b)

before collision

$m_1 = 50.0$ kg $\quad m_2 = 60.0$ kg
$v_1 = 9.82$ m/s $\quad v_2 = 0$

after collision

$m_1 = 50.0$ kg $\quad m_2 = 60.0$ kg
$v_1' = 6.00$ m/s $\quad v_2' = 6.30$ m/s

NOTE: We did not include direction with the magnitude of velocity because in calculating kinetic energy, direction is not necessary.

Kinetic energy of object 1 before

$$E_{k1} = \frac{1}{2} m_1 v_1^2$$
$$= \frac{1}{2}(50.0 \text{ kg})(9.82 \text{ m/s})^2$$
$$= 2.41 \times 10^3 \text{ J}$$

Kinetic energy of object 1 after

$$E_{k1}' = \frac{1}{2} m_1 (v_1')^2$$
$$= \frac{1}{2}(50.0 \text{ kg})(6.00 \text{ m/s})^2$$
$$= 9.00 \times 10^2 \text{ J}$$

Kinetic energy of object 2 before

$$E_{k2} = \frac{1}{2} m_2 v_2^2$$
$$= \frac{1}{2}(60.0 \text{ kg})(0)^2$$
$$= 0$$

Kinetic energy of object 2 after

$$E_{k2}' = \frac{1}{2} m_2 (v_2')^2$$
$$= \frac{1}{2}(60.0 \text{ kg})(6.30 \text{ m/s})^2$$
$$= 1.20 \times 10^3 \text{ J}$$

Total kinetic energy before collision
$= 2.41 \times 10^3 \text{ J} + 0$
$= 2.41 \times 10^3 \text{ J}$

Total kinetic energy after collision
$= 9.0 \times 10^2 \text{ J} + 1.20 \times 10^3 \text{ J}$
$= 2.10 \times 10^3 \text{ J}$

Mechanical (kinetic) energy lost in collision is $2.41 \times 10^3 \text{ J} - 2.10 \times 10^3 \text{ J} = 3.10 \times 10^2 \text{ J}$,
$\therefore$ collision is inelastic. Kinetic energy was not conserved.

c) Most of the loss in mechanical energy was converted to thermal energy—some to sound, etc.

5. a) before collision

$m_1 = 15.0$ kg $\quad m_2 = 10.0$ kg
$\vec{v}_1 = 7.0$ m/s east $\quad \vec{v}_2 = 0$
$\vec{p}_1 = 105$ kg·m/s east $\quad \vec{p}_2 = 0$

before collision

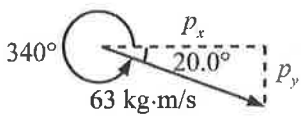
$m_1 = 15.0$ kg
$\vec{v}_1' = 4.2$ m/s 20.0° S of E
$\vec{p}_1' = 63$ kg·m/s 20.0° S of E

$m_2 = 10.0$ kg
$\vec{v}_2' = ?$
$\vec{p}_2' = ?$

$p_{after} = p_{before}$
$p_{before} = 105$ kg·m/s east
$\therefore p_{after} = 105$ kg·m/s east

Find horizontal and vertical components of 63 kg·m/s 20.0° S of E

20.0° S of E = 340° heading counter clockwise from positive x-axis



$\vec{p}_{1x}' = p_{1x}' \cos\theta$
$= (63 \text{ kg·m/s})(\cos 340°)$
$= 59.2 \text{ kg·m/s}$

$\vec{p}_{1y}' = p_1' \sin\theta$
$= (63 \text{ kg·m/s})(\sin 340°)$
$= -21.5 \text{ kg·m/s}$