Year 11 Physics Assignment

Atoms and Nuclei

1. Calculate the maximum kinetic energy of the electrons emitted from a metal (with a work function of 0.51 eV) being hit by photons of wavelength 5.4×10^{-7} m. /3

2. Calculate the de Broglie wavelength of an electron (mass 9.11×10^{-31} kg) travelling at a speed of 9.7×10^{6} ms^{-1}. /2

3.
   (a) Calculate the frequency of light required to excite an atom from the -0.88 eV level to the -0.54 eV level. /3
   (b) Draw this transition on an energy level diagram. /2
   (c) If this atom returns to the ground state by two transitions (first to the -1.5 eV level and then the -13.6 eV level) calculate the frequencies of the two photons emitted. /3
   (d) Draw the frequencies of light from 3 (c) on a line emission spectrum. /2

4. An atom transitions from the -1.5 eV level to the -3.4 eV level. State and explain whether energy was released or absorbed. /2

5. Describe what the ground state of an atom is. /1

6. List four types of radioactive decay and state what kind of radioactive nucleus (e.g. one with too many protons) would undergo each. /4

7. Explain how a chain reaction takes place. Suggest a way you could control it. /2

8.
   (a) State the difference between nuclear fission and nuclear fusion. /1
   (b) Explain why you would expect fusion to be easier to achieve with hydrogen nuclei than uranium nuclei. /2

9. Complete the following nuclear reaction equations:
   (a) ${}^{4}_{2}\mathrm{He} + {}^{9}_{4}\mathrm{Be} \longrightarrow {}^{12}_{6}\mathrm{C} + ?$
   (b) ${}^{27}_{13}\mathrm{Al} + {}^{1}_{0}\mathrm{n} \longrightarrow {}^{1}_{1}\mathrm{H} + ?$
   (c) ${}^{241}_{94}\mathrm{Pu} + ? \longrightarrow {}^{242}_{94}\mathrm{Pu}$
   (d) ${}^{226}_{88}\mathrm{Ra} \longrightarrow {}^{222}_{86}\mathrm{Rn} + ?$

   /4

TOTAL /34