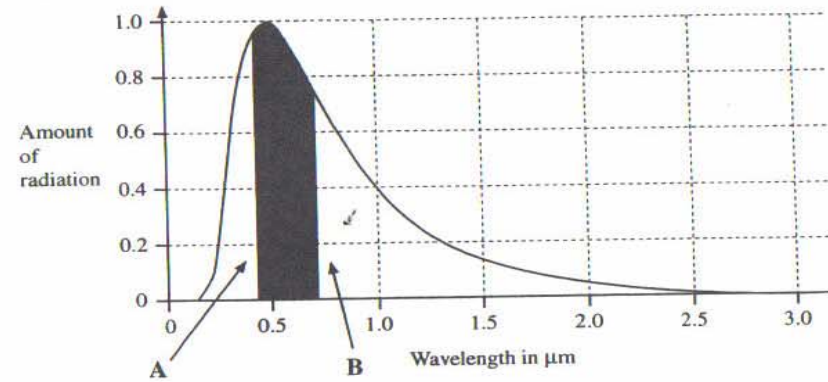


EM Spectrum

(c) The diagram below shows the spectrum of radiation from a star.
①



The shaded region is the visible light from the star.

Name the radiations in the regions A and B.

A U-V

B Infra red

[2]

For Examiner's use only

11 (a) The following waves in the electromagnetic spectrum can be used for communications:

radio infrared visible light microwaves

(i) Place them in the correct order of wavelength with the **shortest** wavelength **first**.

Visible IR micro radio [1]

(ii) Radio waves can carry information over large distances, e.g. radio signals from a Dublin radio transmitter can reach Coleraine.

Describe fully how one of the **other** waves in (a) (i) above can be used to carry information over a similar distance.

microwaves - provide line of sight communication
infrared/visible - optic fibre
digitised signal [2]

(iii) A radio station broadcasts radio waves of frequency 250 kHz. If radio waves travel at 300 000 000 m/s, calculate the wavelength of the radio wave.

Show clearly how you obtain your answer.

$$v = f\lambda$$

$$3 \times 10^8 = 250 \times 10^3 \lambda$$

$$1200 \text{ m} = \lambda$$

Wavelength = 1200 m [3]

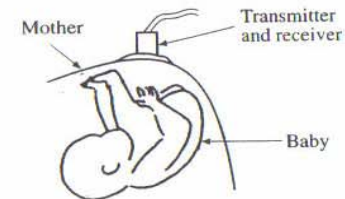
(b) Ultrasound and X-rays are both used in hospitals to produce images of internal body details.

(i) State **two** differences between ultrasound and X-rays.

1 ultrasound - longitudinal x-ray - transverse
mechanical - EM [1]

2 slower fast
long λ short λ
low f high f

(ii) Ultrasound is used to produce an image of a baby in the womb.



The transmitter sends out a pulse of ultrasound, which travels at 1500 m/s through body tissue. The receiver picks up the reflected pulse.

(1) A pulse, reflected from the baby, is detected by the receiver 100 μs after it is transmitted.

Calculate the distance from the transmitter to the baby.

Show clearly how you obtain your answer.

$$s = \frac{d}{t}$$

$$d = 1500 \times 100 \times 10^{-6}$$

$$= 0.15 \text{ m}$$

$$\text{distance} = \frac{0.15}{2} = 0.075 \text{ m} \text{ [3]}$$

(2) Why is ultrasound used rather than X-rays to produce images of the baby?

x-rays damage cells.

X The side panel of Jane's washing machine **resonates** at particular times in the wash and spin cycle.

(f) What condition must be met for resonance to occur?

_____ [1]

(i) What happens to the side panel when resonance occurs?

_____ [1]

(ii) Resonance in panels is considered to be a disadvantage.

Name a situation where resonance can be helpful or useful.

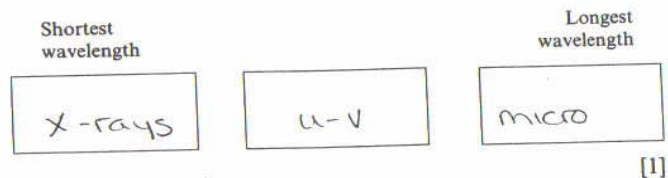
_____ [1]

81

6 (a) Microwaves, X-rays and ultraviolet waves are types of radiation in the electromagnetic spectrum.

3

(i) Place them in order of increasing wavelength.



(ii) Which one of these types of radiation is used to "see through" human tissue?

X-rays _____ [1]

(b) Ultrasound can also be used to "see through" human tissue.

(i) State **two** ways in which ultrasound waves **differ** from electromagnetic radiation.

u-s X-R.

1. longitudinal transverse

Slower faster

2. long λ } \leftarrow either \rightarrow short λ }

low f } high f }

mechanical em. [2]

(ii) Why do doctors prefer to use ultrasound rather than other types of radiation when examining a baby in the womb?

prevention of harm to baby _____ [1]

82