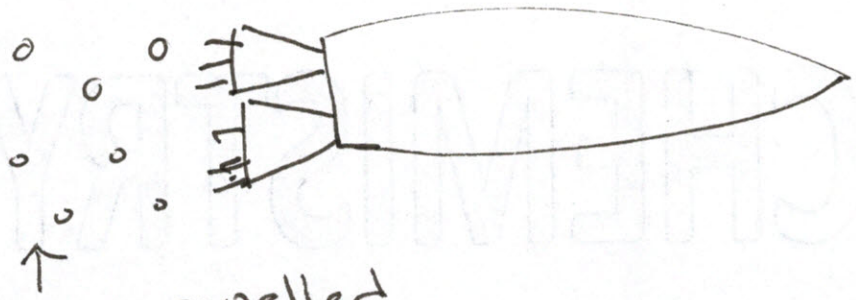
9.4

Q # 10, 13, 23 &
P # 15, 17

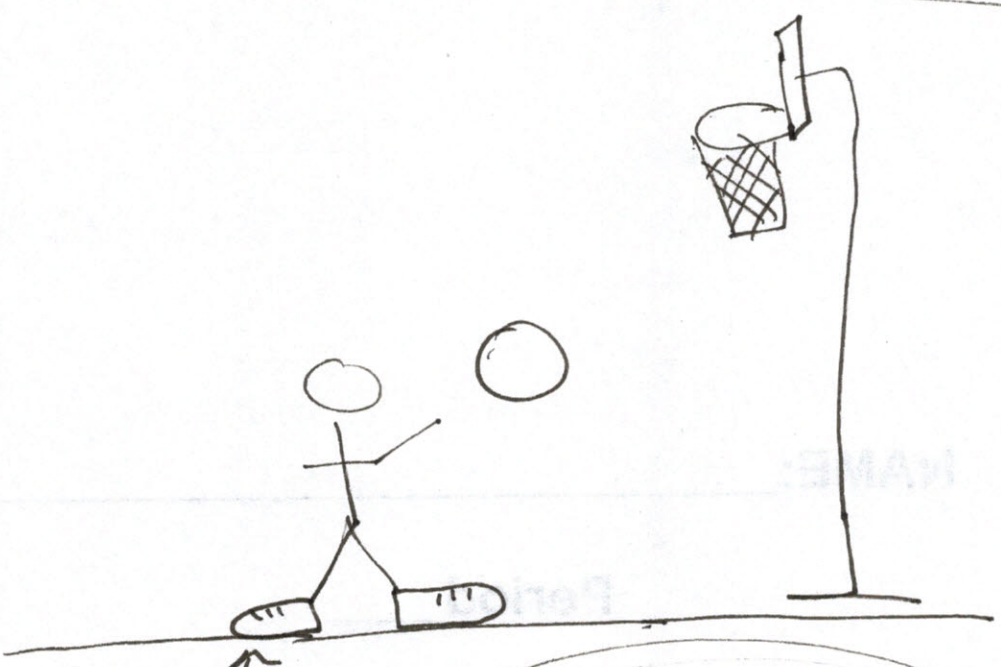
Q #10

space



gases expelled from rocket

Q #13



friction = an external force = not an isolated system = doesn't ~~follow~~ law of conservation

Q #23

before	after
$m_1 - 2.5\ kg$	$m_1 - 2.5\ kg$
$m_2 - 14\ kg$	$m_2 - 14\ kg$
$v_1 - 12.0\ m/s$	$v_{1+2} - ?$
$v_2 - -3.4\ m/s$	

$$(P_{1x})_i = (2.5\ kg)(12.0\ m/s) = 30\ kg \cdot m/s$$

$$(P_{2x})_i = (14\ kg)(-3.4\ m/s) = -47.6\ kg \cdot m/s$$

$$-47.6 + 30 = -17.6\ kg \cdot m/s$$

$$(v_x)_f = \frac{P_{total}}{(m_1 + m_2)} \qquad \frac{-17.6\ kg \cdot m/s}{16.5\ kg} = -1.07\ m/s$$

$$(P_{2x})_f = (14\ kg)(-1.07\ m/s) = -15.0\ kg \cdot m/s$$

$$(J_{1\ on\ 2})_x = \Delta P_{2x} = -15.0\ kg \cdot m/s - (-47.6\ kg \cdot m/s)$$

$$= 32.6\ kg \cdot m/s$$

$$A = \frac{1}{2}(25 \times 10^{-3}\ s)(3000\ N) = 37.5\ N \cdot s = 37.5\ kg \cdot m/s$$

(D)

P # 15

before	after
m_1 - 2.7 kg wood	m_1 - 2.7 kg
m_2 - ~~3.0g~~ 3.0×10^{-3} bullet	m_2 - 3.0×10^{-3}
v_1 - 500 m/s	v_1 - 220 m/s
v_2 - 0 m/s	v_2 - ?

$$(P_1x)_i + (P_2x)_i = \ldots$$

$$(m_1v_1)_i + (m_2v_2)_i = (m_1v_1)_f + (m_2v_2)_f$$

$$0.003\,kg(500\,m/s) + (2.7\,kg)(0\,m/s) = (0.003\,kg)(220\,m/s) + (2.7\,kg)(v_2)$$

$$1.5 + 0 = 0.66 + (2.7\,kg)(v_2)$$

$$1.5 = 0.66 + 2.7\,kg(v_2)$$

$$-0.66 \quad -0.66$$

$$\frac{.84}{2.7} = \frac{2.7\,kg(v_2)}{2.7}$$

$$0.31\,m/s = v_2$$

P #17

before	after
m_1 – 10,000 kg car	m_1 – 10,000 kg
v_1 – 2.00 m/s	v
m_2 – 4,000 kg load	m_2 – 4,000 kg → one unit
v_2 – 0 m/s	v

?

$$(P_x)_f = (P_x)_i$$

$$(10{,}000\text{kg} + 4{,}000\text{kg})(v_x)f = (10{,}000\text{kg})(2.0\text{m/s}) + (4{,}000\text{kg})(0\text{m/s})$$

$$14{,}000\,(v_x)f = 20{,}000 + 0$$

$$\frac{14{,}000\,(v_x)f}{14{,}000} = \frac{20{,}000}{14{,}000}$$

$$(v_x)f = 1.4\text{ m/s}$$