# Communication

## Mark Scheme 1

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|---|---|
| **Level** | International A Level |
| **Subject** | Physics |
| **Exam Board** | CIE |
| **Topic** | Communication |
| **Sub Topic** | |
| **Paper Type** | Theory |
| **Booklet** | Mark Scheme 1 |

**Time Allowed:** **60 minutes**

**Score:** **/50**

**Percentage:** **/100**

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

| | | | | |
|---|---|---|---|---|
| 1 (a) | (i) | loudspeaker/doorbell/telephone etc. | B1 | [1] |
| | (ii) | television set/audio amplifier etc. | B1 | [1] |
| | (iii) | satellite/satellite dish/mobile phone etc. | B1 | [1] |
| (b) | | e.g. lower attenuation/fewer repeaters<br>more secure<br>less prone to noise/interference<br>physically smaller/less weight<br>lower cost<br>greater bandwidth<br>(*any two sensible suggestions, 1 each*) | B2 | [2] |
| (c) | (i) | ratio $= 25 + (62 \times 0.21)$<br>$= 38\,\text{dB}$ | C1 | [2] |
| | (ii) | ratio / dB $= 10\ \lg(P_2 / P_1)$<br>$38 = 10\ \lg(P / \{9.2 \times 10^{-6}\})$ | C | |
| | | $P = 58\,\text{mW}$ or $5.8 \times 10^{-2}\,\text{W}$<br>(*allow 1/2 for missing 10 in equation*) | A1 | [2] |
| 2 (a) | (i) | metal (*allow specific example of a metal*) | B | [1] |
| | (ii) | e.g. provides 'return' for the signal<br>shields inner core from interference/reduces cross-talk/reduces noise<br>increased security<br>*(any two sensible suggestions, 1 each)* | B2 | [2] |
| (b) | ( | (gradual) loss of power/intensity/amplitude | B1 | [1] |
| | (ii) | dB is a log scale | B1 | |
| | | *either* large (range of) numbers are easier to handle (on a log scale)<br>*or* compounding attenuations/amplifications is easier | B1 | [2] |
| (c) | | attenuation $= 190 \times 11 \times 10^{-3} = 2.09\,\text{dB}$ | | |
| | | $-2.09 = 10\ \lg(P_{OUT} / P_{IN})$ | C | |
| | | ratio = 0.62 | A1 | [3] |

3 handset transmits (identification) signal to number of base stations B1
base stations transfers (signal) to cellular exchange B1
*(idea of stations needed at least once in first two marking points)*

computer at cellular exchange selects base station with strongest signal B1
computer at cellular exchange selects a carrier frequency for mobile phone B1 [4]
*(idea of computer needed at least once in these two marking points)*

4 **(a)** **(i)** e.g. satellite communication, mobile phones, line of sight communication, wifi B1 [1]

**(ii)** e.g. connection of TV to aerial, loudspeaker, microphone (if clearly identified) B1 [1]

**(iii)** e.g. a.f. amplifier to loudspeaker, landline for phone B1 [1]

**(b)** **(i)** attenuation / dB = $10\lg(P_2/P_1)$ C1
$-190 = 10\lg(P_2/3.1)$
$P_2 = 3.1 \times 10^{-19}$ kW A1 [2]

**(ii)** signal is amplified M1
frequency is changed M1
to prevent swamping of up-link signal by down-link (signal) A1 [3]

5 **(a)** analogue: continuously variable B1
digital: two / distinct levels only *or* 1 s and 0 s *or* highs and lows B1 [2]

**(b)** **(** 5 A1 [1]

**(ii)** 1 1 0 1 A1 [1]

**(c)** greater number of voltage / signal levels B1
smaller step heights in reproduced signal B1
smaller voltage / signal changes can be seen B1 [3]

| | | | |
|---|---|---|---|
| 6 | **(a)** same carrier frequencies can be re-used | M1 | |
| | but not in neighbouring cells / possible to use more handsets | A1 | [2] |
| | **(b)** e.g. wavelength is short | (M1) | |
| | so aerial on mobile phone conveniently short | (A1) | |
| | e.g. limited ran | (M1) | |
| | so low power / less interference between cells | (A1) | |
| | e.g. large number of channels / greater bandwidth | (M1) | |
| | so more simultaneous callers | (A1) | [4] |
| 7 | **(a)** e.g. noise can be eliminated/waveform can be regenerated | | |
| | extra bits of data can be added to check for errors | | |
| | cheaper/more reliable | | |
| | greater <u>rate</u> of transfer of data | | |
| | (*1 each, max 2*) | B2 | [2] |
| | **(b)** receives bits all at one time | B1 | |
| | transmits the bits one after another | B1 | [2] |
| | **(c)** sampling frequency must be higher than/(at least) twice frequency to be sampled | M1 | |
| | *either* higher (range of) frequencies reproduced on the disc | | |
| | *or* lower (range of) frequencies on phone | A1 | |
| | *either* higher quality (of sound) on disc | | |
| | *or* high quality (of sound) not required for phone | B1 | [3] |