PreDP revision questions Answers for Section B of the exam

Unit 5 and 6: Electricity and Electronics

(a)	**(i)**	0 (A) / zero Unit penalty if wrong unit	B1	
	(ii)	12 V	B1	
(b)	**(i)**	V / R OR $V = IR$ in any form, letters, words or numbers	C1	
		0.5 A	A1	
	(ii)	8 × candidate's **(i)** OR 8/24 × 12	C1	
		4 V OR 4.0 V e.c.f.	A1	
(c)		$1/R_1 + 1/R_2 = 1/R$ OR $R = R_1R_2 / (R_1 + R_2)$ in any form	B1	
		5.3 (Ω) OR 5⅓ (Ω) OR 16/3 (Ω)	C1	
		12 / candidate's R	C1	
		2.25 A c.a.o.	A1	
	Alternatively:	12/16 (= 0.75) OR 12/8 (= 1.5)	C1	
		12/16 (= 0.75) AND 12/8 (= 1.5)	C1	
		Currents added	C1	
		2.25 A c.a.o.	A1	[10]

(a) A NOT or inverter B1
B AND B1

(b) (accept 1 or ON for HIGH, and 0 or OFF or NOT HIGH for LOW throughout)

(i) A – HIGH and B – LOW (both) no e.c.f. B1

(ii) A – HIGH and B – HIGH (both) no e.c.f. B1

(iii) A – LOW and B – LOW (both) no e.c.f. B1

(c) **(i)** B cannot provide enough power / current for lamp, or equiv.
OR allows remote lamp B1

(ii) the second one / dark and warm / HIGH, HIGH e.c.f. from **(b)** B1

(iii) warning if temperature in a closed / dark space (e.g. refrigerator, kiln) reaches too high a value
N.B. "to switch on a lamp when it is dark and warm" not accepted B1

[8]

(a) NOT or inverter B1

(b) **(i)** thermistor NOT thermal resistor B1

(ii) resistance increases OR voltage across it increases B1

(c) **(i)** LOW or 0 or off or NOT HIGH B1

(ii) (much) larger/ large / higher / high B1

(iii) low temperature e.c.f. from **(c) (ii)** B1

(d) to allow adjustment of the temp. at which relay will close / heater comes on B1

(e) automatic control or wtte of heating system / air-conditioning / automatic room heater
OR thermostat
OR any other sensible suggestion involving control of heating B1

[8]

(a) diode B1

(b) **(i)** 2 Ω B1

(ii) 24 OR 22 + 2 (Ω) seen C1

$1 / R = 1 / R_1 + 1 / R_2 (+ 1 / R_3)$ OR $(R =) \frac{R_1 R_2}{R_1 + R_2}$

seen or used with any 2 resistors
ignore extra resistance added to expression for R in equation C1

6 Ω A1

(c) N.B. marks may be scored anywhere in **(c)**

(current =) zero / very small M1

diode reverse biased
OR polarity wrong OR facing wrong way
OR diode only conducts R / + to L / - A1

(d) use $I = V / R$ OR $P = VI$ OR $P=V^2 / R$ symbols, numbers or words M1
use of R = 8 (Ω) & correct calculation to give 2W
OR $R = 4 / 0.5 = 8$ (Ω) OR $R = 4^2 / 2 = 8$ (Ω)
OR any other calculation(s) using ($I = V / R$ & $P = VI$) OR $P = V^2 / R$ to deduce 8 (Ω) M1

switch position B (NOTE: this is dependent on both M1s being scored)
ignore any calculations using 2 Ω A1 [10]

(a) **analogue** any reading possible/idea of continuous variation of value of quantity B1

digital idea of two states only B1

(b) if both inputs are 1/high, the output is 1/high B1
only added to previous line
OR if either or both inputs are 0/low, then output is 0/low B1
(accept both answers in form of a truth table)

(a) (E =) Pt symbols or numbers OR 100 × 13 × 3600 OR 0.1 × 13 OR 3 960 000 OR 4 320 000 C1
4 680 000 J OR 4.68 MJ OR 1.3 kWh OR 1300 Wh A1

(b) EITHER

$I = P/V$ in any form OR P/V OR 100/250 OR 0.4 A C1
$Q = It$ OR 0.4 × 13 × 3600 OR candidate's current × 13 × 3600
OR candidate's current × candidate's time in s C1

18 720 C e.c.f A1

OR

volts = joules/coulombs in any form C1
4680000/250 OR candidate's E/250 C1
18 720 C e.c.f A1

(c) (lost as/changed to) heat/light OR lost to air/surroundings B1

(a) increases (as current increases) M1
at an increasing rate A1

(b) (i) 25 Ω B1

(ii) IR in any form OR 0.070 x 25 C1
1.7/1.8 V A1

(iii) (P =) IV OR I^2R OR V^2/R in any form, numbers, symbols or words C1
0.12 W e.c.f. from **(i)/(ii)** A1

(c) (i) answer to **(b)(ii)** B1

(ii) use of $1/R = 1/R_1 + 1/R_2$ OR $R = R_1R_2/(R_1 + R_2)$ C1
12.5 Ω A1

(a) energy supplied / work done (per unit charge) to — B1
drive charge round a (complete) circuit — B1
OR
p.d. / voltage across battery / power source — B1

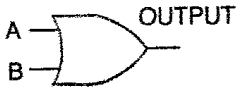
(b) **(i)** $P = IV$ OR $(I =) P/V$ OR $(I =) 60/240$ — C1
$= 0.25$ A OR ¼ A — A1

(ii) $I = V/R$ OR other version OR $(R =) V/I$ — C1
OR $(R =) 240/0.25$
OR $P=V^2/R$ or other version e.g. $(R=) V^2/P$
OR $(R=) 240^2/60$
$R= 960\ \Omega$ — A1

(c) current in series circuit = 240 / 972 =0.247 A — B1

current suits both bulbs, (so both light up so Y is correct) — B1
OR
p.d. across bulb A = 240 × (960/972) = 237 V
p.d. across bulb B = 240 × 12/972 = 2.96 V — B1
p.d. suits both bulbs, (so both light up so Y correct) — B1 [8]

(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) <u>switches</u> 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]

(a) **(i)** 4 V B1

(ii) 12 V B1

(b) **(i)** 6 Ω B1

(ii) $1/R = 1/3 + 1/6$ OR $(3 \times 6)/(3 + 6)$ C1
2 Ω A1

(c) V/R OR 12/candidate's **(ii)** C1
6 A ecf A1

(d) **(i)** stays same B1

(ii) decreases B1 [9]

(a) **(i)** **1.** resistance is constant / doesn't vary B1
2. resistance increases B1

(ii) 7 V B1

(b) resistance of resistor = 4/2.6 (= 1.54 Ω) C1
resistance of lamp = 4/3.6 (= 1.11 Ω) C1
$1/R = 1/R_1 + 1/R_2$ OR $(R =) R_1R_2/(R_1 + R_2)$ OR either eq. with numbers C1
0.645 or 0.65 Ω A1
OR
current through resistor = 2.6 A (C1)
current through lamp = 3.6 A (C1)
total current = 2.6 + 3.6 = 6.2 A (C1)
0.645 Ω OR 0.65 Ω OR R = 4/sum of candidate's currents (A1) [7]
accept R value based on no. of sig. figs. for resistors used by candidate

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

(b) **(i)** 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]

(a) **(i)** $I_1 = I_2 + I_3$ B1

(ii) $I_1 = I_4$ OR same B1

(b) **(i)** ($V = IR = 0.80 \times 3.0 =$) 2.4 V A1

(ii) $I = V/R$ in any algebraic form OR 2.4 / 2 OR **(b)(i)** / 2
OR any voltage divided by 2 C1
($I_3 = V/R = 2.4 / 2 =$) 1.2 A A1
OR
$I_3/I_2 = 3/2$ (C1)
$I_3 = 3/2 \times 0.8$ A = 1.2 A (A1)

(iii) ($I_2 + I_3$ OR Current through $R = 0.8 + 1.2$) = 2.0 (A)
OR 6 V / 2 A used C1
Parallel combination formula: $1/r = 1/r_1 + 1/r_2$
OR ($r =$) $r_1r_2/(r_1 + r_2)$ C1
Use of formula: combined resistance = 1.2 (Ω) C1
($R + 1.2 = 6/2 = 3.0\,\Omega$ $R =$) 1.8 Ω A1
OR
Current through $R = 0.8 + 1.2 = 2.0$ (A) (C1)
P.D. across $R = 6.0 - 2.4$ (C1)
= 3.6 (V) (C1)
$R = 3.6 / 2.0 = 1.8\,\Omega$ (A1)

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]

(a) Transistor B1

(b) Resistor / variable resistor / rheostat identified B1
Light-dependent resistor / LDR identified B1
Resistor or alternative in gap A; LDR in gap B B1

(c) Thermistor / thermal resistor / heat or temperature dependent resistor identified B1
Thermistor (or alternative name) in gap A and resistor in gap B B1

(a) in order downwards: 1 1 1 0 c.a.o. B1

(b) **(i)** 1 AND 0 (e.c.f. from **(b)(i)**) B1

(ii) NOT (gate) (**allow** NOR (gate)) B1

(c) R = 1 AND S = 0 (e.c.f. from **(b)(i)**) B1
T = 1 B1 [5]

(a) **(i)** input high/on/1, output low/off/0
input low/off/0, output high/on/1
OR reverses/inverts state of input OR output opposite to input B1

(a) **(ii)** resistance changes as temperature changes B1

(i) at low temperature resistance of thermistor is high
OR when temperature falls resistance of thermistor rises B1
p.d. across thermistor is high OR p.d. across R is low B1
(voltage) input to gate is low B1
output of gate is high (and warning light is on) B1

(ii) changes the temperature/set value at which the lamp comes on B1

(a) row 1 0 0 accept low / off B1

row 2 0 1 accept low / off and high / on B1

row 3 1 1 accept high / on B1

(b) 2 wires to flat (input) side, 1 wire from curved (output) side
do not accept pointed curved side or small circle B1

(c) NOT gate connected to output of AND gate
accept labelled boxes for gates
do not allow any extra gates or inputs M1

NOT gate correct way round A1

(a) **(i)** **1.** signal has same variation (with time) as the data B1

2. consists of (a series of) 'highs' and 'lows' B1

either analogue is continuously variable (between limits)
or digital has no intermediate values B1 [3]

(ii) e.g. can be regenerated / noise can be eliminated
extra data can be added to check / correct transmitted signal
(*any two reasonable suggestions, 1 each*) B2 [2]