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

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

Mark Schemes

Q1.

(a) High input resistance ✓

low / no energy consumption when in the ON and OFF states ✓
OR
No input current / control by pd only.

2

(b) Prevents static charge building up on gate (-source capacitor) ✓
Makes gate voltage 0 V when no water / nothing between probes ✓

2

(c) Identifies or attempts to use potential divider equation ✓

2.4 = 12 x 1 / (R_{probes} +1) leading to R_{probes} = 9.6 / 2.4 = 4 MΩ ✓

2

[6]

Q2.

(a) $f_0 = 1 / (2\pi \times \sqrt{(L \times C)})$ $C = 1 / (f_0^2 \times 4\pi^2 \times L)$ ✓ [valid rearrangement]
$= 1 / (50^2 \times 4\pi^2 \times 0.1)$
= 5.07 (5.1) μF ✓ [μF]

2

(b) Q factor = f_0 / f_B = 50 / 2.5 = 20 ✓

1

(c) Resonant frequency becomes 25 Hz ✓

Peak higher than original at resonant frequency ✓✓

2

[5]

Q3.

(a) It is not actually connected to 0V ✓
OR
Operational amplifier has a very large open loop gain

The voltage between V_+ and V_- inputs has to be zero [or tiny] otherwise will saturate ✓

2

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(b) V_{OUT} = -270K / 22K x V_{IN} = -12.3 V_{IN}
OR

V_{IN} = 50 x 0.01 = 0.5 V ✓

V_{OUT} = -12.3 x 0.5 = -6.1V ✓

2

(c) At 122 °C V_{OUT} = 122 x 0.01 x 12.3 = 15.0 V ✓
so any higher temp will give no further increase in V_{OUT} ✓ WTTE
OR
Max V_{IN} = 15.0 / 12.3 = 1.22 V ✓

Max input temperature = 1.22 / 0.01 = 122 °C ✓

2

(d) Level is fixed by controlling the pd at the + input)
OR
Turns off at higher temperature if V at + terminal higher✓
Output of the circuit is determined by R_f / R_i(V2 – V1) ✓

When V1 = V2 the output changes from + to - (causing heater to switch off) ✓

3

[9]

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