

SECTION 1 (One hour)

- (a) What is a homogeneous equation?
- (b) The equation $(P^2 + 1)g + 17v^2 = k$ is homogeneous, where P is the pressure, h is the depth, g is the acceleration due to gravity, v the velocity and k is a constant. Determine the base units of k . (6 marks)

A girl swings a stone of mass 100 g at the end of a string in a horizontal circle of diameter 80.0 cm above her head. Her friend observing the action sees a shadow of the motion of the stone on a nearby wall and notices that the stone makes 150 revolutions in 5 minutes. Calculate.

- (a) The frequency of the motion
- (b) The centripetal force on the stone
- (c) Sketch a distance - time graph for this motion of the shadow for two cycles. (6 marks)

A quantity of steam at 100°C is passed into a 1.5 kg of pure melting ice in a highly insulated calorimeter so that the heat given out by the steam in condensing is just enough to melt the ice. Determine

- (a) The quantity of steam passed into the ice to melt it completely.
- (b) The equilibrium temperature attained by the mixture. (6 marks)

Figure 1 shows a small spherical charged metal bob 50 g which initially hangs vertically between two conducting plates. When a potential difference of 12.0 V is maintained across the plates the thread makes an inclination of 30° to the vertical.



- (a) Draw a free body diagram for the bob when the pd is applied.
- (b) Determine the charge on the bob. (5 marks)

5. Figure 2 shows how resistors may be connected in an electrical circuit. The bridge circuit is balanced when the voltmeter M_1 read 3.0 V

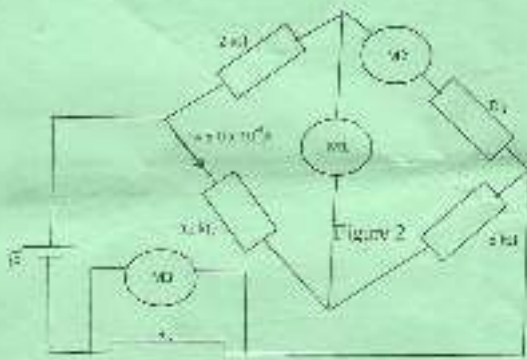


Figure 2

Determine the

- (a) readings of M_1 and M_2
 (b) resistances R_1 and R_2 and x .

(7 marks)

ANSWER EITHER 6 (a), (b) and (c) or (d), (e) and (f).

EITHER 6 (a), (b) and (c)

6. (a) (i) What is meant by a coherence light source?

(2 marks)

- (ii) Describe how you can determine the wavelength λ of monochromatic light using Young's Double Slits. Your account should include a diagram, observations, precautions and how you would use the observations to reach a conclusion.

(8 marks)

- (b) A car sounding an alarm at a frequency of 512 Hz is approaching a stationary listener at a speed of 8 ms⁻¹.

- (i) Explain why the listener has the impression that the frequency of the sound heard is varying.

(2 marks)

- (ii) What is the apparent frequency of the horn as perceived by the listener?

(3 marks)

- (c) An object is placed 20.0 cm away from a thin convex lens and then a thin concave lens each of focal distance 10.0 cm and perpendicular to the principal axis in each case. Use either ray diagrams or otherwise to distinguish clearly between the images obtained in each case when the object is brightly illuminated such that light rays from the object reach the lens parallel to the principal axis.

(5 marks)

OR 6 (d), (e) and (f)

- (d) Explain what is meant by a material is elastic?

(2 marks)

- (e) Describe an experiment to determine Young's Modulus for a copper wire. Your account should include a diagram, procedure, precautions, observations and conclusions.

(8 marks)

- (f) A toy having a plastic head resting on one end of a light spring is stretched as shown in figure 3.

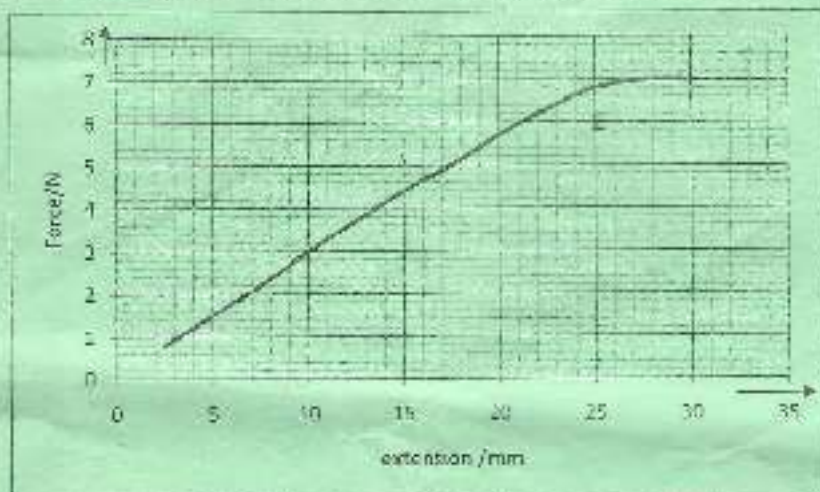


Figure 3

- (i) Explain why there is a change in the gradient of the graph at the point E?
- (ii) Calculate the maximum elastic potential energy of the toy-spring system.
- (iii) Explain what happens to the energy of the system when the load is removed and the spring regains its original length?

(2 marks)

(3 marks)

(1 mark)

Turn over