outline of the mirror.
5. Fix two pins, P1 and P2, on AB. Replace the mirror on its outline. Rotate the mirror gently until it tests on the new line XY. Ensure that the position of B on the outline is maintained
6. Locate the images of P1 and P2 in the mirror. Fix two other pins P3 and P4 such that they appear to be a straight line with the images of P1 and P2.
7. Remove the mirror and the pins P3 and P4

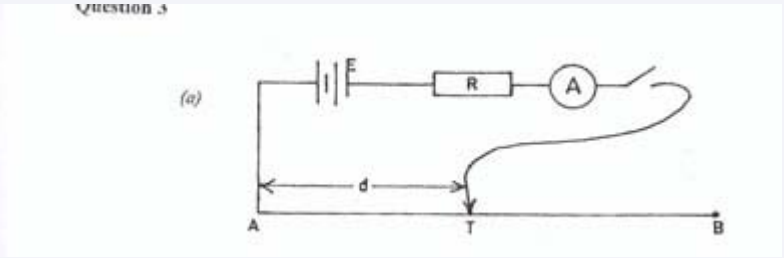
8. Draw a line to join the pin holes of P3 and P4. Produce the line to meet MN at B as shown in the diagram above.
9. Measure and record ϕ.
10. Repeat the procedure for four other values of θ = 15o, 20o, 25o and 30o. In each case, measure and record the corresponding value of ϕ.
11. Tabulate your readings.
12. Plot a graph with ϕ on the vertical axis and θ on the horizontal axis.
13. Determine the slope, s, of the graph.
14. State two precautions taken to obtain accurate results.

(b) (i) State the laws of *reflection of light.*

(ii) List four application of plane mirrors

Question 6

(a) Diagram



You are provided with a potentiometer, an ammeter, a standard resistor, cells and other necessary materials.

1. Connect the circuit as illustrated in the diagram above.
2. Use the jockey to make contact with the wire at a point T such that AT = d = 20cm
3. Close the key, take and record the ammeter reading I
4. Evaluate I-1
5. Repeat the procedure for the values of d = 30, 45, 60, 70 and 85 cm.
6. Tabulate your readings.
7. Plot a graph with I-1 on the vertical axis and d on the horizontal axis.
8. Determine the slope, s, and the intercept, c. on the vertical axis.
9. Evaluate
10. State two precautions taken to ensure accurate results.

(b)(i) From the experiment above, suppose E = 2V, determine the value for R using your intercept, c, on the graph.

(ii) From the graph, determine the value of I when d = 90 cm

Physics Paper 2, May/June. 2011

Question 1

A stone projected horizontally from the top of a tower with a speed of 4 *ms*-1 lands on the level ground at a horizontal distance of 25 *m* from the foot of the tower. Calculate the height of the tower.

[g = 10 *ms*-2]

Question 2

1. Explain *diffusion.*
2. Give one reason why the rate of diffusion is higher in gasses than in liquid at the same temperature.

Question 3

State:

the difference between *plane polarized light* and *ordinary light;*

two uses of polaroids.

Question 4

State

1. two applications of electrolysis in an industry;
2. one application of electrolysis in a school laboratory.

Question 5

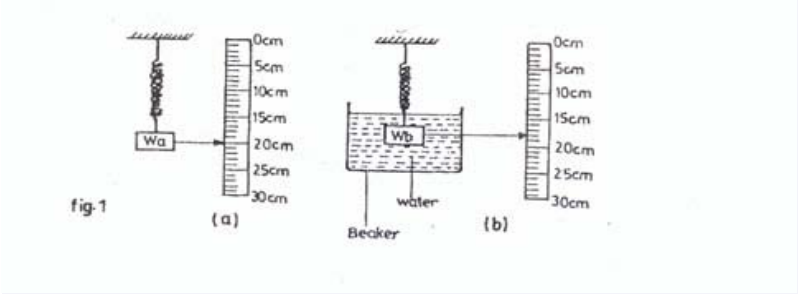


fig.1

In fig. 1a and fig. 1b above, Wa and Wb represent the respective loads on a spring placed near a 30cm rule, when in air and when in water.

(a) Identify the force causing shrink in the spring in fig. 1(b).

(b) Given that the force constant of the spring is 2.0 x 1011 Nm-1, calculate the workdone by the force in causing the shrink.

In response, the force to be identified is the upthrust. Many candidates correctly identified upthrust however, they failed to put down the correct formula. Those that were able to write the correct formula missed the arithmetic because of conversion from cm to m while some got the arithmetic but omitted the unit/put down wrong units.

The expected answers are:

(a) The force is the upthrust of the water

(b) Workdone = ½ Kx2 = ½ (2.0 X 1011) X (2.0 X 10-2)2 = 4.0 X 107 J

Question 6

Explain why water in a narrow glass tube has a concave meniscus while mercury, in the same tube, has a convex meniscus.

Question 7

State three methods of polarizing an unpolarized light.

Question 8

An electron of charge 1.60 x 10-19C is accelerated under a potential difference of 1.0 x 105*V*. Calculate the energy of the electron in joules.

Question 9

State three properties of cathode rays which suggest the particle nature of matter.

Question 10

The uncertainty in determining the duration during which an electron remains in a particular energy level before returning to the ground state is 2.0 x 10-9s. Calculate the uncertainty in determining its energy at that level. ($\frac{h}{2\pi}$ = h = 1.054 x 10-34 Js)

Question 11

1. What is a *vector quantity*?
2. Three vectors 3 ms-1 N 45o W, 12 ms-1W and 5ms-1 S act at a point.
3. Sketch a vector diagram to illustrate the given information
4. Calculate the resultant of the vectors.
5. In a laboratory experiment to determine the force constant of a spiral spring, the mass on the spring was varied and the corresponding extensions were measured and recorded as shown in the table below.

Mass m/g	Weight W/N	Extension e/cm
50		6.5

100		11.0
150		15.0
200		20.0
250		25.0

1. Copy and complete the table. (Take g = 10ms-2)
2. Plot a graph with weight, W, on the vertical axis and extension, e, on the horizontal axis.
3. Using the graph, determine the force constant of the spring.
4. Determine the natural length of the spring if its length was 38.0 cm when loaded with 250 g mass.

Question 12

1. (i) State two advantages of alcohol over mercury as a thermometric liquid.

   (ii) When the bulb of a thermometer is placed in a beaker of hot water, the level of mercury first falls and then rises gradually. Explain this observation.
2. List two factors, other than temperature, that affect the rate of evaporation of a liquid.
3. A block of lead of mass 100kg in a crucible and at a temperature of 40oC was placed in an electric furnace rated 10kW. If the melting point of lead is 320 oC, calculate the:

   (i) quantity of heat required to heat the lead to its melting point;

   (ii) additional heat energy required to melt the lead;

   (iii) time taken to supply this additional energy.

   (Specific heat capacity of lead = 120JKg-1 K-1

(Specific latent heat of fusion of lead = 2.5 x 104 JK-1)

4. State two precautions necessary in an experiment to determine the specific latent heat of vaporization of water.

Question 13

(a) State two factors which affect the angle of deviation of a ray of light through a triangular glass prism.

(b)Seven virtual images of an object are formed when two plane mirrors are inclined at an angle 0 to each other. Calculate the value of 0

(c)By means of a ripple tank, a student was able to generate series of transverse waves by varying the frequency ofthe dipper and all the waves so generated covered a distance of 0.80 m in 0.2 s.

(i)Determine the speed, v, of the waves

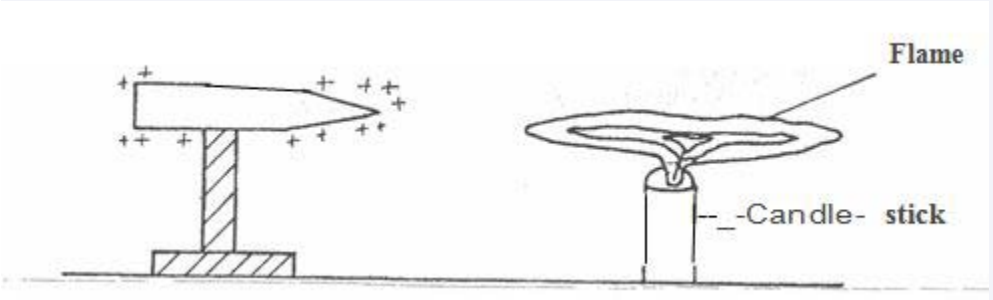
(ii)Copy and complete the table given above in your answer booklet.

(iii)Plot a graph with f on the vertical axis and h^{-1} on the horizontal axis.

(iv)What does the slope of the graph represent?

Question 14

(a)

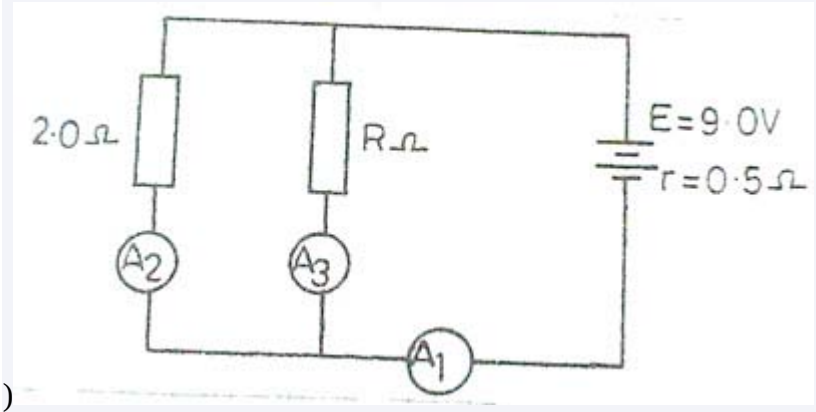


When a positively charged conductor is placed near a candle flame, the flame spreads out as shown in the diagram above.

Explain this observation.

(b)A proton moving with a speed of 5.0 x 10^5 ms^{-1}; enters a magnetic field of flux density 0.2 T at an angle of 30° to the field. Calculate the magnitude of the magnetic force exerted on the proton.[proton charge = 1.6X 10^{-19}C]

(c)



)

The diagram above illustrates 9.0 V battery of internal resistarIce 0.5Ωconnected to two resistors of values 2.0Ωand R Ω A_1,A_2 and A_3, are ammeters of negligible internal resistances. If A_1 reads 4.0 A, calculate the:

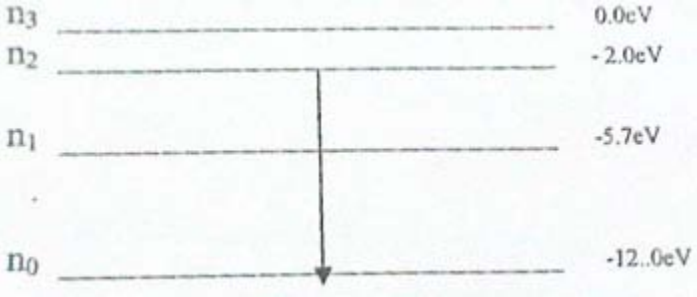
(i) equivalent resistance of the combined resistors 2.0Ω and RΩ

(ii) currents through A_2 and A_3;

(iii) value of R.

Question 15

(a) State three conclusions that can be drawn from Rutherford's experiment on the scattering of alpha particles by a thin metal foil in relation to the structure of the atom.



The diagram above illustrates the energy levels of an electron in an atom. If an excited electron moves from n2 to ns. Calculate the:

(i) frequency;

(ii) wavelength

of the emitted radiation.

[h = 6.6 X 10-34 *Js; 1eV*= 1.6 X 10-19 *J;* C = 3.0 X 108 ms"]

(c)The following nuclear equations represent two types of radioactivity.

$$^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}\alpha$$ (Equation A)

$$^{14}_{7}N + {}^{4}_{2}\alpha \rightarrow {}^{17}_{8}O + {}^{1}_{1}P$$ (Equation B)

Identify each type and explain briefly the difference between them.