***Problem 1:***

***A bomber is flying at a constant horizontal velocity of 820 miles/hr at an elevation of 52000 ft toward a point directly above its target. At what angle of sight φ should a bomb be released to strike the target? [g = 32 ft/sec2]***

Solution: We know, $y= \frac{1}{2}gt^{2} =>t= \sqrt{\frac{2y}{g}}= \sqrt{\frac{2×52000}{32} }$ = 57 sec

In this time horizontal distance travelled by the bomb is

x = ($v\_{0}cosθ\_{0}$)t = 1202.67 $×1×57=68552.19$

Now,

 φ$=tan^{-1}\frac{y}{x}= tan^{-1}\frac{68552.19}{52000}$ = 530

***Problem 2:***

 ***A soccer player kicks a ball at an angle of 370 from the horizontal with an initial speed of 20 m/s. ( A right angle, one of whose angles is 370 has sides in the ratio 3 : 4: 5 or 6 : 8 : 10). Assume that the ball moves in a vertical plane.***

1. ***Find out the time t1 at which the ball reaches the highest point of its trajectory***
2. ***How high does the ball go?***
3. ***What is the horizontal range of the ball?***
4. ***How long is it in the air?***
5. ***What is the velocity of the ball as it strikes the ground?***

***Solution:***

1. t1=$\frac{v\_{0}Sinθ\_{0}}{g}= \frac{20××sin37^{0}}{9.8}=1.22 sec. $
2. H = $\frac{v\_{0}^{2}Sin^{2}θ\_{0}}{2g}$ = $\frac{20^{2}×(sin37^{0})^{2}}{2×9.8}=709.88m.$
3. R = $\frac{v\_{0}^{2}sin2θ\_{0}}{g}$ = $\frac{20^{2}×(sin2×37^{0})}{9.8}=39.24 meters$
4. T = 2t1= 2 X 1.22 = 2.44sec
5. $v\_{x}=v\_{0}cosθ\_{0}=20 ×cos37=15.97 m/s$

 $v\_{y}=v\_{0}sinθ\_{0}- gt=20 ×sin37-9.8×1.22=0.08 m/s$

 $v= \sqrt{v\_{x}^{2}+v\_{y}^{2}}= \sqrt{15.97^{2}+0.08^{2}}=15.97 m/s$

Exercise (Projectile Motion):

1. Prove that the time of flight T and the horizontal range R of a projectile are connected by the equation gT2 =2R tanθ, where θ is the angle of projection.
2. The maximum vertical height of a projectile is 10 m. If the magnitude of the initial velocity is 28 m/s, what is the direction of the initial velocity? (g=9.8 m/s2 )
3. Find the angle of projection at which the horizontal range and the maximum height of a projectile are equal.
4. A person observes a bird on tree 39.6 m high and at a distance of 59.2m. With what velocity the person should shoot an arrow at an angle of 45° so that it may hit the bird?
5. With what minimum velocity a man can throw a ball to a maximum range of 80m, and to what height does it reach in this condition?
6. An object is thrown at velocity 40m/s making an angle 600 with the horizontal plane. Find the maximum height and horizontal range.
7. A man can throw a stone with a velocity of 20 m/sec. Find the maximum distance he can throw it on a horizontal plane and to what height will it rise?
8. With what minimum velocity a man can throw a ball to a maximum range of 80m, and to what height does it reach in this condition?
9. A place kicker kicks a football with a velocity of 20.0 m/s and at an angle of 53 degrees. (a) How long is the ball in the air? (b) How far away does it land? (c) How high does it travel?
10. A golf ball is hit from the ground at35m/s at an angle of 55º.The ground is level. 1. How long is the ball in the air? 2. What is the maximum height of the ball?

Exercise (Motion)

1. An object moving at speed of 20ms-1 loses it speed by 3ms-2. How far does it travel before it stop?(Ans: 66.67)
2. An electric vehicle starts from rest and accelerates at a rate of 2.0 m/s2 in a straight line until it reaches a speed of 20 m/s. The vehicle then slows at a constant rate of 1.0 m/s2 until it stops. (a) How much time elapses from start to stop? (b) How far does the vehicle travel from start to stop?
3. A football kicked making an angle 300 with ground at the velocity 40ms-1. Find the magnitude of velocity of the football after 2s.(Ans: 34.64m/sec)