Q1:

(1): $v = gt = \boxed{9.8}\ m/s$.

(2): $s = ut + \frac{1}{2}gt^2 = \boxed{9.8}\ m$.

(3): The height (from the top) of $B_1 = 4.9t^2$.

The height of $B_2 = 19.6(t-1) + 4.9(t-1)^2 = -15 + 9.8t + 4.9t^2$.

Solving $-15 + 9.8t + 4.9t^2 = 4.9t^2$, we have $t \approx \boxed{1.5}\ s$.

(4): Put $t = \frac{15}{9.8}$, we have $h \approx \boxed{11}\ m$.

Q2:

(1): As the coefficient of restitution is 1, we have $-\frac{v_1 - v_2}{V - v} = 1$, i.e. $V - v = \boxed{v_2 - v_1}$.

(2): As stated in (1), we have $v - 2 - v_1 = 5$.

Moreover, by the conservation of momentum, we have

$$MV + mv = Mv_1 + mv_2$$

$$6v_1 + 4v_2 = 55$$

Solving, we have $v_1 = \boxed{3.5}\ m/s$ and $v_2 = \boxed{8.5}\ m/s$.

Q3:

(1): $f = |660 - 654| = \boxed{6}\ Hz.$

(2): The general form of Doppler effect is given by $f' = \frac{V - v_{observer}}{V - v_{source}} f.$

Therefore, the frequency heard$=\frac{340}{340-10} \cdot 660 = \boxed{680}\ Hz.$

Q4:

(1): By Ohm's law, $E_1 = I(R + R_1)$. Therefore, $R = \frac{E_1}{I} - R_1 = \boxed{24}\ \Omega.$

(2): As $E_2 = 12\ V$, by Ohm's law, we have $12 = R_1 I$, i.e. $I = 1\ A$.

Now consider E_1, by Ohm's law, $R = \frac{E_1}{I} - R_1 = \boxed{6}\ \Omega.$

(3): Let the currents pass through the left part and the right part be I_1 and I_2.

Apply Ohm's law respectively, we have:

$$\begin{cases} 18 = 2I_1 + 12(I_1 + I_2) \\ 12 = 4I_2 + 12(I_1 + I_2) \end{cases}$$ Solving, we have the current in R_1=I_1+$I_2 = \boxed{1.2}\ A.$

Q5:

(1): The magnetude of the electric field due to $Q_1 = \frac{kQ_1}{r^2} = \frac{9.0\times10^9 \cdot 4.0\times10^{-8}}{0.6^2} = 10^3\ N/C$ and similarly, that due to $Q_2 = 2 \times 10^3\ N/C$.

As they are perpendicular to each other, the vector sum$=\sqrt{2^2 + 1^2} \times 10^3 \approx$

$\boxed{2.2 \times 10^3}$ N/C.

(2): The electric potential due to $Q_1 = \frac{kQ_1}{r} = \frac{\frac{9.0\times10^9\cdot4.0\times10^{-8}}{0.6}}{=} 600\ V$ and that due to $Q_2 = -600\ V$. Therefore, the electric potential of the system$=600 - 600 = \boxed{0}\ V$.

(3): The electric potential due to $Q_1 = \frac{kQ_1}{r} = \frac{\frac{9.0\times10^9\cdot4.0\times10^{-8}}{0.3}}{=} 1200\ V$ and that due to $Q_2 = -300\ V$. Therefore, the electric potential of the system$=1200 - 300 = \boxed{900}\ V$.

Q6:

(1): By the ideal gas equation, $pV = nRT$, $T \propto p$, we have $T_B = 4T_A = \boxed{1200}\ K$.

(2): By $U = \frac{3}{2}pV$, $\Delta U = \frac{3}{2}(3p_0)V_0 = 900\ J$.

As the volume is fixed, there is no work done by gas.

Therefore, by the first law of thermodynamics, $Q = \Delta U = \boxed{900}\ J$.

(3): The work done is equal to the signed area under the line, i.e. $\frac{(4p_0+p_0)(4V_0-V_0)}{2} = \boxed{1500}\ J$.

(4): The work done by the gas during $C \to A = -3p_0V_0$.

Moreover, $\Delta U = -\frac{9}{2}p_0V_0$.

By the first law of thermodynamics, $Q_{C\to A} = \Delta U + W_{gas} = \frac{15}{2}p_0V_0 = \boxed{1500}\ J$