

O Level Combined Physics Structured

Electromagnetic Waves Test 1.0

Q1

During a major sports event, live coverage can be viewed from any part of the world through the communication between transmitting and receiving stations on Earth and the satellites in space, as shown in Fig. 12.1.

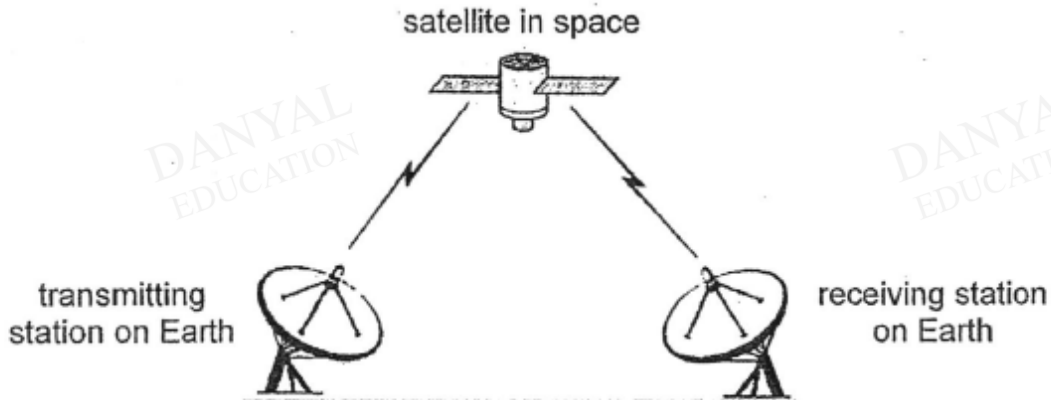


Fig. 12.1

- (i) Name the electromagnetic wave used in this type of communication.

.....[1]

- (ii) The electromagnetic wave in (i) has a wavelength of 2.0 cm. Calculate the frequency of the electromagnetic wave.

frequency = [2]

Q2

Fig. 7.1 represents the different components in the electromagnetic spectrum. The electromagnetic waves are arranged in order.

| | | | | | | |
|-------|--------|---|---------------|---|-----------|-------|
| Gamma | X-rays | P | Visible light | Q | Microwave | Radio |
|-------|--------|---|---------------|---|-----------|-------|

Fig. 7.1

(a) Name the two radiations P and Q. [1]

P is

Q is

(b) State one property of radiation P which differs from those of radio waves. [1]

.....
.....
.....

(c) State two properties which are common to all forms of electromagnetic spectrum. [2]

.....
.....
.....
.....

Q3

c) The table shows the components of the electromagnetic spectrum. Two components X and Y have not been named.

| | | | | | | |
|-------------|-------------|---|---------------|-------------------|--------|---|
| Radio Waves | Micro-waves | X | Visible light | Ultra-violet rays | X-rays | Y |
|-------------|-------------|---|---------------|-------------------|--------|---|

- i) State the components X and Y. [2]
ii) Which component is used for satellite television? [1]

Q4

The table below gives information about the wavelength and output power of some types of laser.

| Type of laser | Wavelength/ m | Output power/ W |
|---------------|-----------------------|-----------------|
| Excer | 3.2×10^{-7} | 20.0 |
| Neon | 4.9×10^{-7} | 2.0 |
| Diee | 5.5×10^{-7} | 0.50 |
| Hee-lee | 6.3×10^{-7} | 0.0050 |
| Yak | 10.6×10^{-7} | 50.0 |

The visible spectrum has wavelengths ranging from 4.0×10^{-7} m to 7.0×10^{-7} m. Speed of light in air is 3.0×10^8 m/s.

(a) Which laser emits infra-red radiation?

..... [1]

(b) Which has the highest frequency? Explain how you derive your answer.

.....
.....
..... [2]

(c) Light from a Neon laser is used to treat a patient's eye. During the treatment, the laser fires 20 short pulses of light. Each pulse lasts 0.20 s. Calculate the energy given out by the laser during treatment.

energy = J [2]

Q5

The following shows four components of the electromagnetic spectrum:

| | | | |
|-----------|-----------|-----------------|------------|
| microwave | gamma ray | ultraviolet ray | radio wave |
|-----------|-----------|-----------------|------------|

(a) Arrange the components in an increasing order of frequency.

_____ [1]

(b) State two common properties of the four components.

_____ [2]

(c) State a medical use of gamma rays.

_____ [1]

Answers

Electromagnetic Waves Test 1.0

Q1

(i) Microwave A1

(ii) $f = \frac{v}{\lambda} = \frac{3.0 \times 10^8}{0.02}$ C1

$= 1.5 \times 10^{10} \text{ Hz}$ A1

Q2

Fig. 7.1 represents the different components in the electromagnetic spectrum. The electromagnetic waves are arranged in order.

| | | | | | | |
|-------|--------|---|---------------|---|-----------|-------|
| Gamma | X-rays | P | Visible light | Q | Microwave | Radio |
|-------|--------|---|---------------|---|-----------|-------|

Fig. 7.1

(a) Name the two radiations P and Q. [1]

P is Ultra-violet Q is Infra-red
 [B1: Both must be correct to get 1 mark, 0 marks for incorrect spelling]

(b) State **one** property of radiation P which differs from those of radio waves. [1]

Ultra-violet waves have **shorter wavelength** than radio waves.

 Ultra-violet waves have **higher frequency** than radio waves.

 [B1: any one of the two reasons, verse vice is accepted]

(c) State **two** properties which are common to all forms of electromagnetic spectrum. [2]

- They transfer energy from one place to another.

- They are transverse waves.

- They travel through vacuum at $3 \times 10^8 \text{ ms}^{-1}$

- They obey wave equation $v = f\lambda$ - They show wave properties
 [B1: any two properties, 1 mark for each correct property]

Q3

- c) i) X = infra red Y = Gamma Ray
 ii) microwave

Q4

| | | |
|-----|--|----------------|
| (a) | Yak | [1] |
| (b) | Excer. Since all travelling at same speed in air/vacuum, the wave with the shortest wavelength will have the highest frequency. | [1] [1] |
| (c) | Energy = power x time = 2.0 x 0.2 x 20 = 8.0 J | [1] [1] |

Q5

| | | |
|-----|--|-----|
| (a) | Radio wave, microwave, ultraviolet ray, gamma ray | [1] |
| (b) | They are all transverse waves. They travel at a speed of 3.0×10^8 m/s in vacuum. Or any other properties. | [2] |
| (c) | Gamma knife surgery/cancer treatment/radiation therapy | [1] |

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