Hazards of Electromagnetic Radiation

Workbook Page 39

Q1 Choose from the words below to complete this passage.

lead plastic bones transmitted soft tissue aluminium absorbed

X-rays can pass easily through soft tissue but are absorbed more by bones. Screens and shields made of lead are used to minimise unnecessary exposure to X-rays.

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Q2 Give two examples of how EM waves can be **helpful** and two examples of how they can be **harmful**.

Helpful

Communications (microwaves and radio waves), cooking (microwaves and IR), medical diagnosis (X and γ rays), killing cancer cells (radiotherapy), photosynthesis (visible light), detecting cracks in aircraft (γ), killing bacteria on food or sterilizing medical instruments (γ) – any 2

Harmful

Cause cell mutations, cell death and cancer (high energy UV, X and γ), burn skin (IR, visible (laser), UV, X- or γ ray), cause blindness (IR, visible (laser), UV, X- or γ ray) etc. – any 2

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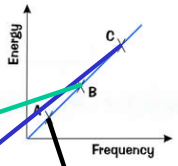
Q3 The graph opposite shows how the **energy** of EM waves varies with **frequency**.

a) What is the mathematical relationship between frequency and energy?

The energy of an EM wave is directly proportional to its frequency



b) Draw arrows to match points **A**, **B** and **C** on the graph to the three types of radiation below.

green light | gamma radiation | radio waves

A | B | C

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Q4 Explain why:

a) It is safe to use fluorescent tubes in lights, even though harmful UV rays are produced inside them.

The UV rays are absorbed by the special coating inside the tubes and so very little intensity of UV rays do get out,

b) Darker-skinned people are less likely to suffer from skin cancer.

The melanin in their skin absorbs the harmful rays preventing it from getting deeper into the skin and damaging more vulnerable tissue.

c) Radiographers stand behind lead screens when they are taking X-rays of a patient, even though it's considered an acceptable risk for the patient to be deliberately exposed to X-rays.

Radiographers need to minimise their exposure while they work, as over time they would be exposed to a large accumulative dose of X rays without their needing it for their own medical well being. The patient has been judged by medical staff to need the X-ray despite the increased exposure to ionising radiation. The two factors – the need for diagnosis and the increased risk are carefully weighed up before an X-ray is approved.

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