NAME: 2020 IUT Admission Test Answer Sheet (SOCIE Physics)

1. [10 points]

The electrical energy converted into heat is given by $Q = I^2 Rt$, where I is current, R is resistance, and t is time in seconds.

Inserting the values in the problem, the heat is determined as

$(0.2\,\mathrm{A})^2 \times 50\,\Omega \times 60\,\mathrm{sec.} = 120\,\mathrm{J}$

Answer: 120 J

2. [10 points]

The average acceleration is defined as $a = \frac{\Delta v}{\Delta t}$. Therefore, the average acceleration in the time interval 0 to 1 min is

$$a = \frac{(20-0)\,\mathrm{m/s}}{60\,\mathrm{s}} = \frac{1}{3}\,\mathrm{m/s^2}$$

Answer: $\frac{1}{3}\,m/s^2$

3. [10 points]

The distance d in the function of time for a moving car with a constant acceleration a from rest can be written as $d = \frac{1}{2}at^2$. Thus, the time is obtained as

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{80\mathrm{m}}{5\,\mathrm{m/s^2}}} = \sqrt{16}\,\mathrm{s} = 4\,\mathrm{s}$$

Answer: 4 s

4. [20 points]

The object and image relation is given by $\frac{1}{o} + \frac{1}{i} = \frac{1}{f}$. According to this relation, $\frac{1}{i} = \frac{1}{f} - \frac{1}{o} = \frac{1}{5} - \frac{1}{10} = \frac{1}{10}$. Therefore $i = 10$ cm. The magnification ratio is $\frac{i}{o} = 10/10 = 1$, so the size of the image is the same as the size of the rod

Answer: 5 cm

5. [20 points]

The total momentum of the system must remain constant, thus we examine the total momentum before and after collision.

Total momentum before collision:

$1\,\mathrm{kg}(10\,\mathrm{m/s}) + m_{wood}(0\,m/s) = 10\,kg\,m/s$,

Total momentum after collision:

$(1\,\mathrm{kg} + m_{wood})(2\,\mathrm{m/s})$

By using the momentum conservation, we find m_{wood},

$$m_{wood} = \frac{10\,(\mathrm{kg})(\mathrm{m/s}) - 2(\mathrm{kg})(\mathrm{m/s})}{2\,\mathrm{m/s}} = 4\,\mathrm{kg}$$

Answer: 4 kg

6. [30 points]

The area of the *F*-*x* graph corresponds to the work done on the object. That is,

$W = \int_0^{10\,\mathrm{m}} F dx = 5\,\mathrm{J}.$

By the work-kinetic energy theorem,

$W = \frac{1}{2}m(v_2^2 - v_1^2).$

Since m = 0.5 kg, v_1= 4.0 m/s,

$5\,\mathrm{J} = \frac{1}{2} \times 0.5\,\mathrm{kg} \times (v_2^2 - (4.0\,\mathrm{m/s})^2)$

Therefore, the speed at x = 10 m, v_2 is 6 m/s.

Answer: 6 m/s