When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with a kinetic energy of $1.68 \times 10\ Jmol^{-1}$**. What is the minimum energy needed to remove an electron from sodium? What is the maximum wavelength that will cause a photoelectron to be emitted?**

The energy (E) associated with 300 nanometre photon is given by:

$$E = \frac{hc}{\lambda}$$
$$= \frac{(6.626 \times 10^{-34})(3.0 \times 10^{8} ms^{-1})}{300 \times 10^{-9}}$$
$$= 6.62 \times 10^{-9} J$$

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Now, we will find energy of one mole of photons.

$$= (6.626 \times 10^{-19} J) \times (6.022 \times 10^{23} mol^{-1})$$
$$= 3.9 \times 10^{5} Jmol^{-1}$$

Now, we will find minimum energy needed to remove a mole of electrons from sodium

$$= 3.9 \times 10^{5} Jmol^{-1} - 1.68 \times 10^{5} Jmol^{-1}$$
$$= (3.99 - 1.68) \times 10^{5} Jmol^{-1}$$
$$= 2.31 \times 10^{5} Jmol^{-1}$$

We will find the minimum energy for one mole of electron

$$= \frac{2.31 \times 10^5 Jmol^{-1}}{6.022 \times 10^{23} mol^{-1}}$$
$$= 3.84 \times 10^{-19} J$$

Now, by using this we will find the wavelength.

$$\lambda = \frac{hc}{E}$$
$$= \frac{(6.626 \times 10^{-34})(3.0 \times 10^8 ms^{-1})}{3.84 \times 10^{-19} J}$$
$$= 517nm$$

This wavelength falls in the region of green light. So, this is the maximum wavelength that will cause the emission of a photoelectron.