31. (3) $X_B = \frac{mL}{m+M}$

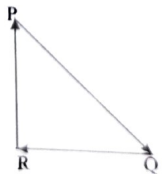
32. (3) $a = \frac{f_{net}}{m} = \frac{1000g - 900g}{900} = \frac{g}{9}$

33. (1) Linear momentum is conserved in the projection/launching of a rocket.

34. (3) Momentum of one bullet, $p = mv = 20 \times 10^{-3} \times 300 = 6$ kg ms^{-1}
N = number of bullets per second = 4

$\therefore \frac{dp}{dt}$ = change of momentum per second or force = $N(p - 0) = 4 \times 6 = 24$ N

35. (3) As three forces are forming closed loop in same order, so net force is zero.



i.e., $\vec{F}_{net} = 0$ or $m\frac{d\vec{v}}{dt} = 0$ $\therefore$ Velocity of the particle

$\vec{v} = \text{constant}$

36. (1) $m = 8 \times 10^{-3}\ kg; t = 5.6; V = 7 \times 10^{-2}\ ms^{-1}$

$$F = V\frac{dm}{dt} = 7 \times 10^{-2} \times \frac{8 \times 10^{-3}}{5.6} = 10^{-4} N$$

37. (4) $t = \frac{v}{a} \Rightarrow t \propto \frac{1}{a}(v\ is\ same) \Rightarrow \frac{t_1}{t_2} = \frac{a_2}{a_1} = \frac{m_1}{m_2} = \frac{3}{5}\left[\because a \propto \frac{1}{m}, \text{F is the same}\right]$

38. (2) The acceleration of the body perpendicular to OE is, $a = \frac{F}{m} = \frac{4}{2} = 2\,m/s^2$

Displacement along OE, $s_1 = vt = 3 \times 4 = 12$ metre,
Displacement perpendicular to OE

$$s_2 = \frac{1}{2}at^2 = \frac{1}{2} \times 2 \times (4)^2 = 16 \text{ metre}$$

The resultant displacement , $s = \sqrt{s_1^2 + s_2^2} = \sqrt{144 + 256} = \sqrt{400} = 20$ metre.

39. (3) $\vec{F} = \frac{dp_x}{dt}\hat{i} + \frac{dp_y}{dt}\hat{j}; 4t\hat{i} + 3t\hat{j}$

$\left|\vec{F}\right|_{t-2s} = \left|8\hat{i} + 6\hat{j}\right|$ = 10 unit

40. (3) $F = 2\rho A v^2 = 400\,N$