Q1:

(1): The normal reaction given by the plane=$mg\cos 30^\circ = 19.6\sqrt{3}\ N$.

Therefore, $f_{max} = \mu N = 0.2 \cdot 19.6\sqrt{3} \approx 6.8\ N$.

(2): The component of the weight of the object in the direction of the inclined plane=$mg\sin 30^\circ = 19.6\ N$.

Therefore, the minimal force to pull up the object=$19.6 + 6.8 \approx \boxed{26}\ N$.

(3: The maximal kinetic friction=$\mu N = 0.05 \cdot 19.6\sqrt{3} = 1.6954\ N$.

Therefore the net force acting on the object=$19.6 - 1.6954 = 17.9046\ N$.

By $F = ma$, $a = \frac{F}{m} \approx \boxed{4.5}\ m/s^2$.

Q2:

By the conservation of momentum (horizontal), we have

$$m(6.0) + m(0) = mv_b\cos 30^\circ + mv_a\cos 60^\circ$$

$$\sqrt{3}v_b + v_a = 12$$

Moreover, by the conservation of momentum (vertical), we have

$$mv_b\sin 30^\circ = mv_a\sin 60^\circ$$

$$\frac{\sqrt{3}}{3}v_b = v_a$$

Solving, we have $v_a = \boxed{3.0}$ and $v_b = 3\sqrt{3} \approx \boxed{5.2}$.

Q3:

(1): By $pV = nRT$, $n_A = \frac{pV}{RT} \approx \boxed{1.0}\ mol$.

(2): Similarly, $n_B \approx \boxed{2.0}\ mol$.

(3): We have $U = \frac{3}{2}nRT$. Therefore, $U_A = 427.5R$ and $U_B = 1155R$.

When mixed, $U = U_A + U_B = 1582.5R = \frac{3}{2}(1+2)RT$, i.e. $T \approx \boxed{350}\ K$.

(4): By $pV = nRT$, $p = \frac{(1+2)R(350)}{0.02+0.04} \approx \boxed{1.5 \times 10^5}\ Pa$.

Q4:

(1): For Doppler effect, we have $f' = \frac{V - v_{observer}}{V - v_{source}} f$.

Therefore, $f' = \frac{340-(-30)}{340} \cdot 100 \approx \boxed{110}\ Hz$.

(2): We have $f' = \frac{340}{340-30} \cdot 100 = \frac{3400}{31}\ Hz$.

As $v = f\lambda$, $\lambda' = \frac{v}{f} = 340 \cdot \frac{31}{3400} = \boxed{3.1}\ m$.

(3): $f' = \frac{340-40}{340-30} \cdot 100 \approx \boxed{97}\ Hz$.

Q5:

(1): $1.0 + \frac{1}{\frac{1}{4.0}+\frac{1}{5.0}+\frac{1}{6.0}} \approx \boxed{2.6}\ \Omega$.

(2): $\frac{1}{\frac{1}{1.0}+\frac{1}{4.0+5.0+6.0}} \approx \boxed{0.94}\ F$.

(3): No current passes through the galvanometer when the potential difference across it is 0.

By that time, the voltage consummed by the 4.0 Ω resistor is the same as that consummed by the 6.0 Ω resistor.

i.e. we have $\frac{4}{4+5}E = \frac{6}{6+R}E$, i.e. $R = \boxed{7.5}\ \Omega$.

Q6:

(1): The magnetic field due to one wire only=$\frac{I}{2\pi r} = \frac{4.5}{8\pi}\ A/m$, which makes a $60°$ with the horizon.

By symmetry, the vector sum=$2 \cdot \frac{4.5}{8\pi} \sin 60° \approx \boxed{0.31}\ A/m$.

(2): The magnetic field due to the wire=$\frac{I}{2\pi r} = \frac{5}{6\pi}\ A/m$.

The magnetic field by the loop itself=$\frac{I}{2r} = 2.5\ A/m$.

By right hand grip rule, they are in opposite direction.

Therefore, the resultant magnetic field=$2.5 - \frac{5}{6\pi} \approx \boxed{2.2}\ A/m$.

Q7:

(1): $s = ut + \frac{1}{2}at^2 = v_0t + \frac{1}{2}gt^2$. Therefore, $H = \boxed{h - v_0t - \dfrac{1}{2}gt^2}$.

(2): The electric field due to the charges at the up-right-hand and the down-left-hand corners are $\frac{kq}{a^2}$.

As they are perpendicular, the vector sum$=\frac{\sqrt{2}kq}{a^2}$.

Moreover, the electric field due to the charge at the down-right-hand conrner is $\frac{kq}{2a^2}$, which is in the same direction as the above resultant electric field.

Therefore, the resultant electric field$=\frac{\sqrt{2}kq}{a^2} + \frac{kq}{2a^2} = \boxed{\dfrac{(2\sqrt{2}+1)kq}{2a^2}}$.

(3): $W_{gas} = -W_{force} = -Fx$.

By the first law of thermodynamics, $\Delta U = Q - W_{gas} = Q + Fx$.

By $U = \frac{3}{2}nRT$, we have $\Delta T = \frac{2\Delta U}{3nR} = \boxed{\dfrac{2(Q+Fx)}{3R}}$.