GREENHILL ACADEMY-SECONDARY.

TERM 3 HOLIDAY WORK

S.5 PHYSICS 1 (P510/1)

Answer **all** questions.

Assume where necessary the following constants;

- ✓ Acceleration due to gravity, g = $9.81ms^{-2}$
- ✓ Electron charge, e = $1.6x10^{-19}C$
- ✓ Electron mass = $9.11x10^{-31}kg$
- ✓ Speed of light in a vacuum, c = $3.0x10^{8}ms^{-1}$
- ✓ Specific heat capacity of water = $4200JKg^{-1}K^{-1}$
- ✓ Avogadro's number N_A = $6.02x10^{23}mol^{-1}$
- ✓ Density of water = $1000kgm^{-3}$

1. (a) A stone is thrown vertically upwards from the top of a building with an initial velocity of $10ms^{-1}$ .The stone takes 2.5 s to land on the ground.
   (i) Sketch the velocity-time graph for the motion of the stone (02mks)
   (ii) Calculate the height of the building (04mks)

   (b) An object A is projected vertically upwards from the ground with a speed of $36ms^{-1}$. If object B is dropped vertically above P from a height of 90m above the ground after 2 seconds, find the;
   (i) time when A and B collide, from the time A was thrown upwards (07mks)
   (ii) height above the ground where A and B collide. (03mks)

   (c) A body of mass m moving with a velocity,u collides with a stationary of mass, M. The collision is elastic and the velocities of $m\ and\ M$ after impact are v and V respectively. If the bodies move in the same direction and $x = \frac{M}{m}$, show that $u = v\frac{(1+x)}{1-x}$ (04mks)

   (d) A copper wire of length 4m and cross-sectional area, $1 \times 10^{-3}mm^2$ is fixed between two rigid supports, A and B, $4m$ apart. What mass, when suspended at the middle of the wire will produce a sag of 1.5m at that point? (Young's modulus of copper$= 1.2 \times 10^{11}Pa$). (04mks)

   (e) The foot of a uniform ladder is on rough horizontal ground, and the top rests against a smooth vertical wall. The weight of the ladder is 400N, and a man weighing 800N stands on the ladder one-quarter of its length from the bottom. If the inclination of the ladder to the horizontal is 30^0, find the reaction at the wall and the total force at the ground. (06mks)

2. (a) A window pane consists of a sheet of glass of area 2.0 m^2 and thickness 5.0 mm. If the surface temperatures are maintained at 0^0c and 20^0C, calculate the rate of flow of heat through the pane assuming a steady state is maintained. The window is now double glazing by adding a similar sheet of glass so that a layer of air 1 0 mm thick is trapped between the two panes. Assuming that the air is still, calculate the ratio of flow of heat through the window in the first case to that in the second. (Conductivity of glass= 0.80 $W\ m^{-1}\ K^{-1}$, *thermal* conductivity of air= 0.025 $W\ m^{-1}\ K^{-1}$) (06mks)

(b) Ice at 0^0c is added to 200g of water initially at 70^0C in a vacuum flask. When 50g of ice has been added and has all melted the temperature of the flask and contents is 40^0C. When a further 80g of ice has been added and has all melted, the temperature of the whole becomes 10^0C. Stating any assumptions made, calculate the specific latent heat of fusion of ice. (06mks)

3.(a) The activity of a sample of dead wood is 50 counts per hour while the activity of a living plant is 100 counts per minute. If the half-life of carbon-14 is 5565 years, find the age of the wood sample. (04mks)

(b) Estimate the energy in MeV for an alpha particle from the source of activity $3.7 \times 10^4 s^{-1}$ which creates a saturation current of $1.0 \times 10^{-9} A$ in the ionization chamber. The energy required to produce an ion pair is 30MeV. (04mks)

END