Q1:

(1): The action-reaction pairs are forces with the same magnitude and the opposite direction and acting on different objects.

Pairs satisfying this condition are $\boxed{(c)}$ and $\boxed{(d)}$.

(2): The normal reaction balanced the weight of the book $\boxed{(a)}$.

Q2:

(1): The acceleration of the object is 2.0 m/s^2.

By Newton's second law, $F = ma = \boxed{8.0}\ N$.

(2): $K = \frac{1}{2}mv^2 = \frac{1}{2} \cdot 4.0 \cdot (-4.0 + 2.0 \cdot 3.0)^2 = \boxed{8.0}\ J$.

(3): By $s = ut + \frac{1}{2}at^2$, we have $21 = -4t + t^2$, i.e. $t = \boxed{7.0}\ s$.

Q3:

(1): During the whole process, the only force acting on the object is its weight, in the negative direction $\boxed{(a)}$.

(2): Same as (1), $\boxed{(a)}$.

Q4:

(1): The wave is a crest (in a $\frac{\pi}{2}$ phase) when $2\pi(0.5t - 0.25x) = \frac{\pi}{2}$, i.e. $\boxed{x = 2t - 1}$.

(2): When $t = 0$, the medium of the two waves are having opposite displacement. Therefore, destructive interference happens and the displacement of the standing wave becomes 0. Hence, the periodic function for t should be sin.

When $x = 0$, the two waves are in the same phase. Therefore, constructive interference happens and the displacement of the standing wave becomes 6. Hence, the periodic function for x should be cos.

The option match the above is $\boxed{(c)}$.

(3): The displacement becomes 0 when $0.5\pi x = \frac{\pi}{2}$, i.e. $x = \boxed{1}$.

Q5:

(1):

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$T_2 = \boxed{240}$$

(2): $W_{gas} = p\Delta V = -6\ J$.

$W_{force} = -W_{gas} = 6\ J$.

(3): For monoatomic ideal gas, $c_V = \boxed{\frac{3}{2}R}$.

(4): By $U = \frac{3}{2}pV$, we have $\Delta U = \frac{3}{2}p\Delta V = 3\ J$.

Moreover, $W_{gas} = p\Delta V = 2J$.

By the first law of thermodynamics, $Q = \Delta U + W_{gas} = \boxed{5.0}\ J$.

Alternative As for monoatomic ideal gas, $c_p = \frac{5}{2}R$,

$Q = \frac{5}{2}nR(T_2 - T_1) = \frac{5}{2}p(V_2 - V_1) = \boxed{5.0}\ J$.

Q6:

(1): The eletric field from A cancelled that from B, we have

$$\frac{k_c q_A}{x^2} = \frac{k_c q_B}{(1.5 - x)^2}$$

$$\frac{1.5 - x}{x} = 2$$

$$x = \boxed{0.5}$$

(2): The magnitude of the electric field on D from A=$\frac{k_c q_A}{0.50^2} = 7.2 \times 10^4\ N/C$.

Similarly, that from B=$1.8 \times 10^4\ N/C$.

Therefore, $E_D = 7.2 \times 10^4 + 1.8 \times 10^4 = \boxed{9.0 \times 10^4}\ N/C$.

(3): The electric potential given by A=$\frac{k_c q_A}{0.50} = 3.6 \times 10^4\ V$.

Similarly, that given by B=$3.6 \times 10^4\ V$.

Therefore, $\phi_D = 3.6 \times 10^4 + 3.6 \times 10^4 = \boxed{7.2 \times 10^4}\ V$.

Q7:

(1): $F = Bqv = \boxed{3.2 \times 10^{-16}}\ N$.

(2): Note that the centripetal force for the rotation is provided entirely by the Lorentz force. We have

$$\frac{mv^2}{r} = 3.2 \times 10^{-16}$$

$$r = \boxed{1.2 \times 10^{-3}}$$

(3): As $\omega = \frac{2\pi}{T} = \frac{v}{r}$, we have $T = \frac{2\pi r}{v} \approx \boxed{1.9 \times 10^{-8}}$.