Combined Science - Physics - Key Stage 4 - Waves

Electromagnetic Spectrum - Part 2

Miss Walrond

OAK NATIONAL ACADEMY

Q1.

Ryan has been advised by doctors that he needs to have a full-body CT scan. The CT scan uses ionising radiation in order to produce an image of his internal organs. Ryan is concerned as he has heard that ionising radiation can damage the body.

	Dose (millisievert)
Average background dose per year	2.7
Lowest dose per year definitely linked to an increase in cancer later in life	100
Fatal dose	5000
Recommended highest dose per year	50
Chest X-ray	0.10
Dental X-ray	0.01
Eating one banana or 100 g of Brazil nuts	0.01

He has found the following information about doses of ionising radiation. The doctors have told Ryan that the CT scan will give him a dose of 10 millisievert. Describe how ionising radiation can damage the body and explain why the doctors say that the benefits of a CT scan outweigh the risks. Use the data in your answer. *The quality of written communication will be assessed in your answer.*

[6]

OCR, Twenty First Century Physics B, Paper A182/01, June 2017

Answers

Q1. Answers

Points to include:

Harm to body: Damage (DNA in) living cells, kill living cells, cause cancer, break molecules into ions

Benefit: CT scan is useful for diagnosis/can find out what is wrong with you. It can help work out your treatment

Use of data CT (10) less than recommended limit (50), CT much less than lowest indicating cancer later (100), Background (2.7) plus CT (10) less than recommended limit (50), other correct numerical comparison

All 3 sections are need to gain 5-6 marks.

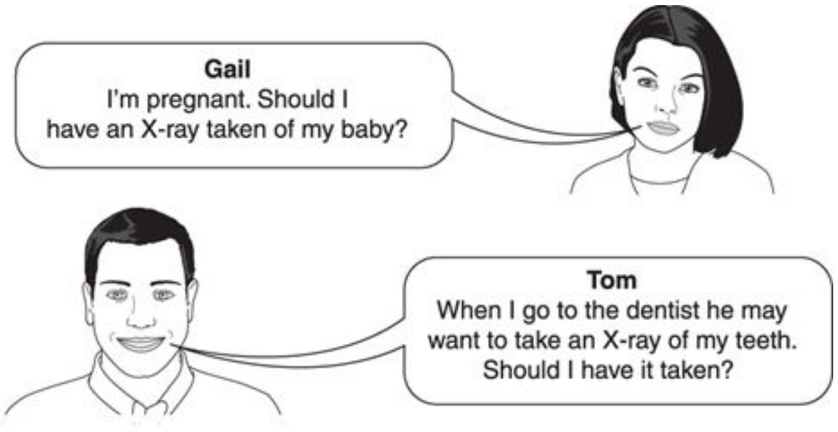
In lesson questions

Independent Task - Dangers of Electromagnetic Radiation

1) Name the two types of electromagnetic radiation that are ionising.
2) Describe one danger of ultraviolet radiation?
3) Describe how x-rays and gamma waves can be dangerous to humans.

Worked Example - Examination question

Gail and Tom are discussing whether to have an X-ray taken. Here are some data about radiation doses.



Source of radiation	Dose in mSv
Background radiation per year	2.600
X-ray of body	0.700
X-ray of teeth	0.005

Use the data and your own knowledge to advise Gail and Tom about the benefits and risks of having an X-ray taken. **[6]**

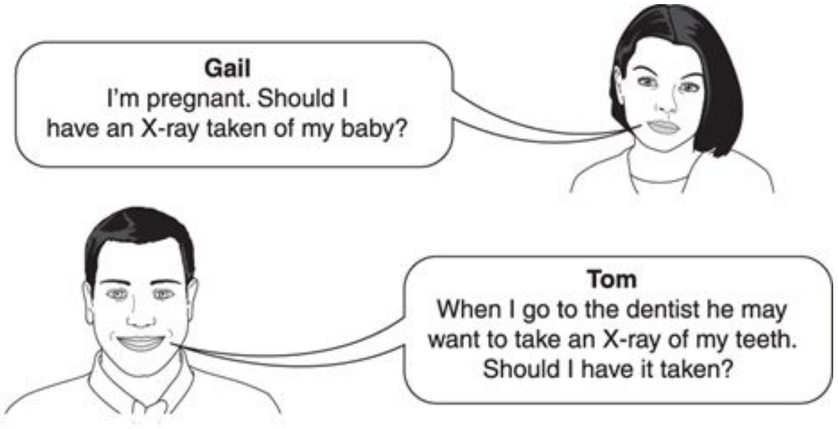
The quality of written communication will be assessed in your answer.

Answers as discussed in this slide have not been seen or verified by OCR.

OCR, Twenty First Century Physics B, Paper A182/01, June 2015

Worked Example - Examination question

Source of radiation	Dose in mSv
Background radiation per year	2.600
X-ray of body	0.700
X-ray of teeth	0.005



Use the data and your own knowledge to advise Gail and Tom about the benefits and risks of having an X-ray taken. **[6]**

Answers as discussed in this slide have not been seen or verified by OCR.
OCR, Twenty First Century Physics B, Paper A182/01, June 2015

Independent Task - Radiation Dose

1) Describe how ionising radiation can damage the body.
2) Using the data below, explain why having an x-ray of teeth is most likely safe.

Source of radiation	**Dose in mSv**
Background radiation per year	2.600
X-ray of body	0.700
X-ray of teeth	0.005

OCR, Twenty First Century Physics B, June 2015

Independent Task - Production of Electromagnetic Radiation

1) Describe how gamma radiation is produced.
2) Describe how radio waves are produced.
3) What can radio waves create?

Answers

Review: Independent Task - Dangers of Electromagnetic Radiation

1) Name the two types of electromagnetic radiation that are ionising.

   X-rays and **Gamma waves**

1) Describe one danger of ultraviolet radiation?

   Ultraviolet radiation can cause **premature ageing of the skin** and it **increases the risk** of **skin cancer.**

1) Describe how x-rays and gamma waves can be dangerous to humans.

   X-rays and **gamma waves** can **mutate genes** and this can **cause cancers.**

Review: Independent Task - Radiation Dose

1) Describe how ionising radiation can damage the body.

   Ionising radiation can **mutate genes** and **cause cancer.**

1) Using the data below, explain why having an x-ray of teeth is most likely safe.

   The **radiation dose** from an x-ray of teeth is significantly **less** than the average radiation dose. Therefore it is **unlikely** to **increase the risk** to the patient. The benefits are greater than the risks.

Review: Independent Task - Production of Electromagnetic Radiation

1) Describe how gamma radiation is produced.

   Gamma radiation is produced when there are changes in the nucleus of an atom.

1) Describe how radio waves are produced.

   Radio waves are produced from oscillating electrical circuits.

1) What can radio waves create?

   Radio waves can produce oscillating electrical currents in circuits.