

Communication

Mark Scheme 4

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Communication
Sub Topic	
Paper Type	Theory
Booklet	Mark Scheme 4

Time Allowed: 63 minutes

Score: /52

Percentage: /100

CHEMISTRY ONLINE

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) (i) modulator B1 [1]
- (ii) serial-to-parallel converter (*accept series-to-parallel converter*) B [1]
- (b) (i) enables one aerial to be used for transmission and receipt of signals A1 [1]
- (ii) all bits for one number arrive at one time B1
bits are sent out one after another B1 [2]
- 2 (a) e.g. large bandwidth/carries more information
low attenuation of signal
low cost
smaller diameter, easier handling, easier storage, less weight
high security/no crosstalk
low noise/no EM interference
(*allow any four sensible suggestions, 1 each, max 4*) B4 [4]
- (b) (i) infra-red B1 [1]
- (ii) lower attenuation than for visible light B1 [1]
- (c) (i) $\text{gain/dB} = 10 \lg(P_2/P_1)$ C
 $26 = 10 \lg(P_2/9.3 \times 10^{-6})$
 $P_2 = 3.7 \times 10^{-3} \text{ W}$ A1 [2]
- (ii) power loss along fibre = $30 \times 0.2 = 6.0 \text{ dB}$ C1
either $6 = 10 \lg(P/3.7 \times 10^{-3})$ *or* $6 \text{ dB} = 4 \times 3.7 \times 10^{-3}$
or $32 = 10 \lg(P/9.3 \times 10^{-6})$
input power = $1.5 \times 10^{-2} \text{ W}$ A1 [2]

- 3 (a) (i) switch M1
so that one aerial can be used for transmission and reception A1 [2]
- (ii) tuning circuit M1
to select (one) carrier frequency (and reject others) A1 [2]
- (iii) analogue-to-digital converter/ADC M1
converts microphone output to a digital signal A1 [2]
- (iv) (a.f.) amplifier (*not r.f. amplifier*) M1
to increase (power of) signal to drive the loudspeaker A1 [2]
- (b) e.g. short aerial so easy to handle
short range so less interference between base stations
larger waveband so more carrier frequencies
(*any two sensible suggestions, 1 each, max 2*) B2 [2]
- 4 (a) e.g. carrier frequencies can be re-used (without interference) (M1)
so increased number of handsets can be used (A1)
e.g. lower power transmitters (M1)
so less interference (A1)
e.g. UHF used (M1)
so must be line-of-sight/short handset aerial (A1)
(*any two sensible suggestions with explanation, max 4*) B4 [4]
- (b) computer at cellular exchange B1
monitors the signal power B1
relayed from several base stations B1
switches call to base station with strongest signal B1 [4]

- 5 (a) frequency of carrier wave varies (in synchrony) with the displacement of the information signal M1 A1 [2]
- (b) (i) 5.0V A1 [1]
- (ii) 640 kHz A1 [1]
- (iii) 560 kHz A1 [1]
- (iv) 7000 (*condone unit*) A [1]
- 6 (a) e.g. acts as 'return' for the signal shields inner core from noise / interference / cross-talk (*any two sensible* answers, 1 each, max 2) B2 [2]
- (b) e.g. greater bandwidth less attenuation (per unit length) less noise / interference (*any two sensible* answers, 1 each, max 2) B2 [2]
- (c) attenuation is 2.4 dB attenuation = $10 \lg(P_1/P_2)$ ratio = 1.7 C1 C1 A1 [3]

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— TUITION —

- 7 (a) e.g. unreliable communication (M1)
because ion layers vary in height / density (A1)
e.g. cannot carry all information required (M1)
bandwidth too narrow (A1)
e.g. coverage limited (M1)
reception poor in hilly areas (A1)
(any two sensible suggestions, M1 & A1 for each, max 4) [4]
- (b) signal must be amplified (greatly) before transmission back to Earth B1
uplink signal would be swamped by downlink signal B1 [2]

