

**1** Different frequencies and wavelengths are used in different channels of communication. Suggest why

**(a)** infra-red radiation rather than visible light is usually used with optic fibres,

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

**(b)** the base stations in mobile phone networks operate on UHF,

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

**(c)** for satellite communication, frequencies of the order of GHz are used, with the uplink having a different frequency to the downlink.

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

2 (a) (i) Describe what is meant by *frequency modulation*.

.....

.....

..... [2]

(ii) A sinusoidal carrier wave has frequency 500 kHz and amplitude 6.0 V. It is to be frequency modulated by a sinusoidal wave of frequency 8 kHz and amplitude 1.5 V. The frequency deviation of the carrier wave is 20 kHz V<sup>-1</sup>. Describe, for the carrier wave, the variation (if any) of

1. the amplitude,

.....

..... [1]

2. the frequency.

.....

.....

.....

..... [3]

(b) State two reasons why the cost of FM broadcasting to a particular area is greater than that of AM broadcasting.

1 .....

.....

2 .....

..... [2]

**3 (a)** Optic fibre transmission has, in some instances, replaced transmission using co-axial cables and wire pairs. Optic fibres have negligible cross-talk and are less noisy than co-axial cables. Explain what is meant by

**(i)** cross-talk,

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

**(ii)** noise.

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

**(b)** An optic fibre has a signal attenuation of  $0.20 \text{ dB km}^{-1}$ . The input signal to the optic fibre has a power of  $26 \text{ mW}$ . The receiver at the output of the fibre has a noise power of  $6.5 \mu\text{W}$ . Calculate the maximum uninterrupted length of optic fibre given that the signal-to-noise ratio at the receiver must not be less than  $30 \text{ dB}$ .

length = ..... km [5]

4 Fig. 10.1 shows the variation with frequency  $f$  of the power  $P$  of a radio signal.

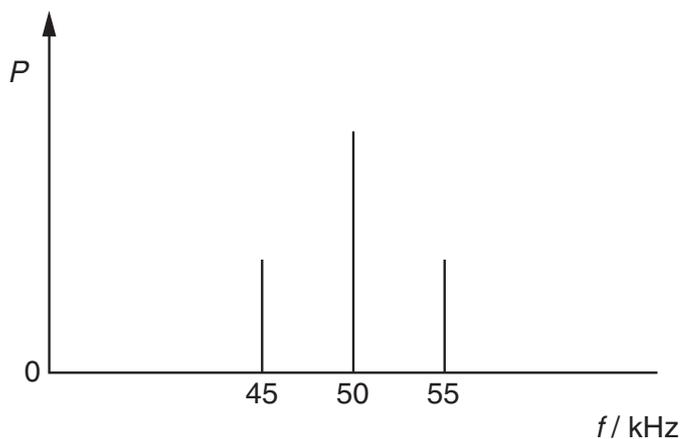


Fig. 10.1

(a) State the name of

(i) the type of modulation of this radio signal,

.....[1]

(ii) the component of frequency 50 kHz,

.....[1]

(iii) the components of frequencies 45 kHz and 55 kHz.

.....[1]

(b) State the bandwidth of the radio signal.

bandwidth = ..... kHz [1]

(c) On the axes of Fig. 10.2, sketch a graph to show the variation with time  $t$  of the signal voltage of Fig. 10.1.

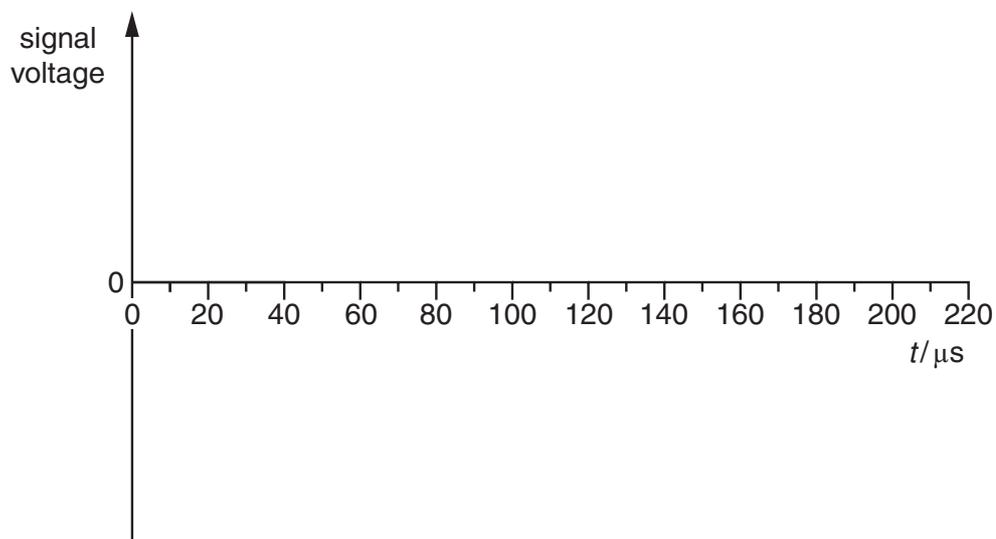


Fig. 10.2

- 4 (a) Fig. 11.1 is a block diagram showing part of a mobile phone handset used for sending a signal to a base station.

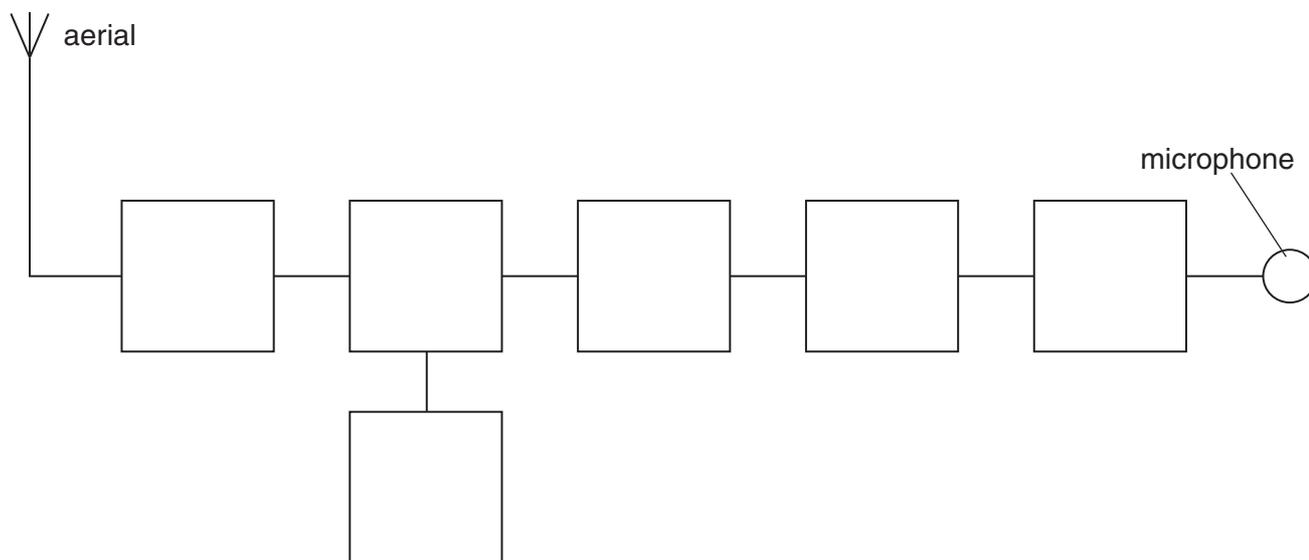


Fig. 11.1

Complete Fig. 11.1 by labelling each of the blocks. [3]

- (b) Whilst making a call using a mobile phone fitted into a car, a motorist moves through several different cells. Explain how reception of signals to and from the mobile phone is maintained.

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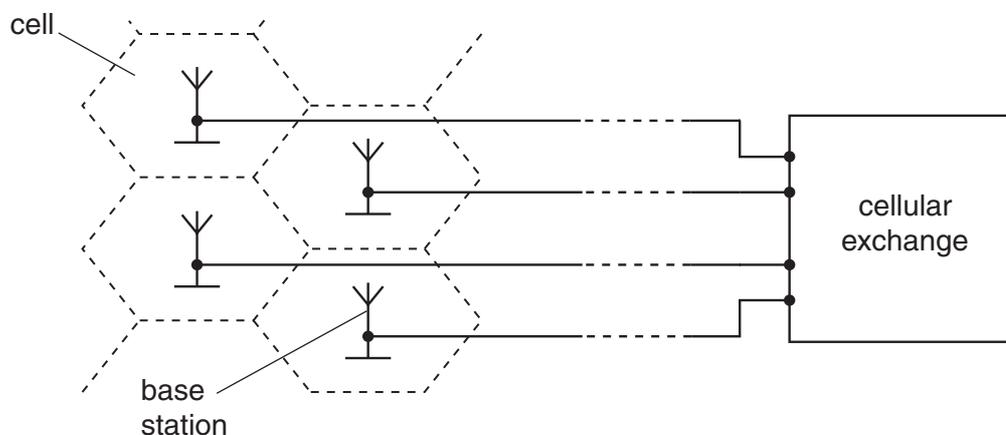
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.....

.....

[4]

- 5 In a cellular phone network, a country is divided into a number of cells, each with its own base station.  
Fig. 11.1 shows a number of these base stations and their connection to a cellular exchange.



**Fig. 11.1**

- (a) Suggest and explain why the country is divided into a number of cells.

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

- (b) Outline what happens at the base station and the cellular exchange when a mobile phone handset is switched on, before a call is made.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [4]