Communication

Mark Scheme 7

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Communication
Sub Topic	
Paper Type	Theory
Booklet	Mark Scheme 7

Time Allowed: **52 minutes**

Score: **/43**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	777.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** **(i)** frequency of carrier wave varies — M1
in synchrony with <u>displacement</u> of information signal — A1 [2]

(ii) **1.** zero (accept constant) — B1 [1]
2. upper limit 530 kHz — B1
lower limit 470 kHz — B1
changes upper limit → lower limit → upper limit at 8000 s^{-1} — B1 [3]

(b) e.g. more radio stations required / shorter range
more complex electronics
larger bandwidth required
(any two sensible suggestions, 1 each) — B2 [2]

2 **(a)** **(i)** picking up of signal in one cable — M1
from a second (nearby) cable — A1 [2]

(ii) <u>random</u> (unwanted) signal / power — B1
that masks / added to / interferes with / distorts transmitted signal — B1 [2]
*(allow this mark in **(i)** or **(ii)**)*

(b) if P is power at receiver,
$30 = 10\lg(P / (6.5 \times 10^{-6})$ — C
$P = 6.5 \times 10^{-3}$ W — C1
loss along cable $= 10\lg(\{26 \times 10^{-3}\} / \{6.5 \times 10^{-3}\})$
$= 6.0$ dB — C1
length $= 6.0 / 0.2 = 30$ km — A1 [5]

3 **(a)** **(i)** amplitude (modulated) (*allow 'AM'*) ..... B1 [1]

(ii) <u>carrier</u> (frequency / wave) ..... B1 [1]

(iii) sideband (frequency) ..... B1 [1]

(b) 10 kHz ..... B1 [1

(c) sketch: general shape i.e. any wave that is amplitude modulated M1
correct period for modulating waveform (200 μs) A1
correct period for carrier waveform (20 μs) ..... A1 [3]

4 **(a)** carrier frequencies can be re-used (simultaneously without interference) B1
so that number of handsets possible is increased B1
OR anything sensible e.g. UHF used (B1)
so 'line of sight' (B1) [2]

(b) handset sends out an (identifying) signal M1
communicated by base stations to (computer at) exchange A1
<u>computer</u> selects base station with strongest signal B1
and allocates a (carrier) frequency ..... B1 [4]

5 **(a)** correct values of 2, 5, 10, 15 and 4 (*–1 each error*) B2
graph drawn as a series of steps M1
steps occurring at correct times A1 [4]

(b) sample more frequently B1
greater number of bits B1 [2]

6 **(a)** modulator and oscillator identified B1
both amplifiers identified correctly B1
ADC and parallel-to serial converter identified B1 [3]

(b) computer at cellular exchange B1
monitors signal strength B1
switches call from one base station to another B1
to maintain maximum signal strength B1 [4]