1 Fig. 10.1 shows schematically a digital electronic circuit.

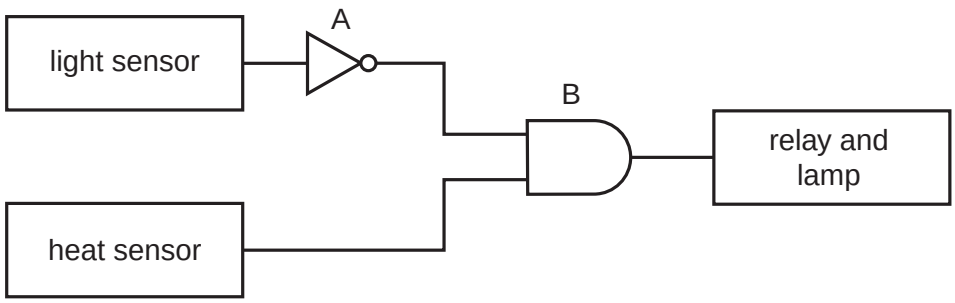

Fig. 10.1

(a) State the name of the logic gate

(i) at A, ...

(ii) at B. .....
[2]

(b) The light sensor has a “high” (logic 1) output in bright light and a “low” (logic 0) output when it is dark.

The heat sensor has a “high” (logic 1) output when it is hot and a “low” (logic 0) output when it is cold.

State the outputs of A and B when

(i) it is bright and cold,

output of A = ...

output of B = ...

(ii) it is dark and hot.

output of A = ...

output of B = ...
[4]

(c) Suggest why B is connected to a relay in order to light the lamp.

.....

.....[1]

(d) Suggest a practical use for this circuit.

.....

.....

.....[1]

[Total: 8]

2 **(a)** Explain what is meant by the terms *analogue* and *digital*, as applied to electronic circuits.

analogue .....

.....

digital .....

..... [2]

(b) Describe, if necessary using a diagram, the function of an AND gate in digital electronics.

.....

.....

.....

..... [2]

[Total: 4]

3 Fig. 11.1 is a schematic diagram of an electronic circuit controlling a lamp.

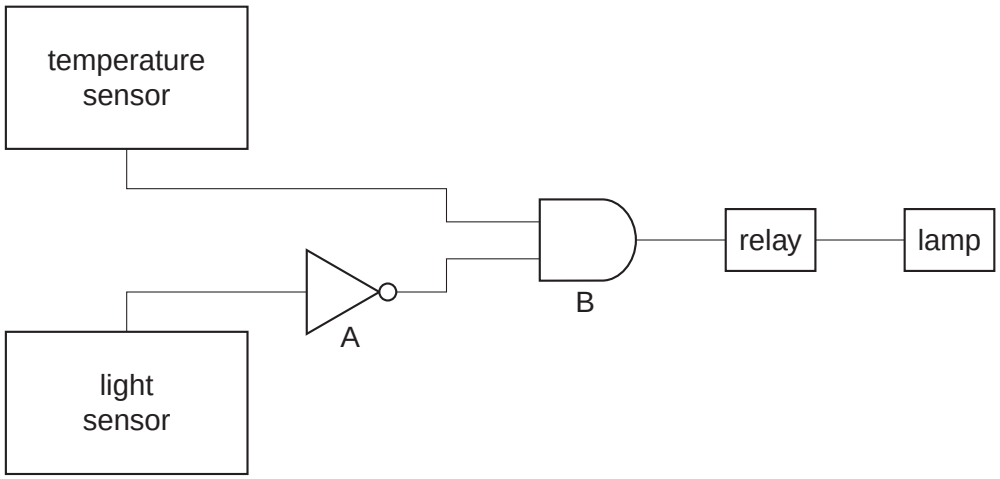

Fig. 11.1

(a) State the names of the logic gates A and B.

A ..... B ..... [2]

(b) The output of the temperature sensor is high (logic 1) when it detects raised temperature. The output of the light sensor is high (logic 1) when it detects raised light levels.

State the outputs of A and B when the surroundings are

(i) dark and cold, output of A = ...

output of B = ... [1]

(ii) dark and warm, output of A = ...

output of B = ... [1]

(iii) bright and warm. output of A = ...

output of B = ... [1]

(c) **(i)** Suggest why B is connected to a relay, rather than directly to the lamp.

..... [1]

(ii) The relay switches on when its input is high. In which of the three combinations in **(b)** will the lamp light up?

..... [1]

(iii) Suggest a practical use for this circuit.

..... [1]

[Total: 8]

4 Fig. 11.1 is an electronic circuit controlling an electric heater.

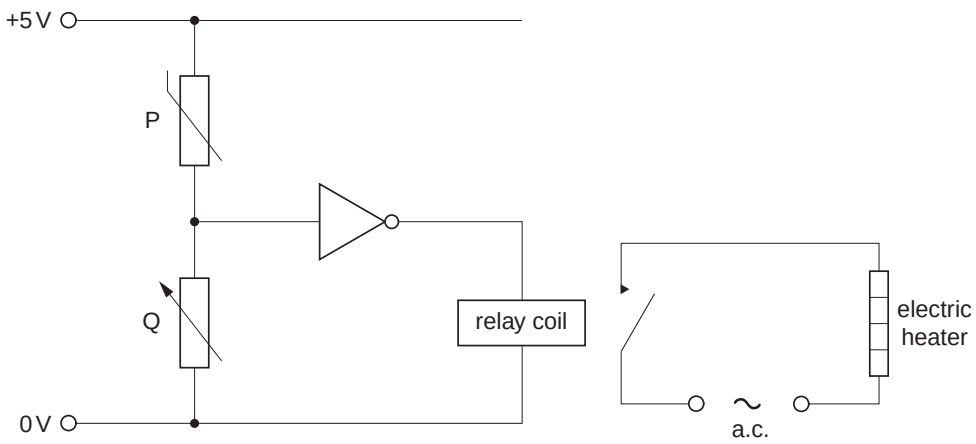

Fig. 11.1

The relay contacts close when there is a current in the relay coil.

(a) State the name of the logic gate in the circuit.

..... [1]

(b) **(i)** State the name of component P.

..... [1]

(ii) State what happens to P when its temperature falls.

..... [1]

(c) For the relay to operate, the output of the gate must be high (logic 1).

(i) What must be the input of the gate for the relay to operate?

..... [1]

(ii) State what the resistance of P must be, compared with the resistance of Q, in order to give this input to the gate.

..... [1]

(iii) Under what conditions will P have this resistance?

..... [1]

(d) Suggest why component Q is a variable resistor, rather than one with a fixed value.

..... [1]

(e) Suggest a practical use for this circuit.

..... [1]

[Total: 8]

5 **(a)** In the space below, draw the symbol for a NOR gate.

[1]

(b) Describe the action of a NOR gate in terms of its inputs and output.

.....

.....

.....

.....

..... [2]

(c) A chemical process requires heating at low pressure to work correctly.

When the heater is working, the output of a temperature sensor is high.

When the pressure is low enough, a pressure sensor has a low output.

Both outputs are fed into a NOR gate. A high output from the gate switches on an indicator lamp.

(i) Explain why the indicator lamp is off when the process is working correctly.

.....

.....

..... [1]

(ii) State whether the lamp is on or off in the following situations.

1. The pressure is low enough, but the heater stops working. .....

2. The heater is working, but the pressure rises too high. ..... [2]

[Total: 6]

6 Fig. 10.1 shows a circuit for a warning lamp that comes on when the external light intensity falls below a pre-set level.

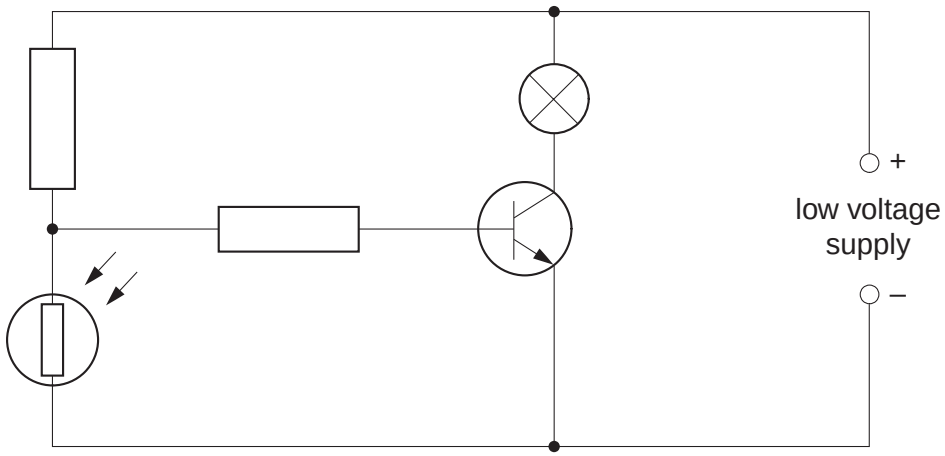

Fig. 10.1

(a) On Fig. 10.1, label

(i) with the letter X the component that detects the change in external light intensity,

(ii) with the letter Y the lamp,

(iii) with the letter Z the component that switches the lamp on and off.

[3]

(b) Describe how the circuit works as the external light intensity decreases and the lamp comes on.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 6]