**Skills Test 7: Quantum and applications NAME:\_\_SOLUTIONS\_\_\_\_\_\_\_**

*(22 Marks, 22 Minutes)*

**Question 1 (5 Marks)**

a) Explain how a fluorescent light works.

*Electricity arcs through gas in tube ✓*

*Electrons in gas are excited to higher level ✓*

*Electrons drop back down causing line emission in UV range ✓*

*Paint on glass absorbs UV and in turn fluoresces in visible ✓*

b) What is the name for the type of spectrum a fluorescent light gives?

Line emission spectrum. *✓*

**Question 2 (9 Marks)**

(a) ESTIMATE the energy of an X ray photon (show working)

(2 marks)

Choose frequencies from to *Hz* ✓

to ✓

(b) How many photons would you receive during an X ray examination if the X ray tube,

rated at 2 mW, was activated for 2 secs?

(2 marks)

✓ Answers from to photons ✓

(c)Describe X-Ray production (Include a labelled diagram)

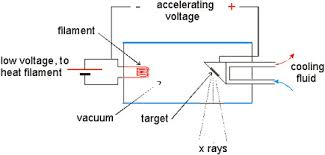
(5 marks)

Correctly labelled Diagram ✓✓

Heating Circuit to produce electrons ✓

Accelerating Voltage sends electrons to hit target anode ✓

X-rays produced across broad spectrum with characteristic spikes ✓



**Question 3 (8 marks)**

The emission spectra from excited hydrogen gas contain three distinct lines of wavelength 431.1 nm, 486.1 nm and 656.3 nm respectively.

1. Calculate the largest photon energy

(2 marks)

= ✓

= ✓

(b) In which region of the electromagnetic spectrum do the three spectral lines appear? Visible ✓ (1 mark)

The diagram below is an energy level diagram for the hydrogen atom. Use the diagram to answer questions (c) and (d) below.

✓✓

(c) Calculate the amount of energy, in joules required to ionise an electron from the ground state.

(2 marks)

✓

✓

(d) Draw arrows on the diagram to show all the possible energy transitions that would result in photon emission. One such transition is already shown. How many transitions are there?

15 ✓ (3 marks)