Worksheet: Energy Levels in the Bohr Model

Q1: The electron in a hydrogen atom occupies the energy level with $n = 3$. Calculate the ionisation energy of this atom.

A 8.079×10^{-19} J

B 1.938×10^{-18} J

C 1.453×10^{-19} J

D 7.266×10^{-19} J

E 2.422×10^{-19} J

Q2: The electron in a He^{+} ion occupies the energy level with $n = 7$. Calculate the ionization energy of this atom.

A 2.670×10^{-17} J

B 1.779×10^{-19} J

C 1.246×10^{-18} J

D 8.897×10^{-20} J

E 4.449×10^{-20} J

Q3: The electron in the $n = 4$ energy level of a hydrogen atom absorbs a photon and is promoted to the energy level with $n = 6$. Calculate, to 3 significant figures, the wavelength of the absorbed photon.

A 4.56×10^{-9} m

B 2.62×10^{-6} m

C 4.56×10^{-8} m

D 1.09×10^{-6} m

E 9.37×10^{-8} m

Q4: The electron in the $n = 3$ energy level of a He^{+} ion absorbs a photon and is promoted to the energy level with $n = 5$. Calculate the wavelength of the absorbed photon to 3 significant figures.

A 1.82×10^{-7} m

B 3.20×10^{-7} m

C 3.42×10^{-7} m

D 1.71×10^{-7} m

E 6.41×10^{-7} m

Q5: An electron in an excited hydrogen atom occupies the $n = 2$ energy level. Using the Bohr model, calculate the ionization energy for the excited hydrogen atom.

A 7.266×10^{-19} J

B 5.450×10^{-19} J

C 1.090×10^{-18} J

D 2.725×10^{-19} J

E 2.422×10^{-19} J

Q6: An electron in a hydrogen atom moves from the $n = 5$ energy level to the $n = 2$ energy level. Using the Bohr model, calculate the energy of the photon produced by this transition.

A 2.857 eV

B 4.578 eV

C 10.88 eV

D 4.082 eV

E 13.06 eV

Q7: Using the Bohr model, calculate the energy of an electron in the $n = 4$ energy level of the Li^{2+} ion.

A -3.875×10^{-18} J

B -5.450×10^{-19} J

C -1.226×10^{-18} J

D -1.635×10^{-18} J

E -4.905×10^{-18} J

Q8: Using the Bohr model, calculate, to 4 significant figures, the lowest possible energy of an electron in the He^{+} ion.

A -2.180×10^{-18} J

B -1.090×10^{-18} J

C -5.450×10^{-19} J

D -4.360×10^{-18} J

E -8.719×10^{-18} J

Q9: Using the Bohr model, calculate the energy of an electron in the $n = 8$ energy level of the hydrogen atom.

A -6.812×10^{-20} J

B -3.406×10^{-20} J

C -1.362×10^{-19} J

D -2.724×10^{-19} J

E -2.146×10^{-18} J

Q10: The electron in the $n = 3$ energy level of a Li^{2+} ion absorbs a photon and is promoted to the energy level with $n = 6$. In which of the following transitions would an electron absorb a photon of the same energy?

A Promotion of an electron from $n = 2$ to $n = 8$ in the hydrogen atom

B Promotion of an electron from $n = 2$ to $n = 4$ in the hydrogen atom

C Promotion of an electron from $n = 2$ to $n = 8$ in the He^{+} ion

D Promotion of an electron from $n = 1$ to $n = 2$ in the He^{+} ion

E Promotion of an electron from $n = 2$ to $n = 4$ in the He^{+} ion

Q11: Which of the following ions would have the same ionization energy as a hydrogen atom with an electron in the $n = 4$ energy level?

A A Be^{3+} ion with an electron in the $n = 18$ energy level

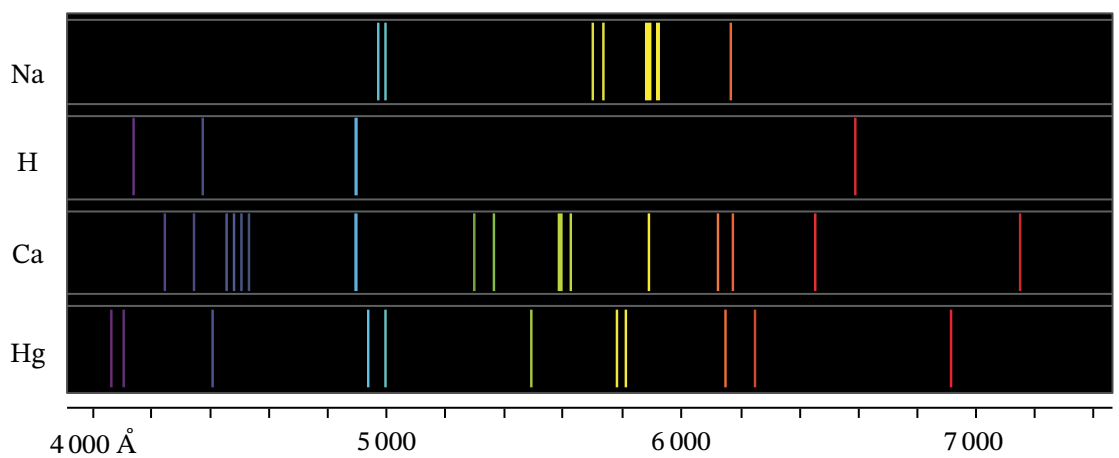
B A He^{+} ion with an electron in the $n = 12$ energy level

C A Li^{2+} ion with an electron in the $n = 12$ energy level

D A He^{+} ion with an electron in the $n = 6$ energy level

E A Li^{2+} ion with an electron in the $n = 18$ energy level

Q12: The atomic emission spectra for the atoms of four elements are shown.



Which transition is responsible for the line at 489 nm in the hydrogen spectrum?

A $n = 3$ to $n = 1$

B $n = 4$ to $n = 2$

C $n = 5$ to $n = 2$

D $n = 4$ to $n = 3$

E $n = 3$ to $n = 2$

In which of these atoms does an electronic transition produce a photon with an energy of 4.506×10^{-19} J?

A H

B Hg

C Ca

D None of these atoms

E Na

Which of these spectra contains lines at both 613 THz and 518 THz?

A H

B None of these spectra

C Ca

D Hg

E Na