Q1.(a) **MOSFETs are commonly used in circuits where low power consumption is important to extend battery life.**

State and explain the property of MOSFET devices that makes them useful in these circuits.

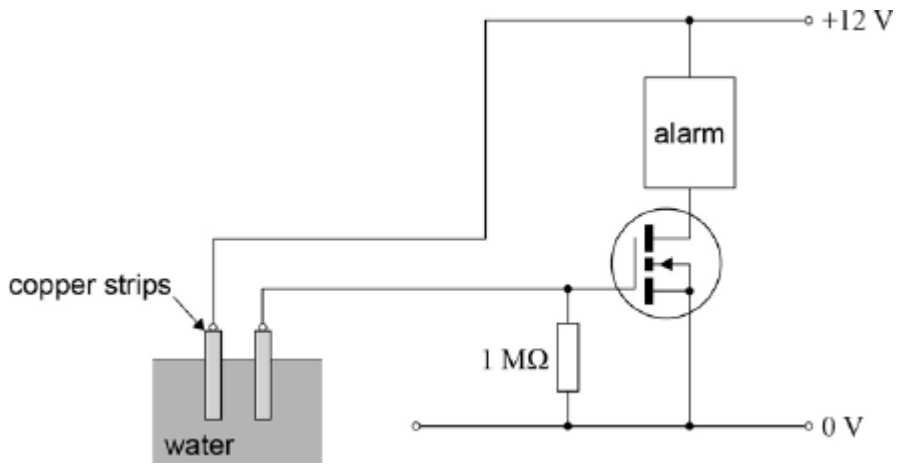
.....

.....

.....

(2)

The figure below shows an N-channel enhancement mode MOSFET, being used as part of a circuit for the water level alarm in a garden pond.
When the gap between the copper strips is filled with water the MOSFET turns on and the alarm sounds.



(b) Explain the reason for the 1 MΩ resistor in this application.

.....

.....

.....

(2)

(c) The circuit is tested by immersing the copper strips in the water, and bringing them closer together until the alarm sounds.
V_{th} for the MOSFET in the figure above is 2.4 V.

Determine the resistance of the water between the copper strips when the alarm sounds.

resistance = ... MΩ

(2)
(Total 6 marks)

Q2. A student designs an electronic system to control a ventilation fan for a greenhouse. The fan should be switched on only when both the temperature and humidity exceed certain levels that can each be set independently.

(a) Choosing appropriate input, process and output subsystems from the list below, draw a labelled block diagram to show a possible design for the system.

Choose from:

AND gate	**comparator**	**driver**	**humidity sensor**
fan motor	**temperature sensor**	**voltage divider**	

(7)

(b) In which subsystem would:

(i) a MOSFET be used

.....

(1)

(ii) an op-amp be used

.....

(1)

(iii) a thermistor be used?

.....

(1)

(c) The controller circuit operates from a 12 V power supply and draws a current of 25 mA under all conditions.
The fan motor requires a current of 450 mA when switched on and operates from the same 12 V power supply.

Calculate:

(i) the total current drawn by the whole system when the fan motor is switched on

.....

(1)

(ii) the input power to the whole system when the fan motor is switched on.

.....

(2)

(Total 13 marks)