I

(a) Platform is moving to right.  
Reason: \( P_{ \text{tot}} = 0 \) \( P_{\text{bullet}} = mV_{\text{bullet}} \) left 
\[ = -P_{\text{platform}} \]
\[ \Rightarrow V_{\text{platform}} = \frac{mV_{\text{bullet}}}{M_{\text{platform}}} \]  

(b) Total momentum of bullet + platform = 0.  
\Rightarrow \text{after collision total moment of object is 0} 
\[ \Rightarrow v = 0 \]

(c) Velocity of platform is as in case (i)

(iv) After bullet Just before bullet hits wall, it has been slowed down by air resistance \( \Rightarrow \) system of bullet + platform has lost some moment to air.  
\Rightarrow P_{\text{tot}} = 0, \text{ and corresponds to net motion to right} \Rightarrow \text{after collision, bullet + platform move to right}
(II) Initial energy: kinetic, \( E = \frac{1}{2} mv^2 \)

\[
\Rightarrow E = \frac{1}{2} \cdot 3 \cdot 1.1^2 = 1.55 \text{ J}
\]

Final energy: kinetic

\[
E = \frac{1}{2} \cdot 3 \cdot 4^2 \cdot (5)^2 = 6 \text{ J}
\]

\[
\Rightarrow 4.5 \text{ J of work has been done}
\]

III) Initial momentum

Particle 1: \( P_x = \frac{1}{\sqrt{2}} \cdot 10 \cdot 10 \) \( P_y = \frac{1}{\sqrt{2}} \cdot 0 \cdot 10 \)

Particle 2: \( P_x = -\frac{1}{\sqrt{2}} \cdot 5 \cdot 10 \) \( P_y = \frac{1}{\sqrt{2}} \cdot 5 \cdot 10 \)

\[
P_{\text{tot}} = \frac{1}{\sqrt{2}} \cdot 5 \cdot 10 \hat{x} + \frac{1}{\sqrt{2}} \cdot 15 \cdot 10 \hat{y}
\]

= Momentum after collision

\[
\Rightarrow \text{magnitude} \sqrt{( \frac{50}{\sqrt{2}} )^2 + ( \frac{150}{\sqrt{2}} )^2} = \frac{50}{\sqrt{2}} \sqrt{1 + 9}
\]

\( \cong 100 \) N

Direction: \( \left( \frac{1}{\sqrt{10}} \hat{x} + \frac{3}{\sqrt{10}} \hat{y} \right) \)
Initial energy: $\frac{1}{2}m_1 v_1^2 + \frac{1}{2}m_2 v_2^2$

$v_1 = v_2 = 10 \text{ m/s} \quad m_1 + m_2 = 15 \text{ kg}$

$\Rightarrow E_{\text{initial}} = \frac{1}{2} \times 15 \times 100 = 750 \text{ J}$

Final energy: $\frac{P^2}{2(M_1 + M_2)} = \frac{(50)^2 \times 10}{2 \times 15} = \frac{25 \times 10^3}{60} = 416.67 \text{ J}$

$\Rightarrow$ Energy difference $\approx 350 \text{ J}$

(4) Condition that $M_1 + M_2$ just hits well is condition that:

$K E_{\text{just post collision}} = \text{spring energy, } x = L$

i.e. $\frac{P^2}{2(M_1 + M_2)} = \frac{1}{2} K L^2$

$P = P_{\text{initial}} \Rightarrow P_{\text{initial}} = \sqrt{(M_1 + M_2) K} \cdot L$

$\Rightarrow v_{\text{initial}} = \sqrt{\frac{(M_1 + M_2) K}{M_1}} \cdot \frac{L}{m_1}$

#5 $M_1 = 1 \quad M_2 = 2 \quad K = 2 \Rightarrow L = 3$

$v = \sqrt{2 \cdot 3} \cdot \frac{3}{1} = 3\sqrt{6} \approx 4 \text{ m/s}$