

1 B

4 B

7 C

2 A

5 C

3 D

6 E

8 a) speed of light is much faster than the speed of sound.

b).  $d = s \cdot t$   
 $d = 340 \times 20$   
 $d = \underline{\underline{6800 \text{ m}}}$

c). Storm is getting closer.

9 a) electrical  $\rightarrow$  sound

a) sound  $\rightarrow$  electrical.

b). "an electrical signal" "greater than"

10 a) speed of light is much faster than the speed of sound.

b) i) speeds of sound.

b) ii). Human reaction time is too slow.  
 The time interval is very short.

GENERAL

11 a i). D

a ii). B

b). Hears telephone "sound" 1st

The electrical signals travel much faster than the sound in air.

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12 a). Speed of light is much faster than the speed of sound.

b).  $d = s \cdot t$   
 $d = 340 \times 2.5$   
 $d = \underline{\underline{850 \text{ m}}}$

c). Loud sounds can damage your hearing.

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13 a i).  $f = \frac{N}{t} = \frac{10}{5} = 2 \text{ Hz}$

a ii).  $\frac{12 \text{ m}}{8 \text{ waves}} = 1.5 \text{ m}$  (8 wavelengths can fit into 12 m.)

a iii).  $v = f \cdot \lambda$   
 $v = 2 \times 1.5$   
 $v = \underline{\underline{3 \text{ m}}}$

b i). Amplitude = 1 cm. [ $13 - 13 = 2$ ,  $2 \div 2 = 1 \text{ cm}$ ]

b ii). Q is further away (from wave generator).

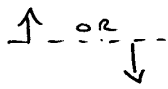
14 a i)



x 0.2 x !

GENERAL

a ii)



b).

- - m

Frequency - Hz

- Distance wave travels in 1 second m/s

- - m (or cm).

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15 a).

$$A = 1.8 \div 2 = \underline{\underline{0.9 \text{ m}}}$$

b).

$$6 \text{ waves in } 30 \text{ m, } \lambda = \frac{30}{6} = \underline{\underline{5 \text{ m}}}$$

c).

$$v = f \lambda$$

$$2.5 = f \times 5$$

$$f = \frac{2.5}{5}$$

$$f = \underline{\underline{0.5 \text{ Hz}}}$$


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GENERAL

16 ai). 2 waves in 80 m.  $\lambda = \frac{80}{2} = \underline{\underline{40\text{ m}}}$

aii).  $v = \frac{d}{t}$   $v = ?$   
 $v = \frac{80}{5}$   $d = 80\text{ m}$   
 $v = 16\text{ m/s}$   $t = 5\text{ s}$

aiii).  $v = f \cdot \lambda$   $\lambda = 40$   
 $16 = f \cdot 40$   $v = 16\text{ m/s}$   
 $f = \frac{16}{40}$   $f = ?$   
 $f = \underline{\underline{0.4\text{ Hz}}}$

b). decreases                      increases

17 a). FM radio, Air Traffic Control.

b). 300 to 3000 MHz.

18 a)i microphone: sound  $\rightarrow$  electrical  
 loudspeaker electrical  $\rightarrow$  sound.

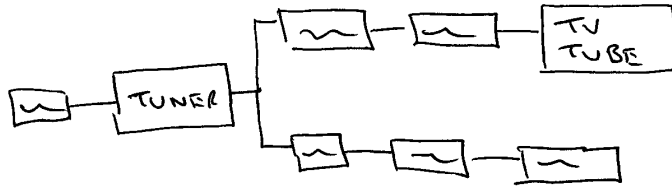
bi)  $3 \times 10^8\text{ m/s}$

bii) Rodos transmit and Receive radio waves  
 which carry the information.

c). PA system: - No wires to trip over.

2 way Radio: Easier to move around  
 (large distances - not too large)  
 though!

19. a)



b). Aerial.

c). Provide energy for TV, mainly the amplifiers.

20 a). Amplifier

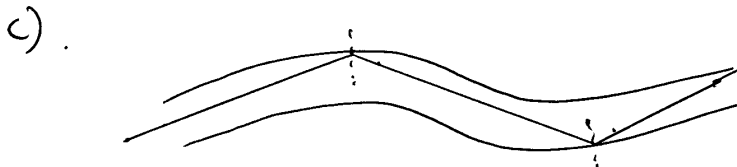
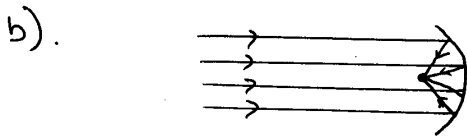
b). Increase strength of the signal.

c). Provide the energy for the amplifier. (to make the signal stronger).

21 a).

|         |             |
|---------|-------------|
| STAGE 1 | SOUND       |
| STAGE 2 | MICROWAVES  |
| STAGE 3 | LIGHT       |
| STAGE 4 | ELECTRICAL. |

aii). STAGE 1.



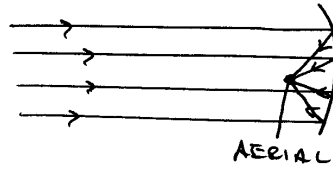
Not!



22 a)  $3 \times 10^8$  m/s

GENERAL

b). Weak signals concentrated at the aerial.



c)  
Geostationary  
24 Hours (1 DAY)  
Ground station.  
Microwave.

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23.a)

$$d = v \cdot t$$

$$19 = 340 \cdot t$$

$$t = \frac{19}{340}$$

$$t = \underline{\underline{0.056 \text{ s}}}$$

CREDIT

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

$$t = \frac{19}{340}$$

$$t = \underline{\underline{0.056 \text{ s}}}$$

Note 0.0558823 etc are too many significant figures so will LOSE  $\frac{1}{2}$  mark i:

23b)i: have 8 swimmers started race 0.056 s later than lane 1 swimmer.

$$\begin{aligned} \text{have 8's time should be } & 20.55 - 0.056 \\ & = \underline{\underline{20.49 \text{ s}}} \end{aligned}$$

bii) Connect horn to a microphone + put speakers behind each swimmer.

oe

Adjust timer for each swimmer to allow for the time delay in hearing the sound.

2.4 a). average times then calculate speed. **CREDIT**

$$\bar{t} = (0.00287 + 0.00282 + 0.00286) \div 3$$

$$\bar{t} = 0.00285 \text{ s.}$$

$$v = \frac{d}{t} = \frac{1}{0.00285} = 350.9 \text{ m/s}$$

b). Plate + hammer are not directly in line with the 2 microphones. OR

Air at a different temperature.

2.5 ai) 1500 m/s

aii).

$$d = s \cdot t$$

$$d = 1500 \times 0.2 \quad \text{OR}$$

$$d = 300 \text{ m}$$

$$\text{depth} = 300 \div 2 \text{ echo.}$$

$$\text{depth} = \underline{\underline{150 \text{ m}}}$$

$$d = s \cdot t$$

$$d = 1500 \times 0.1$$

$$d = \underline{\underline{150 \text{ m}}}$$

echo

$$t = \frac{0.2}{2}$$

$$t = 0.1$$

acii)

$$v = f \cdot \lambda$$

$$1500 = 30,000 \times \lambda$$

$$\lambda = \frac{1500}{30,000}$$

$$\lambda = \underline{\underline{0.05 \text{ m}}}$$

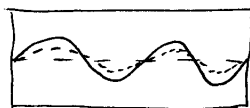
$$v = 1500 \text{ m/s}$$

$$f = 30 \text{ k Hz}$$

$$= 30,000 \text{ Hz}$$

$$\lambda = ?$$

b).



— TRANSMITTED

--- REFLECTED.

ie lower  
amplitude  
same frequency

c). No difference as distance to the sea bed is the same.

CREDIT

26. a).  $v = \frac{d}{t}$   
 $v = \frac{24}{20}$   
 $v = \underline{\underline{1.2 \text{ m/s}}}$

b).  $f = \frac{N}{t} = \frac{5}{20} = 0.25 \text{ Hz}$

c).  $\lambda = \frac{\text{Length}}{\text{no of waves}} = \frac{24}{5} = \underline{\underline{4.8 \text{ m}}}$

d).  $v = \frac{d}{t}$  let  $d = 1 \lambda$   
 $v = \frac{\lambda}{T}$   $t = \text{time for } 1 \lambda$   
 $v = \lambda \cdot \frac{1}{T}$   $t = T \text{ (period)}$   
 $f = \frac{1}{T}$   
 $v = \lambda \times f$

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27 a). RADIO ; CARRIER ; AUDIO ; MODULATION .

bi). Signal strength decreases as distance  $\uparrow$  .

bir). Different frequency .

28 a). Need Red, Green + Blue  
∴ SPOTLIGHTS 3, 5 + 4.

CREDIT

b). Yellow: R + G ⇒ SPOTLIGHTS 3 + 5.

c). 2 or 4.

Use RGB ⇒ white  
switch off blue to leave green.  
white + green ⇒ pale green.

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29 a).  $N = 25 \times 60$   
 $N = 1500$  (images per minute)

b). Decoders removes the audio/video signals from the carrier wave.

c) i) 1 electron beam for red, green + blue which are needed for all colours on the screen.

ii) Mask only lets the electron beam for red hit the red paint. Does the same for the other colours.

The mask blocks the unwanted beams.

30 a).  $v = f \cdot \lambda$   
 $3 \times 10^8 = 1500,000 \times \lambda$   
 $\lambda = \frac{3 \times 10^8}{1500,000}$   
 $\lambda = \underline{\underline{200 \text{ m}}}$

**CREDIT**  
 $v = 3 \times 10^8$   
 $f = 1500,000 \text{ Hz}$   
 $\lambda = ?$

b). Medium wave [1500 kHz = 1.5 MHz]

c) i). Signal sent by radio waves which are blocked by the tunnel.

ii). Signal sent along wires to speakers so unaffected by the tunnel.

31 a i). Tuner

aii). Pick up lots of radio waves/frequencies.

aiii). Electricity supply / Power supply / Battery-Mains.

aiv). Picture Tube.

31 b) i). higher than.

bii). That is the frequency that is selected by the tuner

biii). Modulation.

32. a)  $3 \times 10^8 \text{ m/s}$

CREDIT

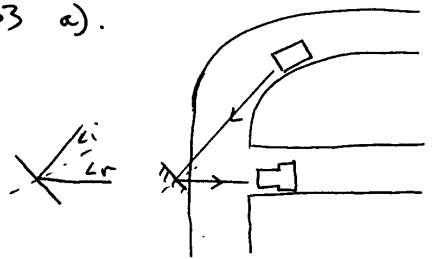
b)  $v = f \lambda$   
 $3 \times 10^8 = 1900 \times 10^6 \times \lambda$   
 $\lambda = \frac{3 \times 10^8}{1900 \times 10^6}$   
 $\lambda = \underline{\underline{0.16 \text{ m}}}$

$v = 3 \times 10^8$   
 $f = 1900 \text{ MHz}$   
 $f = 1900 \times 10^6 \text{ Hz}$   
 $\lambda = ?$

c)  $v = \frac{d}{t}$   
 $3 \times 10^8 = \frac{72000 \times 10^3}{t}$   
 $t = \frac{72000 \times 10^3}{3 \times 10^8}$   
 $t = \underline{\underline{0.24 \text{ s}}}$

$d = 72000 \times 10^3$   
 $v = 3 \times 10^8$   
 $t = ?$

33 a).



$L_i$  - angle of incidence  
 $L_r$  - " " reflection

b) Light reflecting off tractor travels along same path to mirror then she can

34 a i). 900 MHz (long  $\lambda \equiv$  low frequency)

a ii).  $v = f \cdot \lambda$

$$3 \times 10^8 = 1800 \times 10^6 \cdot \lambda$$

$$\lambda = \frac{3 \times 10^8}{1800 \times 10^6}$$

$$\lambda = \underline{0.167 \text{ m}}$$

34 b). can send more signals / information  
signal can't be topped.  
signal does not need amplified so often  
signal not affected by electrical interference.

b ii). (A)  $2 \times 10^8 \text{ m/s}$

(B)  $d = v \cdot t$   
 $d = 2 \times 10^8 \times 1.2 \times 10^{-3}$   
 $d = \underline{240,000 \text{ m}}$

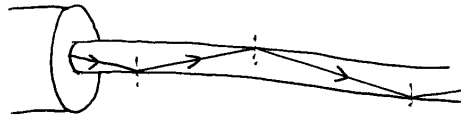
$d = ?$   
 $v = 2 \times 10^8 \text{ m/s}$   
 $t = 1.2 \text{ } \underline{\text{ms}}$   
 $t = 1.2 \times 10^{-3} \text{ s}$

35 ai)

|              | copper              | glass               |
|--------------|---------------------|---------------------|
| speed signal | $3 \times 10^8$ m/s | $2 \times 10^8$ m/s |
| Type signal  | electrical          | light               |

CREDIT

b).



NOT IN SW!

c).

glass - less repeaters.

light signal loses less energy in optical glass than the electrical signal in the copper wire.

cii).

Glass - optic fibres can carry more information/signals than the copper wires.

36a).

Satellite that takes 24 hours to orbit earth OR  
 Satellite orbits above same point on the Earth's surface.

b).

$$v = f \lambda$$

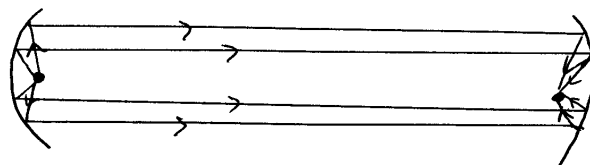
$$3 \times 10^8 = 6 \times 10^6 \cdot \lambda$$

$$\lambda = \underline{\underline{50 \text{ m}}}$$

c).

4 GHz (can't use same frequency as the transmitted signal as they might interfere)

d).



Need to show direction arrows

37 a i).  $3 \times 10^8$  m/s

CREDIT

a ii).  $d = v \cdot t$

$$780 \times 10^3 = 3 \times 10^8 \cdot t$$

$$t = \frac{780 \times 10^3}{3 \times 10^8}$$

$$t = \underline{\underline{2.6 \times 10^{-3} \text{ s}}}$$

$$v = 3 \times 10^8$$

$$t = ?$$

$$d = 780 \times 10^3$$

a ii i).  $v = f \cdot \lambda$

$$3 \times 10^8 = 137.5 \times 10^6 \cdot \lambda$$

$$\lambda = \frac{3 \times 10^8}{137.5 \times 10^6}$$

$$\lambda = \underline{\underline{2.18 \text{ m}}}$$

$$v = 3 \times 10^8$$

$$f = 137.5 \times 10^6$$

$$\lambda = ?$$

37 b).  $1440 \text{ mins} = \frac{1440}{60} = 24 \text{ hours}$

Early Bird is Geostationary.

37 c).  $T: 102 > T > 99 \quad T \geq 100 \text{ mins}$

37 d). Heat  $\Rightarrow$  Infra Red.

37 e). Moon !

38 a i).  $3 \times 10^8$  m/s

CREDIT

a ii).  $d = v \cdot t$   
 $20200 \times 10^3 = 3 \times 10^8 \cdot t$   
 $t = \frac{20200 \times 10^3}{3 \times 10^8}$

$t = ?$   
 $d = 20,200 \times 10^3$   
 $v = 3 \times 10^8$

$t = \underline{0.0675}$  [67 ms]

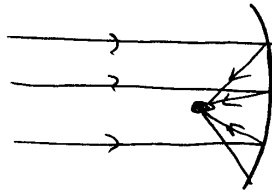
a iii).  $v = f \cdot \lambda$   
 $3 \times 10^8 = 1228 \times 10^6 \cdot \lambda$   
 $\lambda = \frac{3 \times 10^8}{1228 \times 10^6}$

$v = 3 \times 10^8$   
 $f = 1228 \times 10^6$   
 $\lambda = ?$

$\lambda = \underline{0.24}$  m

b). 1575 MHz. (short  $\lambda \leftrightarrow$  high frequency)

c). i)



c ii). Period is less than 24 hours as it is closer to Earth's surface.

$T = 2$  hours.

39 a) Medium frequency.

CREDIT

b) i Surface wave.

bii). Surface wave has a longer wavelength

iii). The sky waves REFLECT off the charged particles

iv). SHF signal

- Transmitted from Ground station to satellite
- Signal received by satellite
- Signal is amplified.
- Signal is retransmitted by satellite
- Signal received by Ground station.

