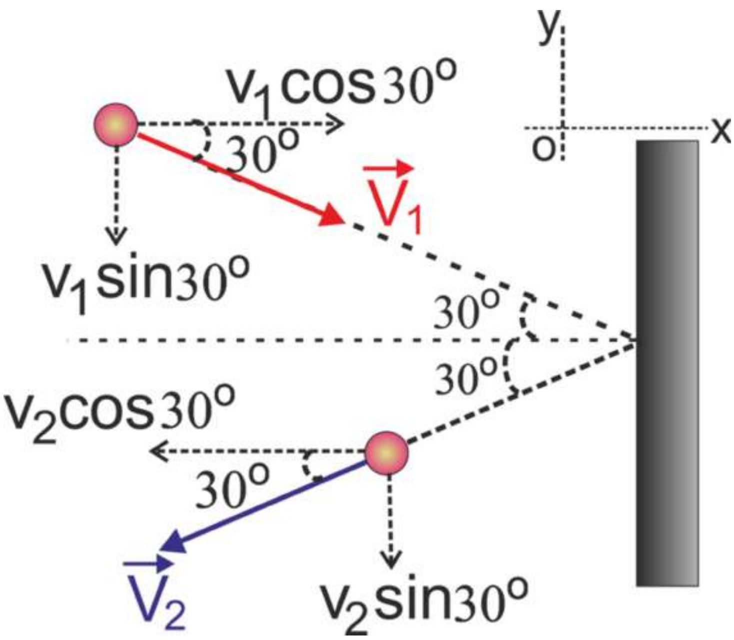
$= -2mv\cos 30^0$ .... (iii) $(\because v_1 = v_2 = u)$

$\Delta p_x = p_{xf} - p_{xi} = m(-v_2 \sin 30^0) - m(v_1 \sin 30^0)$

$= -mv_2 \sin 30^0 + mv_1 \sin 30^0$ $(v_1 = v_2 = u)$

$= 0$



Since the change in momentum of the ball is only along the –ve x-axis by eq. (iii). So the force applied by the wall on the ball is along –ve x-axis so by III law the force applied by the balloon the wall is along +ve x-axis.

In this case magnitude of impulse

$$I = |\Delta p| = \Delta p_x$$

Or $\quad I = 2mu\cos 30^0$

Force on ball is $F = \dfrac{\Delta p}{\Delta t} = \dfrac{-2mu\cos 30^0}{\Delta t}$

So, by third Law $F' = -F = \dfrac{2mu\cos 30^0}{\Delta t}$

Method II:

$$\vec{V_1} = (v_1\cos 30^0)\,\hat{i} - (v_1\sin 30^0)\,\hat{j}$$

$$= u\cos 30^0\,\hat{i} - u\sin 30^0\,\hat{j}$$

$$\vec{V_2} = (-v_2\cos 30^0)\,\hat{i} - (v_2\sin 30^0)\,\hat{j}$$

$$= -u\cos 30^0\,\hat{i} - u\sin 30^0\,\hat{j}$$

$$\Delta\vec{P} = m\vec{v_2} - m\vec{v_1}$$

$$= m(-u\cos 30^0\,\hat{i} - u\sin 30^0\,\hat{j}) - m(u\cos 30^0\,\hat{i} - u\sin 30^0\,\hat{j})$$

$$\Delta\vec{P} = -2mu\cos 30^0\,\hat{i} + 0\hat{j}$$

So, $Impulse = \Delta\vec{P} = -2mu\cos 30^0\,\hat{i}$

The negative sign $(-\hat{i})$ indicates that the direction of impulse is normal to the surface of wall and outward.

Force on ball is $\vec{F} = \dfrac{\Delta\vec{p}}{\Delta t} = \dfrac{-2mu\cos 30^0}{\Delta t}\hat{i}$

So, by third Law $\vec{F}' = -\vec{F} = \dfrac{2mu\cos 30^0}{\Delta t}\hat{i}$