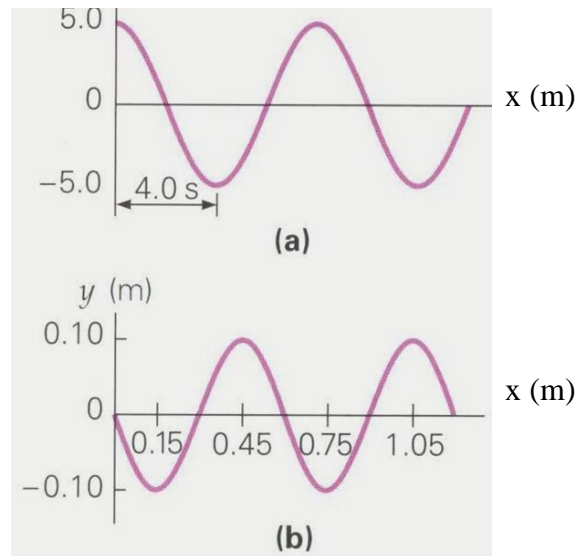


4. Use the diagrams below to determine the wavelength and frequency of each wave shown. (Assume the same time and distance scale for both waves)



5. The energy needed to remove an electron completely from an atom is called its *ionization energy*. In terms of Bohr's model, ionization can be considered a process in which the electron moves to an "orbit" of infinite radius. The ionization of a ground-state hydrogen atom can therefore be calculated by assuming that the electron undergoes a transition from $n_i=1$ state to $n_f=\infty$ state. Calculate this energy in kJ/mol.
6. The energy required to ionize sodium atom is 496 kJ/mol. What minimum frequency of light is required to ionize sodium?

7. The binding energy of electrons in a metal is 193 kJ/mol. Determine the threshold frequency for this metal.

8. Determine the velocity of an electron emitted by a metal whose threshold frequency is $2.25 \times 10^{14} \text{ s}^{-1}$ when it is exposed to visible light of $5.00 \times 10^{-7} \text{ m}$.
(mass of electron = $9.11 \times 10^{-28} \text{ g}$)

9. Determine if each set of quantum numbers below is permissible or not. If yes, write the orbital designation for each.

a) $n=2$ $l=1$ $m_l=+1$

b) $n=1$ $l=0$ $m_l=-1$

c) $n=4$ $l=2$ $m_l=+1$

d) $n=3$ $l=3$ $m_l=0$

10. Write the quantum numbers associated with each of the following orbitals:

a) 4p n= l= m_l =

b) 3d n= l= m_l =

c) 7s n= l= m_l =

d) 5f n= l= m_l =

11. The quantum numbers listed below are for four different orbitals. List them in order of increasing energy. Indicate whether any two have the same energy.

a) n= 4 l= 0 m_l = 0

b) n= 3 l= 2 m_l = +1

c) n= 3 l= 1 m_l = -1

d) n= 3 l= 2 m_l = 0

12. When a compound containing cesium is heated in a Bunsen burner flame, photons with energy of 4.30×10^{-19} J are emitted. What color is the cesium flame?

13. The He^+ ion contains one electron and is therefore a hydrogen-like ion. Calculate the wavelength of the first four electron transitions ($6 \rightarrow 2$, $5 \rightarrow 2$, $4 \rightarrow 2$ and $3 \rightarrow 2$) for this ion and compare with the same transitions in the H atom. Comment on the differences. (R for $\text{He}^+ = 8.72 \times 10^{-18} \text{ J}$)