NAME: **2021 IUT Admission Test Answer Sheet**

1. [10 points]

The acceleration over a time interval $t_1 \le t \le t_2$ is given by $a = \dfrac{\Delta v}{\Delta t} = \dfrac{v(t_2) - v(t_1)}{t_2 - t_1}$.

Therefore, $a = \dfrac{5\,\text{m/s} - 1\,\text{m/s}}{6\,\text{s} - 0\,\text{s}} = \dfrac{2}{3}\,\text{m/s}^2$

Answer: $\dfrac{2}{3}\,\text{m/s}^2$

2. [10 points]

The resistance of the resistor is $R = \dfrac{V}{I} = \dfrac{100\,\text{V}}{2\,\text{A}} = 50\,\Omega$

With the new voltage of 200 V, power dissipation becomes $P = \dfrac{V^2}{R} = \dfrac{(200\,\text{V})^2}{50\,\Omega} = 800\,\text{W}$

Answer: **800 W**

3. [10 points]

The photon energy of incident light is *hf*, where *h* is the Plank constant, *f* is frequency:

$hf = (4.1 \times 10^{-15}\,\text{eV} \cdot \text{s})(2.0 \times 10^{15}\,\text{Hz}) = 8.2\,\text{eV}$

In the photoelectric effect, the kinetic energy is given by $KE = hf - \Phi$. Therefore, the kinetic energy is

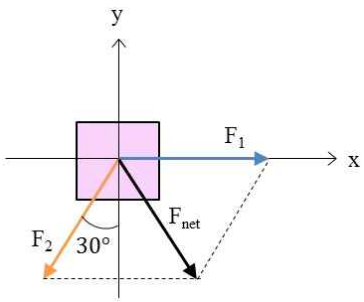
$KE = 8.2\,\text{eV} - 4.6\,\text{eV} = 3.6\,\text{eV}$

Answer: **3.6 eV**

4. [20 points]

Since the net force is the vector sum of two forces, the magnitude of net force $F_{\text{net}} = F_1 = F_2 = 10\,\text{N}$.

Therefore,



$a = \dfrac{F_{\neq t}}{m} = \dfrac{10\,\text{N}}{2\,\text{kg}} = 5\,\text{m/s}^2$

Answer: $5\,\text{m/s}^2$

5. [20 points]

The equivalent capacitance of two capacitors in parallel, 2 μF and 1 μF is equal to 3 μF (= 2 μF + 1 μF).

Then, the circuit is equivalent to the series combination of two capacitors with capacitance 3 μF and 6 μF. The equivalent capacitance of the circuit, C_{eq} is given by the equation,

$\dfrac{1}{C_{eq}} = \dfrac{1}{3\,\mu\text{F}} + \dfrac{1}{6\,\mu\text{F}}$, from which C_{eq} is calculated to be 2 μF.

Then, the total accumulated charge of the circuit is given as $Q = C_{eq} V = 2\,\mu\text{F} \times 9\,\text{V} = 18\,\mu\text{C}$

Therefore, the voltage across the 6-μF capacitor is obtained to be $\dfrac{18\,\mu\text{C}}{6\,\mu\text{F}} = 3\,\text{V}$

Answer: **3V**

6. [30 points]

The total momentum of the system must be conserved before and after the collision.

$m v = (M + m) V$

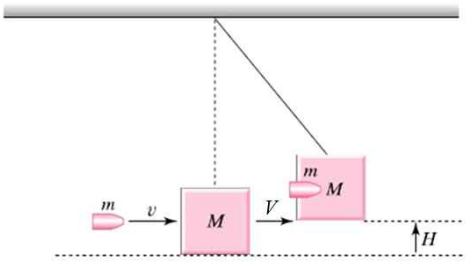
Therefore, the speed of the block just after the collision

$V = \dfrac{m}{M+m} v = \dfrac{0.1\,\text{kg}}{5.1\,\text{kg}} \times 51\,\text{m/s} = 1\,\text{m/s}.$

Now due to the conservation of mechanical energy, the kinetic energy just after the collision should be same as the potential energy at the height *H*.

$\dfrac{1}{2}(M+m) V^2 = (M+m) g H$

Therefore, $H = \dfrac{V^2}{2g} = \dfrac{(1\,\text{m/s})^2}{2 \times 10\,\text{m/s}^2} = 0.05\,\text{m}$



Answer: **0.05 m**