Oxford Cambridge and RSA

GCSE Physics A (Gateway)

J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 3

1 Look at the table showing information about the electromagnetic spectrum.

Radio	Micro-wave	Infra-red	Visible light	Ultra-violet	X-rays	Gamma-rays
3 MHz	30 GHz	3 THz		3000 THz	3 000 000 THz	300 000 000 THz
100 m	1 cm	100 μm				

(a) The speed of all electromagnetic radiation is 3×10^8 m/s.

(i) Use data in the table to show that the speed of microwaves is 3×10^8 m/s.

[2]

(ii) Ultra-violet waves typically have a frequency of 3000 THz.

Calculate the wavelength of these ultra-violet waves in nm.

Answer = ... nm

[3]

(b) Ultra-violet waves can damage human skin.

Describe the damage caused to human skin by ultra-violet waves.

[1]

(c) Sun cream can be used to protect skin from ultra-violet waves. Sun creams have different sun protection factors (SPF).

Look at the information about a bottle of sun cream.

This sun cream has a SPF of 10. If used sensibly it can allow you up to 10 × longer in the Sun without increasing the risk from ultra-violet waves.

(i) A doctor says 'adults should not sunbathe for more than 20 minutes in the midday sunshine when **not** using sun cream'.

If an adult used sun cream with SPF 6, how long could they safely sunbathe for?

Answer = ... minutes

[1]

(ii) The doctor says that children should always use at least SPF 50 sun cream. Suggest reasons why.

[2]

(d)* Ultrasound and X-rays are used to scan patients in hospital.

Look at the information about these two different waves.

Name	Frequency	Wavelength	Type	Description
Ultrasound	≥ 2 MHz	≤ 1.6×10^{-4} m	Longitudinal	Pressure sound wave
X-rays	≥ 3×10^{16} Hz	≤ 10 nm	Transverse	Electromagnetic wave

Ultrasound and X-rays are used to scan different parts of the patient.

Explain how ultrasound and X-rays are used and evaluate the risks and benefits of using these two different waves to scan patients in hospital.

Use the information in the table in your answer.

[6]

Total Marks for Question Set 3: 15

Equations in physics

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance

change in thermal energy = mass × specific heat capacity × change in temperature

thermal energy for a change in state = mass × specific latent heat

energy transferred in stretching = 0.5 × spring constant × (extension)^2

potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil

Higher tier only –

force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length