Prelim Revision Answer Booklet

Waves and Radiation

1. (a) $\text{wavelength} = \dfrac{\text{speed of radio wave}}{\text{frequency of radio wave}}$

choosing correct frequency of 30MHz
and speed of a radio wave 3×10^8m/s.

$$\lambda = \frac{3\times10^8}{30\times10^6}$$
$$\lambda = 10m$$

(b) The frequency range of the four main TV stations is 300 to 3000 MHz

(c) Radio waves are longer than TV waves.
They diffract/ bend better than TV waves.

2. D

3. A

4. C

5. (a) He hears the clap of thunder after he sees the lightning because light travels a lot faster than sound

(b) (i)

$$v = \frac{d}{t}$$
$$d = v \times t$$
$$d = 340 \times 8$$
$$d = 2720\text{m}$$
$$\underline{\text{the distance is } 2720\text{m}}$$

(ii)

$$v = f\lambda$$

$$\lambda = \frac{v}{f}$$

$$\lambda = \frac{340}{34}$$

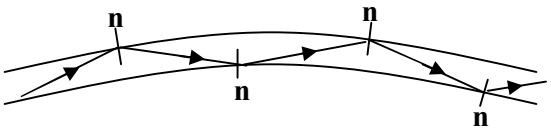
$$\lambda = 10\text{m}$$

$$\underline{\text{The wavelength is } 10\text{m}}$$

(c) (i) An optical fibre is a long thin piece of glass.

(ii) The light in an optical fibre is totally internally reflected along the optical fibre because the angle of incidence on the glass is greater than the critical angle for the glass

on diagram



6. (a) (i) Alpha, beta or gamma. (any two types of radiation are acceptable)

(ii) The radiation <u>can remove or add one or more electrons</u> when it ôhitsô atoms or molecules of a substance thus <u>producing positive or negative ions</u>.

(b)

$$A = \frac{N}{t}$$

$$A = \frac{8\times10^{10}}{40}$$

$$\underline{A = 2000\times10^{6}\text{ Bq or } 2\times10^{9}}$$

(c) (i)

$$D = \frac{E}{m}$$

$$D = \frac{2 \times 10^{-3}}{4 \cdot 2}$$

$$\underline{D = 4 \cdot 8 \times 10^{-4}\ Gy}$$

(ii)

$$H = D\omega R$$

$$H = 4 \cdot 8 \times 10^{-4} \times 10$$

$$\underline{H = 4 \cdot 8 \times 10^{-3}\ Sv}$$

7. Some of the Uranium nuclei in the fuel undergo fission when they are hit by neutrons.
This builds up chain reactions where more neutrons are released to cause more fission reactions.
These release huge amounts of energy.

Question		Marking Instructions
8.	(a)	$v = f \times \lambda$ $250 = 5 \times \lambda$ $\lambda = 50$ m
	(b)	$d = v \times t$ $10000000 = 250/t$ $t = 40000$ s
	(c) (i)	$d = v \times t$ $10000000 = 300000000/t$ $t = 0.033$ s

(c) (ii)	The time between detecting the wave and finding out about it is so short because of its great speed.

9.	1000 Ÿ 500 **or** 800 Ÿ 400 etc half-life = 250 s

Question		Marking Instructions
10	(a)	Removal (addition) of electrons from atoms (1)
	(b)(i)	Sievert (1)
	(b)(ii)	Energy of radiation Type of radiation Type of absorbing tissue any two (1) each
	(c)(i)	160/2 = 80 (1) 5.2 hours (1)
	(c)(ii)	5.2 hours (1)

11. (*a*) Can carry many signals at once/ thinner/ cheaper/ less signal loss. Any two

(*b*) (i) $2\_0 \times 10^{8}$ m/s

(ii) $v = f \lambda$

$2.0 \times 10^{8} = f \times 850 \times 10^{\bar{1}\,9}$

$f = 2.35 \times 10^{14}$ Hz **(1)**

(iii) $d = v \times t$ **(½)**

$20\,000 = 2.0 \times 10^{8} \times t$

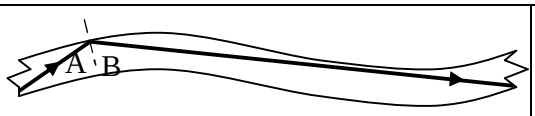
$t = 1 \times 10^{-4}$ s

12. (a) Gamma radiation can escape from the body

(b) The time taken for the activity of the source to decrease by half

(c) 1 _ 1/2 _ 1/4 _ 1/8 _ 1/16 = 4 half-lives

4 half-lives = 24 hours

13	(a)		
	(b)	$v = 2{\cdot}00 \times 10^{8}$ (m/s) – $d = vt$ $60\,000 = 2{\cdot}00 \times 10^{8} \times t$ $t = 3{\cdot}0 \times 10^{-4}$ m/s	if d = 60 used deduct (½) for unit error
	(c)	before speed of radio waves faster than light in fibre	

14	(a)	Photographic film
	(b)	type of radiation energy/quantity of radiation
	(c)	no. of X-rays = 0·10/0·020 no. of X rays = 5
	(d)	dentist carries out many X-rays per year screen reduces equivalent dose to safe level

	(e)	gamma

15	(a)	<table><tr><th>*detector*</th><th>*electromagnetic radiation*</th></tr><tr><td>photographic film</td><td>visible light</td></tr><tr><td>fluorescent paint</td><td>ultraviolet</td></tr><tr><td>heat sensitive paper</td><td>infrared</td></tr><tr><td>aerial</td><td>radio/TV/microwaves</td></tr></table>
	(b)	d = vt 30 000 = 3·00 × 10^{8} × t t = 1·0 × $10^{\bar{4}}$ s

16. D

17. C

18. Nuclear Fusion

19. C