DTEMS PAST PAPERS
TECHNICAL.

SIR ARTHUR LEWIS COMMUNITY COLLEGE
DIVISON OF TECHNICAL EDUCATION AND MANAGEMENT STUDIES

EXAMINATION SESSION	:	End of Semester Two Examination
TUTOR	:	R. John Baptiste, A. Daniel, K. Harris, K. Numa
COURSE TITLE	:	Physics
COURSE CODE	:	Phy102
CLASS	:	Year 1
DATE	:	6th May, 2009
TIME	:	9:00 a.m.
DURATION	:	2 Hours
ROOM(s)	:	CEHI-1H-02
INVIGILATOR(s)	:	**N. Heeralall,** M. Plummer, S. Yarde

INSTRUCTIONS:

- This paper contains **four (4) sections; A, B, C and D**.
- **Answer six (6) questions, at least one (1) question from each section and no more than two (2) from any section.**
- Write **only your ID number** on the answer scripts
- All **cell phones** should be **off**
- Students must produce sufficient working steps, to justify solution.
- Formulae used in obtaining solutions must first be stated.
- Write legibly.
- Number all questions attempted properly.
- All submitted work must be in ink/pen (preferably **Blue or Black**)

SECTION A

1. (a) Explain what is meant by the dimensions of a physical quantity. [2]

(b) Express the units of the following derived quantities using the products of base units only?

(i) work

(ii) charge [4]

(c) It is believed that the period of a of a simple pendulum T is related to the mass of the bob m, the length of the string l and the acceleration due to gravity g. An equation can then be written in the form $T = k\, m^x\, l^y\, g^z$, where k is a dimensionless constant and x, y and z are unknown indices. Use the method of dimensions to determine the values of x, y and z and hence write the equation for the period of oscillation. [4]

2. (a) Given $F = 2\pi r l v \eta / R$ where F is force, r is radius, l is length, v is speed and R is distance determine the dimensions and SI units of η (viscosity). [4]

(b) Determine if the two equations below are homogeneous [6]

i) $x = x_o + v_o t + (1/2)\, a t^2$, where x is the displacement at time t , x_o is the displacement at time $t = 0$, v_O is the velocity at time $t = 0$, a is the constant acceleration

ii) $P = \sqrt{\rho g h}$, where P is pressure, r is density, g is gravitational acceleration, h is height.

3. (a) Distinguish between a systematic and a random error. Give one example of each [4]

(b) A graph of d (y-axis) is plotted against t^2 (x-axis) as shown in Fig.1

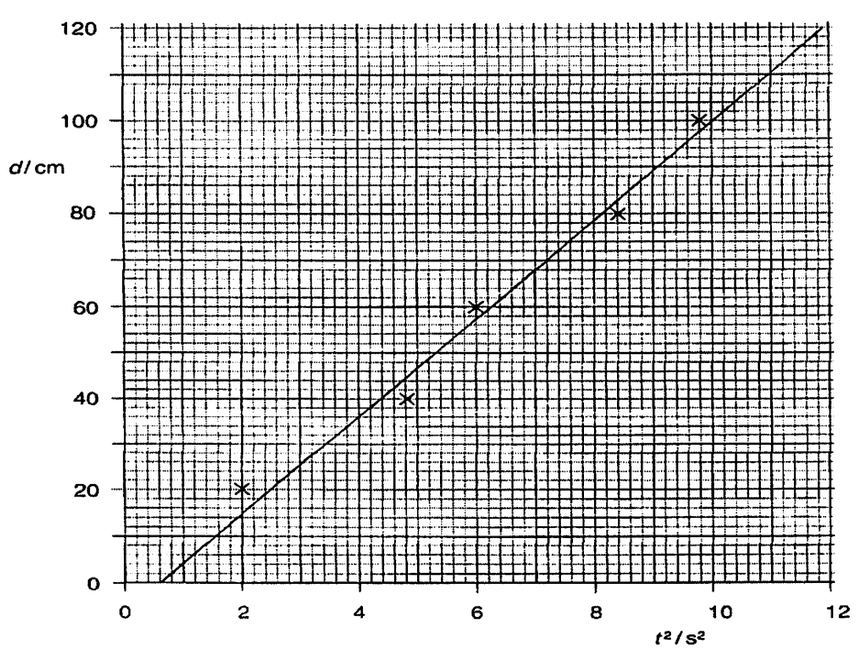


Fig. 1

Theory suggests that the graph is a straight line through the origin.

Name the feature on Fig.1 that indicates the presence of

(i) random error,

(ii) systematic error. [2]

(c) A student measured the speed of a transverse pulse in a spring using a metre rule and a digital stop watch.

(i) Explain how the measurement of the time may be precise but not accurate.

(ii) How can the accuracy be improved?

[4]

SECTION B

4. (a) An object attached to the end of a string is whirled round in a horizontal circle. Explain why the string holding the object cannot be horizontal. [2]

(b) A particle of moves along a circular path of radius 3.0 m with an angular velocity of 20 rad s^{-1}. Calculate:

(i) the linear speed of the particle,

(ii) the angular velocity in revolutions per minute,

(iii) the time for one revolution,

(iv) the centripetal acceleration [8]

5. An object of mass 450g moves in a circular path of radius 1·5m. It completes 2·5 revolutions per second. Calculate

i) the angular velocity [2]

ii) the linear speed of the object [2]

iii) the magnitude of the force needed to maintain this motion [3]

iv) the work done by this force during 10 revolutions. [3]

6. (a) Explain how the centripetal force is provided in each of the following cases.

i) a vehicle going round a bend

ii) a satellite orbiting the Earth [4]

(b) An aeroplane loops the loop in a vertical circle of radius 200 m, with a speed of 40 ms^{-1} at the top of the loop. The pilot has a mass of 80 kg. What is the tension in the strap holding him onto his seat when he is at the top of the loop? [6]

SECTION C

7. (a) Explain what is meant by resonance in an oscillating system. [2]

(b) Name two devices which operate by using resonance. [2]

(c) Using the same axes sketch the displacement – time graph for the following types of oscillations:

(i) free

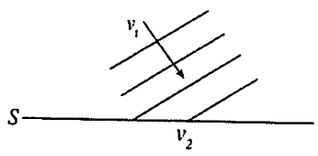
(ii) lightly damped,

(iii) heavily damped and

(iv) critical damped. [4]

(d)Identify two differences between progressive waves and stationary waves. [2]

8. (a) (i)

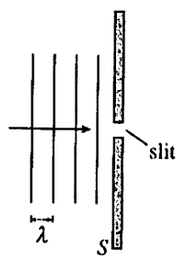


Waves after crossing the boundary S travel with a speed $v_2 = 2v_1$. Show the waves after crossing the boundary S.

[4]

(ii) Name the property of the wave displayed above. [1]

(b) (i)



Some plane waves are incident on an absorber S with a narrow slit whose width is smaller than λ. Show the waves that emerge from the slit.

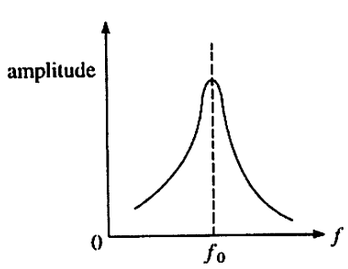
[2]

(ii) The wave above is replaced by one having a shorter wavelength. Sketch a diagram to show the incident and emerging wave. [2]

(iii) Name the property of the wave displayed above. [1]

9. (a) Identify three (3) instances where resonance is useful and three (3) instances where it is a nuisance. [6]

A pendulum is constructed from a fixed length of light thread and a spherical, low density, polystyrene bob. It is forced to oscillate at different frequencies f in air, and the response is shown in the graph.



(b) Copy the graph in section 9. (a). Use the same axes to show the results if

(i) The air resistance was decreased, and

(ii) The air resistance was increased. NB. Graphs must be labelled. [4]

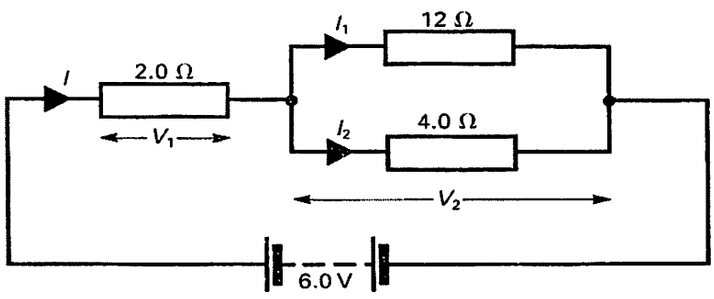
SECTION D

10. For the circuit shown below, calculate:

(a) The combined resistance of the 12 Ω and 4.0 Ω resistors [3]

(b) The total resistance of the circuit [2]

(c) I, (d) V_1 (e) V_2, (f) I_1, (g) I_2 [5]



11. In the circuit shown, (Figure A), find the reading of the ammeter A when the switch is:

i. Open;

ii. Closed. (Assume that the battery resistance is negligible).

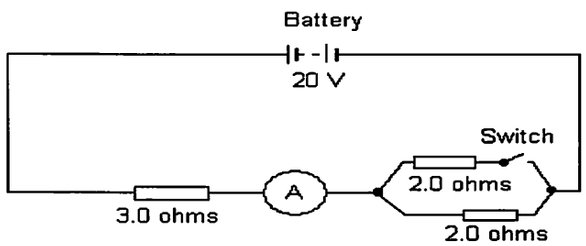


Figure A [10]

12. (a) State Ohm's Law. [2]

(b) A 2.4 Ω resistor is connected across the terminals of a dry cell of e.m.f 1.5v. If the internal resisteance of the cell is 0.6 ohms, calculate

(i) the current flowing in the circuit

(ii) the p.d. across the terminal of the cell [4]

(c) A cooling fan of resistance 55 ohms, connected to a 110 V supply.

(i) How much current flows through the fan?

(ii) What is the power rating of the fan? [4]

END OF EXAMINATION