1 for **(b)** and **(d)** accept HIGH/LOW or ON/OFF

(a) NOR **B1** [1

(b) outputs 1, 0, 0, 0
lose 1 mark e.e.o.o. B2 [2]

(c) **(i)** OR and NOT gates either order B1

(ii) both symbols correct B1
OR <u>then</u> NOT, connected B1 [3]

(d) logic level at Y, 0 B1
logic level at Z, opposite to candidate's answer to Y B1 [2]

[Total: 8]

2 **(a)** triangle with bar at apex, pointing either way NOT circle at apex B1 [1]
condone:
enclosing circle (but must have horizontal lines to/from triangle), no line through triangle, triangle filled in

(b) deflection/reasonable value/no deflection
must be <u>consistent</u> with direction of recognisable arrow B1 [1]
if no recognisable direction in symbol of **(a)**, assume arrow L to R

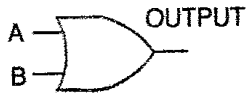
(ii) his **(i)** <u>different way round</u>
i.e. if deflection in **(i)** must be no deflection in **(ii)**;
if no deflection in **(i)** must be deflection in **(ii)**; B1 [1]

(c) half waves up or down on alternate half cycles B1
reasonable shapes of correct frequency AND amplitude 2.5–3V AND flats 0V (±1 small square) B1 [2]

(d) **(i)** transistor B1 [1]

(ii) 1st line of table : both off B1
2nd line of table : both on B1 [2]
give one compensatory mark : 1st line both on AND 2nd line both off
accept HIGH/LOW or 1/0 for on/off ignore ticks/crosses/yes/no

3 **(a)** correct symbol for OR gate



B1

(b) output is low / zero / off if both inputs are low / zero / off B1

output is high / one / on if one input is high / one / on
BUT this mark is not scored if candidate puts output low when both inputs high B1

(c) switches in doors are on if doors are open or vice versa B1
(switches in) doors provide inputs (to gate) B1
output (of gate) is connected to buzzer / warning light / alarm B1 [6]

4 **(a)** **(i)** thermistor B1

(ii) lamp is ON at 20 °C / low temperature and OFF at 100 °C / high temperature B1

p.d. across B is high at 20 °C / low temperature B1
p.d. across B is low at 100 °C / high temperature B1
OR as temperature rises, p.d. across B falls (B2)

transistor acts as a switch for the lamp at a certain temperature
OR lamp is ON if there is current in base / collector
OR potential of base is high
OR lamp is OFF if there is no current in base / collector
OR potential of base is too low B1

(b) to switch on a warning light when temperature (required for a process) becomes too low
OR to switch off a warning light when temperature (required for a process) becomes high enough B1 [6]
example (e.g. freezer or incubator) not needed, but if given, explanation required

5 **(a)** decreases / low / very low / zero B1 [1]

(b) ecf from **(a)**, both answers must be consistent with candidate's **(a)** B1

e.g. decreases / low / very low / zero increases / high / v. high / > 5V

light high OR 1 light low OR 0

AND dark low OR 0 AND dark high OR 1

(ii) switch position P high OR 1

AND switch position Q low OR 0 B1 [2]

(c) AND gate B1 [1

(d) transistor B1 [1]

(e) any 2 of:

(input) A high

(input) B high

C high

transistor switches on/works M1

yes / it would work A1 [2]