Projectile

U83-6 Standing on the balcony of a certain building, a man projects a ball A *vertically upwards* with a speed u, and he also projects another ball B *horizontally outwards* with the same speed u. Would the two balls attain the same *speed* when they reach the ground below, if air resistance is neglected?

A A. Their speeds would be the same.
B. Not the same, A's speed is greater than B's.
C. Not the same, A's speed is smaller than B's.
D. Cannot be ascertained, depending on the relative mass of A and B; the one with larger mass would attain a greater speed.
E. Cannot be ascertained, depending on the height of the balcony; A's speed would be greater than B's if the height is greater than 10 m, otherwise B's speed would be greater than A's.

U87-P3a Show that:
for a projectile of given initial velocity, its horizontal range would be greatest when it is projected with an angle of 45°.

(b) A shell is projected with an initial velocity of 40 m s^{-1} at an angle of inclination of 60° as shown in Fig.U87-P3b. Calculate
(i) the height of the shell at the end of the 2nd second;
(ii) the greatest height attained by the shell;
(iii) the horizontal range of the shell.
[49.68 m; 61.22 m; 141.39 m]

Fig.U87-P3b

U91-3 An aeroplane, flying at a high altitude with uniform speed along a horizontal range and rectilinear path, releases one parcel every two seconds. If the air resistance is negligible, which of the following statements is **not** correct?

D A. While still in air, the parcels are so spaced out that the distances between every two adjacent parcels, in order, form an arithmetic progression (A.P)
B. The distance between two adjacent parcels is the same for all landed parcels.
C. While still in air, the parcels appear to form a vertical straight line.
D. While still in air, the parcels appear to form a parabola.
E. Both B and C above are incorrect, and must therefore be taken to be the correct responses.

U92-7 Three small spheres of equal mass are separately projected from a point of height h measured from the ground. One is projected horizontally, the other vertically upwards, and the third slanting upwards, all with the same initial speed. When they strike the ground, their _____ would be the same.

B A. velocity B. kinetic energy C. time of flight D. velocity and time of flight

U95-5 Three identical wooden blocks A, B and C are falling down freely at the same height from the ground simultaneous. Block A is hit by a horizontally flying bullet at the initial moment of falling. Block B is hit by a horizontally flying bullet when falling at half the height. The bullets are staying in both blocks. Let t_1, t_2 and t_3 be the times needed by the three blocks A, B and C respectively to fall down on the ground. Which of the following relationship is **true**?

C A. $t_1 = t_2 < t_3$ B. $t_1 = t_2 > t_3$ C. $t_1 = t_2 = t_3$ D. $t_1 > t_2 > t_3$

U2k-8 What is the **lowest** speed during the motion of a projectile when it is projected with an angle of θ and an initial velocity of u?

A A. $u\cos\theta$ B. $u\sin\theta$ C. u D. 0

U2k04-P4 A shell of mass M = 10 kg is shot up vertically with a velocity v_0 = 20.0 m s^{-1} from a horizontal floor. At the highest point, the shell suddenly breaks into two pieces A and B, both shooting out along the horizontal direction. The moving directions of A and B are perpendicular to each other when striking the floor with a distance of 100 m apart. Neglecting the air resistance and taking g = 10 m s^{-2}, find
(a) the time taken for the shell to rise to the highest point;
(b) the greatest height the shell can achieve;
(c) the masses of the two pieces A and B. [2 s; 20 m; (2 kg, 8 kg) or (8 kg, 2 kg)]

U2k2-8 The initial velocities of two projectiles are u_1 and u_2, with angles $\theta_1$and θ_2 respectively. Which of the following is **true** when they are projected to the same maximum height?

C A. $u_1 \tan\theta_1 = u_2 \tan\theta_2$ B. $u_1 \cot\theta_1 = u_2 \cot\theta_2$
C. $u_1 \sin\theta_1 = u_2 \sin\theta_2$ D. $u_1 \cos\theta_1 = u_2 \cos\theta_2$

U2k05-8 As shown in Fig.U2k05-8, a water skier of weight 800 N is towed at a uniform speed of 15 m s^{-1} and goes up a ramp that is built with an angle of inclination of 30º and with its end 1.5 m above the water surface. The skier will let go of the rope upon reaching the end of the ramp. Determine the maximum height above the water surface that the water skier will achieve.

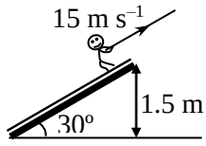

Fig.U2k05-8

B A. 2.9 m B. 4.4 m C. 8.6 m D. 11.5 m

U2k06-10 With negligible air resistance, which of the following statements are **true**?

I. For any projectile motion, the speed of downward motion is larger than that of upward motion at the same height.
II. For two objects projected obliquely from a similar altitude, the time taken of flight shall be equal.
III. The trajectory for an object projected at angle of 45° will have a maximum horizontal range.
IV. For two objects projected horizontally from a similar altitude, the time of flight shall be equal.

C A. I, II B. II, III C. III, IV D. I, II, IV

U2k06- 11 A body is launched with initial velocity 25 m s^{-1}. If the angle of projection is 35°, what is the magnitude of its velocity after 2 seconds?

B A. 22.4 m s^{-1} B. 21.1 m s^{-1} C. 20.6 m s^{-1} D. 18.2 m s^{-1}

U2k08-P2 A 5 kg object moves in a plane. Fig.U2k08-P2a and Fig. U2k08-P2b give the horizontal and vertical components of its velocity those vary with time.

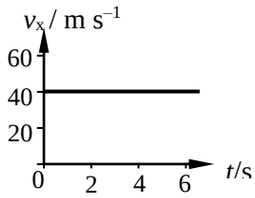

Fig. U2k08-P2a

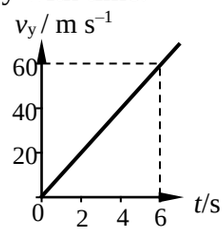

Fig.U2k08-P2b

Determine,

(a) the initial velocity of the object; [1%]
(b) the velocity of the object at t = 6 s; [2%]
(c) the force acting on the object; [3%]
(d) the displacement of the object at t = 6 s; [2%]
(e) the path's equation of the object traveled. [2%]

[40 m s^{-1}, horizontally; 72.11 m s^{-1}, 56.31°; 50 N vertically; 300 m, 36.87°; $x^2 = 320y$]

U2k09-5 Fig.U2k09-5 shows an object of mass m being projected upwards with an initial velocity u and projectile angle 45° at point W. The object then falls back to the ground at point Z. What is the change in momentum between the point W and Z?

C A. 0
B. $\sqrt{2}mu$, along the x - axis
C. $\sqrt{2}mu$, along the y - axis
D. mu, 45° above the horizontal

Fig.U2k09-5

U2k14-8 A projectile is fired upwards from its origin and moves along a projectile path. It reaches the highest points at P. Which of the following statements regarding the state of motion of the projectile at point P is **true**?

C A. The acceleration of the projectile is smallest.
B. The resultant force executed on the projectile is zero.
C. The vertical component of momentum of the projectile is zero.
D. The potential energy of the projectile is the greatest while the kinetic energy is zero.

U2k16-P3a A soldier launching a bomb to hit an invaded aircraft. The aircraft was 1200 m above the sea level and was flying horizontally with a uniform velocity of 1800 km h^{-1}. When the aircraft was directly above the soldier, a bomb was launched and it hit the aircraft at the highest pint of its trajectory. Assume the aircraft and the bomb were on the same vertical plane, and g = 10 m s^{-2}, find

(i) the time duration from the moment the bomb was launched until it hit the aircraft;

(ii) the initial velocity and launching angle of the bomb.

[15.49 s; 523.45 m s^{-1}, 17.22°]

U2k17-8 A ball is thrown horizontally from a certain height with an initial velocity v_0, and it reaches the ground with a velocity v_1. What is the time taken by the ball to reach the ground?

D A. $\frac{v_1 - v_0}{g}$ B. $\frac{v_1 - v_0}{2g}$ C. $\frac{v_1^2 - v_0^2}{g}$ D. $\frac{\sqrt{v_1^2 - v_0^2}}{g}$

U2k18-05 A bullet is fired horizontally from the top of a high cliff with speed of 40 m s^{-1}. What is the speed of the bullet after 3 seconds, if the air resistance is negligible? [g = 10.0 m s^{-2}]

C A. 30 m s^{-1} B. 40 m s^{-1} C. 50 m s^{-1} D. 70 m s^{-1}