1. The energy of a single photon is given by:

   ☐ $E = mc^2$

   ☐ $E = \frac{1}{2}mv^2$

   ☐ $E = hf$

   ☐ $E = IV$

2. In the Bohr model, an electron can have:

   ☐ any energy at all

   ☐ zero energy always

   ☐ negative frequency

   ☐ only certain fixed energy levels

3. An emission spectrum shows:

   ☐ dark lines on a rainbow

   ☐ nothing

   ☐ bright lines on a black background

   ☐ a smooth rainbow only

4. As a blackbody gets hotter, its peak wavelength:

   ☐ stays the same

   ☐ disappears

   ☐ gets longer (redder)

   ☐ gets shorter (bluer)

5. Below the threshold frequency, increasing the brightness of the light:

   ☐ ejects many electrons

   ☐ ejects faster electrons

   ☐ melts the metal

   ☐ ejects no electrons at all

6. Compton scattering shows that photons carry _____ as well as energy.

   _____

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_____

8. A sample starts with 80 unstable nuclei of half-life 2 years. What is the expected number of undecayed parent nuclei after 4 years?

   _____

9. Light shows its _____ nature in interference and diffraction.

   _____

10. In the ideal energy-level model, a bound-to-bound photon absorption requires photon energy equal to the gap between the initial and final levels.

    ☐ True ☐ False

1. $E = hf$

   $E = hf$ – Planck's constant times the frequency.

2. **only certain fixed energy levels**

   Energy levels are quantised – only certain fixed values are allowed.

3. **bright lines on a black background**

   Electrons dropping down emit photons, giving bright lines on black.

4. **gets shorter (bluer)**

   A hotter body peaks at a shorter wavelength – the glow shifts toward blue.

5. **ejects no electrons at all**

   Below threshold, each photon is too weak – brightness cannot free any electrons.

6. **momentum**

   The collision only makes sense if photons carry momentum.

7. **Sun**

   The Sun fuses hydrogen into helium, releasing its energy.

8. **20**

   4 years = two half-lives: $80 \to 40 \to 20$.

9. **wave**

   Interference and diffraction are wave behaviours.

10. **True**

    A bound-to-bound photon transition matches an allowed gap. Photons above the ionisation threshold can also be absorbed, leaving a free electron with kinetic energy.

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