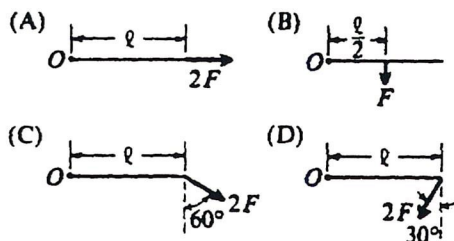


31. In which of the following diagrams is the torque about point O equal in magnitude to the torque about point X in the diagram above? (All forces lie in the plane of the paper.)



(E) None of the above

32. A 10-kilogram body is constrained to move along the x -axis. The potential energy U of the body in joules is given as a function of its position x in meters by

$$U(x) = 6x^2 - 4x + 3$$

The force on the particle at $x = 3$ meters is

- (A) 32 N in $+x$ direction
 (B) 32 N in $-x$ direction
 (C) 45 N in $+x$ direction
 (D) 45 N in $-x$ direction
 (E) 98 N in $+x$ direction

33. A rock is dropped from the top of a 45-meter tower, and at the same time a ball is thrown from the top of the tower in a horizontal direction. Air resistance is negligible. The ball and the rock hit the level ground a distance of 30 meters apart. The horizontal velocity of the ball thrown was most nearly

- (A) 5 m/s
 (B) 10 m/s
 (C) 14.1 m/s
 (D) 20 m/s
 (E) 28.3 m/s

34. Two objects of equal mass hang from independent springs of unequal spring constant and oscillate up and down. The spring of greater spring constant must have the

- (A) smaller amplitude of oscillation
 (B) larger amplitude of oscillation
 (C) shorter period of oscillation
 (D) longer period of oscillation
 (E) lower frequency of oscillation

35. A satellite moves in a stable circular orbit with speed v_0 at a distance R from the center of a planet. For this satellite to move in a stable circular orbit a distance $2R$ from the center of the planet, the speed of the satellite must be

- (A) $\frac{v_0}{2}$
 (B) $\frac{v_0}{\sqrt{2}}$
 (C) v_0
 (D) $\sqrt{2}v_0$
 (E) $2v_0$