• Complete the following table. **3**

Species	Full electron configuration
gallium atom	$\mathbf{1}s^2\ \mathbf{2}s^2\ \mathbf{2}p^6\ \mathbf{3}s^2\ \mathbf{3}p^6\ \mathbf{4}s^2\ \mathbf{3}d^{10}\ \mathbf{4}p^1$
P^{3-}	$\mathbf{1}s^2\ \mathbf{2}s^2\ \mathbf{2}p^6\ \mathbf{3}s^2\ \mathbf{3}p^6$
K^+	$\mathbf{1}s^2\ \mathbf{2}s^2\ \mathbf{2}p^6\ \mathbf{3}s^2\ \mathbf{3}p^6$

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY

- Gaseous lithium atoms absorb light with a wavelength of 323 nm. The resulting excited lithium atoms lose some energy through collisions with other atoms. One of the emission lines has an energy of 2.44×10^{-19} J.

  Calculate the energy of the light used for the excitation. **4**

The energy of electromagnetic radiation can be calculated from its wavelength using Planck's equation:

$$E = hc / \lambda$$

As the absorbed light has λ = 323 nm:

$$E = (6.626 \times 10^{-34}\ \text{J s})(2.998 \times 10^{8}\ \text{m s}^{-1}) / (323 \times 10^{-9}\ \text{m}) = 6.15 \times 10^{-19}\ \text{J}$$

Answer: **6.15×10^{-19} J**

Calculate the wavelength of the light emitted.

The emitted light has $E = 2.44 \times 10^{-19}$ J and the same relationship can be used to calculate the corresponding wavelength:

$$\lambda = hc / E$$
$$= (6.626 \times 10^{-34}\ \text{J s})(2.998 \times 10^{8}\ \text{m s}^{-1}) / (2.44 \times 10^{-19}\ \text{J})$$
$$= 8.14 \times 10^{-7}\ \text{m} = 814\ \text{nm}$$

Answer: **814 nm**

- Consider the elements **W**, **X**, **Y** and **Z** from the same period, *n*, with the following valence electron configurations: **3**

W $ns^2\ np^3$ **X** ns^2 **Y** $ns^2\ np^5$ **Z** $ns^2\ np^6$

Which element will conduct electricity in the solid state?	**X (alkaline earth)**
Which element will be the most electronegative?	**Y (halogen)**
Which element will possess the largest atomic radius?	**X (left hand side)**

- Write the electronic configuration of lowest energy for the following species. **2**
Na is given as an example.

Na	$1s^2\ 2s^2\ 2p^6\ 3s^1$
Al^{3+}	**$1s^2\ 2s^2\ 2p^6$**
Cl	**$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$**

What is the ground state electron configuration for the chlorine atom?	**Marks 2**
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$ or [Ne] $3s^2\ 3p^5$	

- What element has the ground state electronic arrangement of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$?

1

Phosphorus