1. Approximate the rate at which the photons are hitting the wall if a 1 mW laser pointer with
the wavelength of about 650 nm is shining on it.

2. The ration of the photon rate coming out of a 2 mW 540 nm source to the photon rate
coming out of a 1 mW 1080 nm source is about
   a. ¼
   b. ½
   c. 1
   d. 2
   e. 4

3. What is the maximum wavelength absorbed by each of the materials in the table below,
where their room temperature energy gap is provided.

<table>
<thead>
<tr>
<th>Material</th>
<th>$E_{\text{gap}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlAs</td>
<td>2.17 eV</td>
</tr>
<tr>
<td>GaAs</td>
<td>1.44 eV</td>
</tr>
<tr>
<td>Si</td>
<td>1.11 eV</td>
</tr>
<tr>
<td>Ge</td>
<td>0.65 eV</td>
</tr>
<tr>
<td>InAs</td>
<td>0.36 eV</td>
</tr>
</tbody>
</table>


4. A table of lasers and their wavelengths is shown below. Which of these are absorbed by
GaAs (energy gap is 1.44 eV)?

   a. Only Er:Glass
   b. Only HeNe
   c. Er:Glass and InGaAs
   d. HeNe and InGaAs
   e. All of them

<table>
<thead>
<tr>
<th>laser</th>
<th>wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Er:Glass</td>
<td>1540 nm</td>
</tr>
<tr>
<td>InGaAs</td>
<td>980 nm</td>
</tr>
<tr>
<td>HeNe</td>
<td>633 nm</td>
</tr>
</tbody>
</table>
5. If a resistor is connected to a brightly illuminated photodiode, which statement is true?
   a. The photodiode is not supplying power.
   b. The bigger the resistance, the more power the photodiode supplies.
   c. The smaller the resistance, the more power the photodiode supplies.
   d. The resistance that leads to maximum power depends on illumination.
   e. The power supplied by the photodiode does not depend on load resistance.

6. Consider a single photodiode under a certain illumination which has an open circuit voltage, $V_{OC}$, and a short-circuit current, $I_{SC}$. Sketch the photodiode’s IV curve. Now, what would be an IV curve of two such photodiodes connected in parallel? What if they are connected in series? Consider the resulting $V_{OC}$ and $I_{SC}$.

7. EXTRA CHALLENGE PROBLEM. Comparing the power that one can get out of two photodiodes in parallel vs. two photodiodes in series, which one of the following statements is true?
   a. The parallel combination can deliver more maximum power.
   b. The series combination can deliver more maximum power.
   c. The combinations deliver the same power to any resistive load.
   d. The combination deliver the same maximum power, but the optimum resistance for a parallel combination is bigger than for a series one.
   e. The combination deliver the same maximum power, but the optimum resistance for a parallel combination is smaller than for a series one.

8. An architect calculated that a 25% efficiency solar panels which cover the available roof area would save $60/month in utilities and pay for the cost of installation in 10 years. How much would it cost to install 35% efficiency solar panels if their installation pays off in 12 years?