UNEB UACE PHYSICS PAPER 1 2018

SECTION A

1. a) What is meant by **relative velocity**?

b) A ship is heading due-north at a speed of 30kmh-1. Water in the lake is moving in the north-east direction at an average speed of 5kmh^{-1}.

Calculate the:

i) velocity of the ship

ii) distance off course the ship will be after 40 minutes

c) i) Explain why a passenger in a car jerks forwards when the brakes are suddenly applied.

ii) Use Newton's second law to define the Newton

d) Three forces of 8.0N, 12.5N and 2.0N act on a body of mass 0.7kg as shown in **figure 1**.

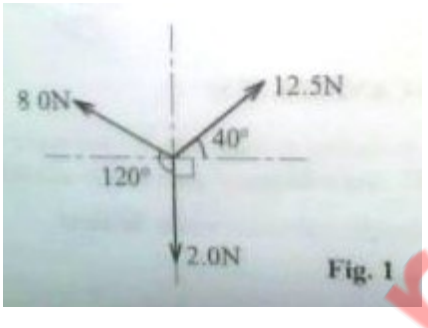

Fig. 1

Calculate the acceleration of the body.

2. a) What is meant by centre of mass?

b) Explain why a long spanner is preferred to a short one in undoing a tight bolt.

c) A uniform ladder of length 10m and weight 400N, leans against a smooth wall and its foot rests on rough ground. The ladder makes an angle of 600 with the horizontal.

If the ladder just slips when a person of weight 800N climbs 6m up the ladder, calculate the:

i) reactions of the wall and the ground

ii) distance another person of weight 600N can climb so that the same reactions are exerted as in (c) (i).

d) i) State the principle of conservation of energy.

ii) How does the principle in (d) (i) apply to a child sliding down an incline?

c) A pump with power output of 147.1 W can raise 2 kg of water per second through a height of 5m and deliver it into a tank. Calculate the speed with which the water is delivered into the tank.

f) Explain the effect of a couple on a rigid body.

3. a) What is meant by a

i) brittle material?

ii) ductilematerial?

b) Give one example of each of the materials in (a)

c) Explain why bicycle frames are hollow.

d) i) Sketch a labeled graph of stress against Strain for a ductile material

ii) Explain the main features of the graph in (d) (i)

e) Derive the expression for the energy stored per unit volume in a rod of length, L, Young's Modulus, Y, when strectched through distance, ***e***

f) A load of 5kg is placed on top of a vertical brass rod of radius 10mm and length 50cm. If Young Modulus of brass is

3.5×10^{10} Nm^{-2},

Calculate the:

i) decrease in ength

ii) energy stored in the rod

4a) Define the following:

i) Angular velocity

ii) Period

b) An object moves in a circular path of radius, r, with a constant speed, V. Derive an expression for its acceleration.

c) i) State two factors on which the rate of flow of a fluid through a tube depends

ii) Describe an experiment to measure the coefficient of viscosity of a liquid using Poiseulle's formula.

d) Find the time taken for an oil drop of diameter 6.0×10^{-3} mm to fall through a distance of 4.0cm in air of coefficient of viscosity 1.8×10^{-5} Pa. (*The density of oil and air are* 8.0×10^{2} kgm^{-3} *and 1 kg* m^{-3} *respectively*)

SECTION B

5. a) Define the following quantities

i) Thermometric property

ii) Specific heat capacity

b) i) State two examples of commonly used thermometric properties.

ii) Describe briefly how to determine the lower and upper fixed points for an uncalibrated liquid-in-glass thermometer.

c) i) Describe with the aid of a diagram, an experiment to determine the specific heat capacity of a liquid using the continuous flow method

ii)State two advantages of the continuous flow method over the method of mixtures.

iii) State two disadvantages of the method in (c) (i)

d) The brake linings of the wheels of a car of mass 800kg have a total mass of 4.8kg and are made of a material of specific heat capacity 1200J kg^{-1} K^{-1}. If the car is at $15mS^{-1}$ and is brought to rest by applying the brakes, calculate the maximum possible temperature rise of the brake linings.

6. a) i) What is meant by conduction of heat?

ii) Explain why mercury conducts heat better than water

iii) Explain the occurrence of and sea breezes.

b) A copper sphere of radius 7cm and density 900kg m^{-3}, is heated to a temperature of 127^0C and then transferred to an evacuated enclosure whose walls are at a temperature of 27^0C. Calculate the:

i) net rate of loss of heat by the copper sphere

ii) temperature of the copper sphere after 5minutes

c) Explain why heating systems based on the circulation of steam are more efficient than those based on the circulation of boiling water.

7a) i) What is meant by a black body?

ii) Give two examples of a black body

b) With the aid of graphs, describe how radiation emitted by a black body varies with wavelength for two temperatures.

c) i) Define thermal conductivity

ii) Describe an experiment to determine the thermal conductivity of glass.

d) Radiation from the sun falls normally on a blackend roof measuring 20m x 50m. If half of the solar energy is lost in passing through the earth's atmosphere, calculate the energy incident on the roof per minute.
(*Temperature of the sun's surface = 6000K; radius of the sun = 7.5 x 10^8 m; distance of the sun from the earth = 1.5 x 10^{11}m.*)

SECTION C

8. a) Define the following

i) Binding energy

ii) Unified Atomic Mass Unit

b) Explain how energy is released in a nuclear fusion process.

c) Explain what is observed in a discharge tube when the pressure is gradually reduced to low values.

d) With the aid of a labeled diagram, describe the operation of Bainbridge mass spectrometer in the determination of charge to mass ratio.

e) An ion of mass 2.6 x 10^{-26} kg moving at a speed of 4.0 x 10^4 ms^{-1} enters a region of uniform magnetic field of flux density 0.05T. Calculate the radius of the circle described by the ion.

9. a) i) State three differences between X-rays and cathode rays.

ii) Describe using a labeled diagram, the mode of operation on X-ray tube

iii) What is difference between soft and hard X – rays

b) i) What is the main distinction between work function and ionization energy?

ii) An electron of charge, e, enters at right angles into a uniform magnetic field of flux density ***B*** and rotates at a frequency, f, in a circle of radius, ***r***

Show that the frequency, f, is given by

$$f = \frac{Be}{2\pi m}$$

c) An X-ray beam is produced when electrons are accelerated through 50kV are stopped by the target of an X-ray tube. When the beam falls on a set of parallel atomic planes of a certain metal at a glancing angle of 16^0, a first order diffraction maximum occurs.

Calculate the atomic spacing of planes.

10.a) State two differences between alpha and beta particles

b) Describe with the aid of a diagram. the structure and mode of operation of an ionization chamber.

c) i) Explain the application of carbon -14 in carbon dating

ii) A sample of dead wood was found to have activity of 20 units due to carbon – 14 – isotope whose half-life is 5600 years.

If activity of wood just cut is 47.8 units, estimate the age of the sample.

d) The photoelectric work function of potassium is 2.25 eV. Light having a wavelength of 360mm falls on a potassium metal.

i) Calculate the stopping potential

ii) Calculate the speed of the most energetic electrons emitted by the metal.