**PROJECTILE MOTION**

1. A projectile is projected at 22.5° to the horizontal with speed u. At what angle another projectile of mass double the first one be projected with the same speed to achieve the same range? (22.50 or 67.50).
2. The range of a projectile is √3V2 / 2g and maximum height is V2 / 8g. Find its angle of projection. (300)
3. To a man going east in a car with a velocity of 40 km/hr, a train appears to be moving towards north with a velocity of 40√3 km/hr. find the actual velocity of the train. (80 km/hr, 600)
4. A bomb is dropped on an enemy post by an aeroplane flying with a horizontal velocity of 60 kmh-1 and at a height of 490 mts. How far the plane must be from the enemy post at the time of dropping the bomb, so that it may directly hit the target? g = 9.8 ms-2. (166.7 m)
5. Two shots are fired simultaneously from the top and bottom of a vertical cliff with angles 30° & 60° from horizontal respectively and strikes the ground simultaneously at the same point. Find the height of the cliff if the range is 30√3 m for both the shots. (7.5 m)
6. A projectile is thrown with velocity ‘u’ making angle ‘θ’ with vertical. It just crosses the tops of two poles each of height ‘h’ after 1 sec and 3 sec respectively. Find -

*(i)*  The maximum height of the projectile.

*(ii)*  The height of the poles.

*(iii)*  The total time of flight.

1. A projectile is projected in upward direction making angle 60° with the horizontal with the velocity of 147 m/sec. The time after which the inclination with horizontal is 45° -

*(i)*  15 sec *(ii)* 10.98 sec *(iii)* 5.49 sec *(iv)*  2.745 sec

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1. *(i)* Show that for a projectile the angle b/w the velocity and the x-axis as a function of time is given by

α (t) = tan–1[v0y – gt / v0*x*]

*(ii)* Show that the projection angle θo for a projectile launched from the origin is given by

θ(t) = tan-1[4hm / R]

Where the symbols have their usual meaning.

Q.9. A balloon starts rising from rest with acceleration 4 ms-1. A stone is dropped from the balloon when it has gone up for 2s. Calculate the time when it reaches the ground relative to an observer on the ground. Calculate the time with reference to the instant when the stone is dropped.

Q10. An aeroplane flies horizontally at a height h at a speed v. An anti- aircraft gun fires a shell at the plane when it is vertically above the gun. Show that the minimum muzzle velocity required to hit the plane is at an angle 

Q.11. A particle to be projected so as to just pass though three equal rings of diameter d and placed in parallel vertical planes at distances a apart with their highest point at a height h above the point of the projection. Prove that the elevation of projection is .

Q.12. A stone dropped from the window of a bus moving at 60kmh-1. If the window is 196cm. High, find the distance along the track which the stone moves before striking the ground. [10.54m]

Q.13. A ball is thrown horizontally from the top of a tower with a speed of 50ms-1. Find the velocity and position at the end of 3 s. g = 9.8 m/s2 [58ms-1; 300with horizontally away from the starting point]

Q.14. An aircraft is flying at a height of 3500 m above the ground. If the angle subtended at a ground observation point by the aircraft position 10s apart is 300 while passing over his head, what is the speed of the aircraft? [187.5ms-1]

Q.15. A body projected downwards at an angle of 300 to the horizontal with a velocity of 9.8m/s from the top of a tower 29.4m high. How long will it take before striking the ground? [2.0s]

Q.16. A projectile has the same range when the maximum height attended by it is eitherH1 orH2. Find the relation between R, H1 and H2. [R =]

Q.17. Find the maximum horizontal range of a cricket ball projected with a velocity of80m/s. If the is ball to have a range of100meters, find the last angle of projection and the least time taken. [653.06m, horizontal, 2.19s]

Q.18. Find the minimum velocity with which the horizontal range is 39.2m. [19.67ms-1]