

Unit 3 practice NAB

1.a) $\lambda = v/f$

$$\lambda = 340/3400$$

$$\lambda = 0.1\text{m}$$

b) path difference = $1.5 - 1.25 = 0.25\text{m}$
this is 2.5 wavelengths, i.e. $(n + \frac{1}{2})$
interference is **destructive**.

c) the reflections prevent formation of a clear interference pattern

2. a) $3 \times 10^8 \text{ms}^{-1}$.

b) $n = v_1/v_2$

$$1.48 = 3 \times 10^8/v_2$$

$$v_2 = 2 \times 10^8 \text{ms}^{-1}$$

3. $n = \sin 49/\sin 28$

$$n = 1.6$$

4. $I_1(d_1)^2 = I_2(d_2)^2$

$$4 \times 2^2 = 0.25 \times d_2^2$$

$$d_2 = 8\text{m}$$

5. a) minimum energy required to free an electron from an atom.

b) $E = hf$

$$E = 6.63 \times 10^{-34} \times 1.2 \times 10^{15}$$

$$E = 7.96 \times 10^{-19} \text{J}$$

this greater than the work function so photoelectric emission **will** occur.

c) i) $E = hf = 6.63 \times 10^{-34} \times 1.5 \times 10^{15}$

$$E = 9.95 \times 10^{-19} \text{ J}$$

extra energy = $9.95 \times 10^{-19} - 6.4 \times 10^{-19}$

$$= 3.55 \times 10^{-19} \text{ J}$$

ii) this energy is converted into kinetic energy of the emitted electron.

iii) blue (highest frequency)

6. a) fission (1 heavy/large nucleus splits into 2 lighter/smaller nuclei)

b) spontaneous: nucleus breaks up, random process,

induced: forced by addition of a neutron, which makes the nucleus unstable .

c) i) mass is "lost" in the reaction, this missing mass is changed to energy.

ii) mass before = $390.173 \times 10^{-27} + 1.675 \times 10^{-27}$
 $= 391.848 \times 10^{-27} \text{ kg}$

mass after = $232.242 \times 10^{-27} + 155.883 \times 10^{-27}$
 $+ 2 \times (1.675 \times 10^{-27})$
 $= 391.475 \times 10^{-27} \text{ kg}$

mass lost = $391.848 \times 10^{-27} - 391.475 \times 10^{-27}$
 $= 0.373 \times 10^{-27} \text{ kg}$

$$E = mc^2$$

$$= 0.373 \times 10^{-27} \text{ kg} \times (3 \times 10^8)^2$$

$$= 3.36 \times 10^{-11} \text{ J}$$

7. a) the absorbed dose,
the kind of radiation, e.g. γ , β , α , slow/fast neutron,
the body organs or tissues exposed.

b) $H = D\omega_r$ (ω_r was formerly known as Q)

$$H = (6 \times 10^{-3} \times 1) + (0.5 \times 10^{-3} \times 20)$$

$$H = 16 \times 10^{-3} \text{ Sv}$$