Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section B (Section 13_ Electronics)

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) Q = ($\overline{A}$.B) + (A.$\overline{B}$) ✔✔ (allow written format)
Do not allow (A ⊕ B)

- *Correct two terms* ✔
- *Correct operator for OR gate* ✔

2

(b)

B	A	C	D	E	F	Q
0	0	1	1	0	0	0
0	1	0	1	0	1	1
1	0	1	0	1	0	1
1	1	0	0	0	0	0
		✔		✔		

Correct column C
Correct column E

2

(c) Any two criteria ✔✔

Less complex circuit – easier to manufacture
Only uses one type of chip – more economical to buy
Uses fewer ICs so saves space
Uses fewer ICs so saves on power consumption
Accept any other valid reason

2

(d) EOR ✔
Also allow EXOR, XOR

1

[7]

Q2.

(a) Voltage in = Voltage out / Voltage gain

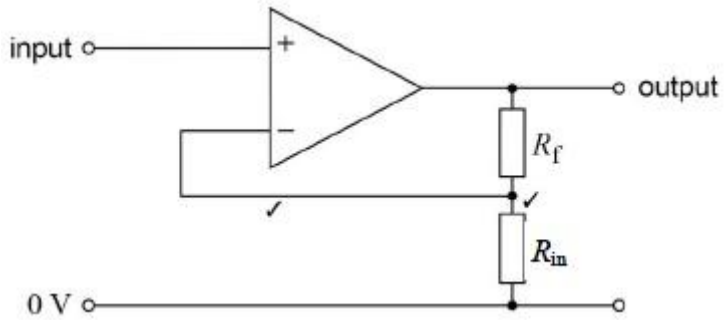
= 3 V / 40

= 75 × 10^{-3} V ✔

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1

(b)



Two resistor chain, correctly labelled connected between output and ground

Inverting input connected to mid-point of resistor chain

2

(c) $\frac{V_{out}}{V_{in}} = 1 + \frac{R_f}{R_{in}}$

$40 = 1 + \frac{R_f}{R_{in}}$ calculation to give resistor ratio of 39 ✔

R_{in} = 1 kΩ ; R_f = 39 kΩ ✔

2

(d) Desired gain × bandwidth is 40 × 50 kHz = 2 MHz ✔

The Op Amp can only provide ½ the amplification needed. Not suitable. ✔

1 mark - relevant calculation

1 mark - reference to only providing ½ require amplification / gain so not suitable

2

[7]

Q3.

The mark scheme gives some guidance as to what statements are expected to be seen in a 1 or 2 mark (L1), 3 or 4 mark (L2) and 5 or 6 mark (L3) answer.

Level	Criteria	QoWC
L3 5–6 marks	All bullet points in the question are covered in detail. The candidate shows good knowledge and uses the technical terms correctly. The answer has structure and clearly conveys the information required by the question. The candidate may show a depth of understanding that goes beyond basic recall and will appreciate the impact of the technology on society.	The student presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible.
L2 3–4 marks	All of the main processes are addressed and most of the detail is present. There may be an understanding of the impact	The student presents relevant information and in a way which assists the communication of meaning. The text is legible.

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	of the technology on society. There will be some structure, but may be brief or unclear in parts.	Sp&g are sufficiently accurate not to obscure meaning.
L1 1–2 marks	A limited answer with significant detail missing. The impact on society may be stated basically but not developed. Candidates may be able to recall some technical terms, but these may be used without expansion or understanding. The material may lack organisation.	The student presents some relevant information in a simple form. The text is usually legible. Sp&g allow meaning to be derived although errors are sometimes obstructive.
0	The work contains no significant analysis of the question asked.	The student's presentation, spelling, punctuation and grammar seriously obstruct understanding.

Expected information:

***Quantisation** – the conversion of a continuously varying voltage level by sampling into one that contains discrete (stepped) voltage levels*

Factors affecting quality of conversion

i) Sampling rate:

• The number of times/second that the analogue signal is assigned a digital code

*• Audio requires a sample rate = 2 × highest frequency component -------- **(Nyquist rate)***

*• Under sampling will cause a loss in quality. -------- **(Aliasing)***

• Over sampling results in superfluous data

ii) Size of digital code:

*• Number of bits per sample determines smallest change in analogue signal that can cause a change in digital code – ---------- **resolution***

*• **CD** – standard is 16 bits*

The combination of these two factors will determine the amount of data generated in the conversion process. The quantity of data will be very large and will probably require compression techniques to be applied

Advantages of a digital format:

• Good noise immunity

• Digital recordings don't degrade with frequent use in the same way as analogue recordings (Tape v CD)

• Digital files can be saved and manipulated by computer

• Can be coded for downloading across the Internet

Disadvantages of a digital format

• Can be conceived as being too clinical

• Data can become corrupt

• Format compatibility issues

Further points:

Why digital is dominant format in the recording industry

• V. good digital system is cheaper than v. good analogue system

• Scratch resistant format even on CDs

• Development of small personal music devices

• Development of downloads using personal computer

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• *Development of higher density storage devices (CD to SSD)*

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