

Quiz 5

Name: _____ Student Number: _____

1. (10 marks) An 80 gm mass is shot vertically from a balloon at a height of 1 km. The projectile reaches its maximum height in 6 seconds and then falls back to the Earth. Neglect any sideways motion. Also assume, that the projectile does not hit the balloon when it falls back to the Earth. Calculate the following.
- a) its initial speed
 - b) its initial kinetic energy
 - c) its maximum height reached
 - d) its gravitational potential energy at maximum height
 - e) its speed when it hits the ground

a) Vertical speed $v_y = u_y + at$
at max. height $0 = u_y - 10 \times 6$
 $\therefore$ initial speed $u_y = 60 \text{ m/sec.}$

b) Initial K.E. $= \frac{1}{2} m u_y^2$
 $= \frac{1}{2} (0.08) (60)^2$
 $= 144 \text{ J}$

c) Vertical Position $y = y_0 + u_y t + \frac{a_y}{2} t^2$

Max. height $y(t=6) = 1000 + 60 \times 6 - \frac{10}{2} (6)^2$
 $= 1180 \text{ meters}$

d) Grav. P.E. at $= mg y(t=6)$

Max. Height
 $= .08 \times 10 \times 1180$
 $= 944 \text{ J}$

e) Final K.E. $= 944 \text{ J.}$

$$\therefore \frac{1}{2} m v_f^2 = 944$$

$$v_f = \sqrt{\frac{2 \times 944}{.08}}$$

$$= 154 \text{ m/sec.}$$

Total = 10 marks