



2015 Technological Studies

Intermediate 2

Finalised Marking Instructions

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Part One: General Marking Principles for Technological Studies Intermediate 2

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question.

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader/Principal Assessor. *You can do this by posting a question on the Marking Team forum or by e-mailing/phoning the e-marker Helpline.*
- (b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

GENERAL MARKING ADVICE: Technological Studies Intermediate 2

The marking schemes are written to assist in determining the “minimal acceptable answer” rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates’ evidence, and apply to marking both end of unit assessments and course assessments.

Part Two: Marking Instructions for each Question

Question			Expected Answer(s)	Max Mark	Additional Guidance
1.	(a)		<p>A Kinetic (1 mark)</p> <p>B Electrical (1 mark)</p>	2	Not electric
1.	(b)	(i)	An energy source that will never run out.	1	
1.	(b)	(ii)	<p>Solar, wave, tidal, hydroelectric, biomass, geothermal.</p> <p>(1 mark) for each correct answer.</p>	2	
1.	(c)		<p>Advantage – reduces CO₂ / greenhouse gases emissions because less need for fossil fuel (1 mark)</p> <p>Disadvantage – can destroy natural habitat, cannot produce electricity if there is no wind / eye sore/ noise. (1 mark)</p>	2	<p>Not pollution on its own.</p> <p>Not cost unless relative</p>

(7)

Question		Expected Answer(s)	Max Mark	Additional Guidance
2.	(a)	<p>The start switch is pushed it will send a signal to the control unit. The control unit will compare the set level to the actual level. If the actual level is below the set level the output driver switching on / opening the water valve. When the set level and the actual level are the same the control will cause the water valve to close stopping the water.</p> <p>(1 mark) for each relevant descriptive statement.</p>	3	
2.	(b)	<p>It is closed loop control as the sensor continually monitors the output, sending information to the control unit. The control unit will then alter the output to <u>suit</u> the required conditions.</p> <p>(1 mark) for stating 'closed loop'. (1 mark) for explanation.</p>	2	
2.	(c)	<p>The system is set / started by the user. The system then completes all others processes by itself.</p>	1	

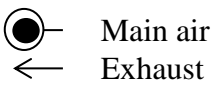
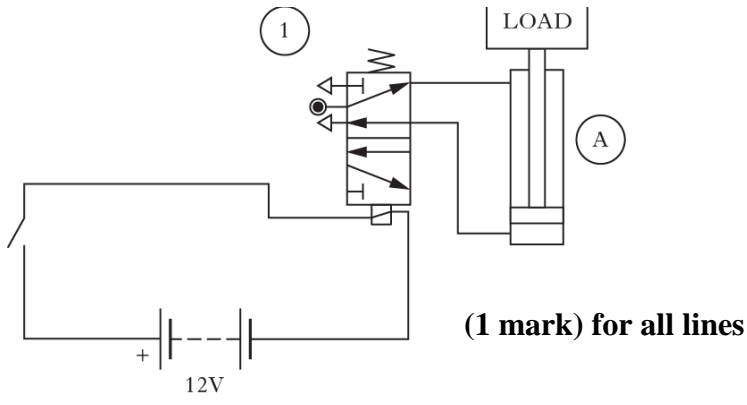
(6)

Question		Expected Answer(s)	Max Mark	Additional Guidance
3.	(a)	$Z = (\bar{A}.B.\bar{C}) + (A.\bar{B}.\bar{C}) + (A.\bar{B}.C)$ <p>all AND (1 mark) all OR (1 mark) all NOT (1 mark)</p>	3	Accept any other correct Boolean statement for Z
3.	(b)	<p>(1 mark)</p> <p>(1 mark)</p> <p>(1 mark)</p>	3	NOT symbol – 1 mk AND symbol – 1 mk OR symbol – 1 mk
3.	(c)	Invertor	1	

(7)

Question			Expected Answer(s)	Max Mark	Additional Guidance
4.	(a)		1. Same voltage / Brightness across all lamps. (1 mark) 2. If one lamps 'blows' the rest stay on / easier to fault find as the broken lamp can be easily identified. (1 mark)	2	
4.	(b)	(i)	$R_T = 2k2 + 2k2$ $= 4k4$ or 4400Ω (1 mark) for correct answer.	1	
4.	(b)	(ii)	$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$ $= \frac{2k2 \times 2k2}{2k2 + 2k2}$ (1 mark) $= 1.1 k\Omega$ or 1100Ω (1 mark) for correct answer for working.	2	
4.	(c)	(i)	$V_5 = IR$ 0.003×4400 $= 13.2V$ (1 mark) $A_2 = I = \frac{V}{R}$ $= \frac{13.2}{1100}$ $A_2 = 0.012A$ (1 mark)	2	Allow FTE from (b)(ii) answer
4.	(c)	(ii)	$A_3 = \frac{A_2}{2}$ $= \frac{0.0012}{2}$ $= 0.0006A$ (1 mark)	1	Allow FTE from (c) answer

(8)

Question			Expected Answer(s)	Max Mark	Additional Guidance
5.	(a)		Clean, reliable, cheap to run, safety (no spark).	1	Not cheap on its own
5.	(b)	(i)	Solenoid 5/2 valve spring return.	1	All three aspects
5.	(b)	(ii)	 Main air (1 mark) Exhaust (1 mark)	2	
5.	(c)		 (1 mark) for all lines	1	
5.	(d)		$F = PA$ $= 0.6 \times 490.625$ $= 294.375N$ (1 mark) for answer. Yes it will be able to lift it. (1 mark)	3	Allow FTE for statement based on calculated value

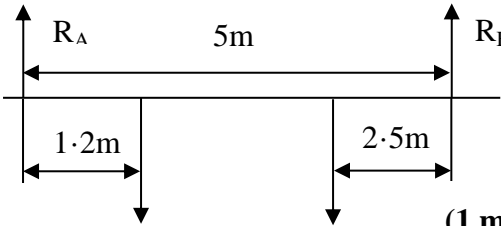
(8)

Question	Expected Answer(s)	Max Mark	Additional Guidance
<p>6. (a)</p>	<pre> graph TD Start([Wash]) --> IO1[/water and soap on/] IO1 --> P1[wait 10 seconds] P1 --> IO2[/car wash forward/] IO2 --> P2[wait 20 seconds] P2 --> IO3[/all off*/] IO3 --> IO4[/Brushes on/] IO4 --> IO5[/car wash reverse/] IO5 --> D{is limit switch on?} D -- No --> D1[Decision] D -- Yes --> IO6[/All off/] IO6 --> End([Return]) </pre> <p>(1 mark) for all correct symbols</p>	<p>8</p>	
<p>6. (b)</p>	<p>Quicker development time, allows for the same coding to be used again and again.</p>	<p>1</p>	

(9)

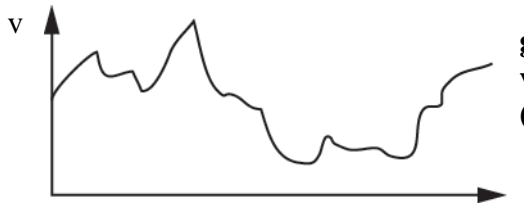
Question			Expected Answer(s)	Max Mark	Additional Guidance
7.	(a)		Type 4.	1	
7.	(b)	(i)	$V = \frac{R_1}{R_T} \times V_s$ $= \frac{10}{90} \times 6 \quad \text{(1 mark)}$ $= 0.667V \quad \text{(1 mark) answer from working}$	2	
7.	(b)	(ii)	The transistor is not saturated.	1	
7.	(c)		Thermistor resistance will decrease. (1 mark) V_1 will increase. (1 mark)	2	Apply FTE to resistance statement
7.	(d)		<ul style="list-style-type: none"> • Current limiting resistor. (1 mark) • at base leg (1 mark) 	2	

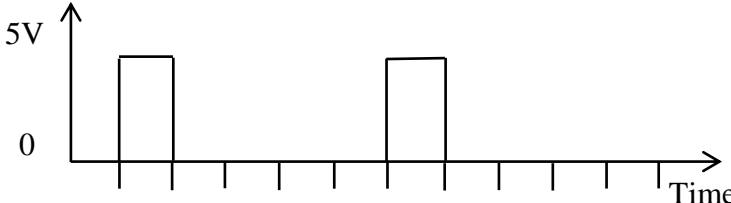
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Question		Expected Answer(s)	Max Mark	Additional Guidance
8.	(a)	 <p>(1 mark) all forces (1 mark) all distances</p>	2	
8.	(b) (i)	$\Sigma CWM = \Sigma AWM$ $(R_A \times 5) = (25 \times 2.5) + (45 \times 3.8) \quad (1 \text{ mark})$ $R_A = \frac{(62.5 + 171)}{5} \quad (1 \text{ mark})$ $= 46.7 \text{ kN} \quad (1 \text{ mark})$	3	
8.	(b) (ii)	$\Sigma F_V = 0$ $46.7 + R_B = 45 + 25 \quad (1 \text{ mark})$ $R_B = 23.3 \text{ kN} \quad (1 \text{ mark})$	2	Allow FTE from (b) (i)


(7)

Section B

Question			Expected Answer(s)	Max Mark	Additional Guidance
9.	(a)		<p>When the runner is in position the resistance and voltage across the LDR increase. This will cause the transistor to saturate when it reaches 0.7V. When the transistor saturates the relay will be activated, switching on the 230V circuit. When the user selects the start switch the motor will turn. The speed of the motor can be altered by adjusting the variable resistor.</p> <p>(1 mark) for each correct statement.</p>	4	
9.	(b)	(i)	$P = IV$ $I = \frac{P}{V}$ $= \frac{8}{5} \quad \text{(1 mark)}$ $= 1.6A \quad \text{(1 mark)}$	2	
9.	(b)	(ii)	$I_B = \frac{I_C}{h_{FE}}$ $= \frac{1.6}{50} = 0.032A \quad \text{(1 mark)}$	1	Allow FTE from (b) (i)
9.	(c)		 <p>graph showing varying signal (1 mark)</p>	1	
9.	(d)		Constant / high output torque.	1	
9.	(e)	(i)	ROM / EEPROM.	1	
9.	(e)	(ii)	I/O Port. (Input/Output port)	1	

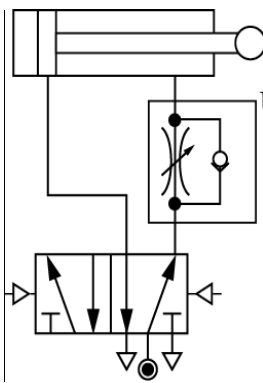
Question		Expected Answer(s)	Max Mark	Additional Guidance
9.	(f)	<p>main: let pins = 0 (1 mark)</p> <p> if pin 0 = 0 then main (1 mark)</p> <p> if pin 1 = 0 then main (1 mark)</p> <p> gosub set speed (1 mark)</p> <p>(1 mark) for both</p> <ul style="list-style-type: none"> ● high 7 (1 mark) ● pause mark for both ● low 7 (1 mark) ● pause space ● goto main (1 mark) 	7	Accept any other alternative PBASIC commands
9.	(g)	 <p>(1 mark) correct ratio</p> <p>(1 mark) digital signal</p>	2	

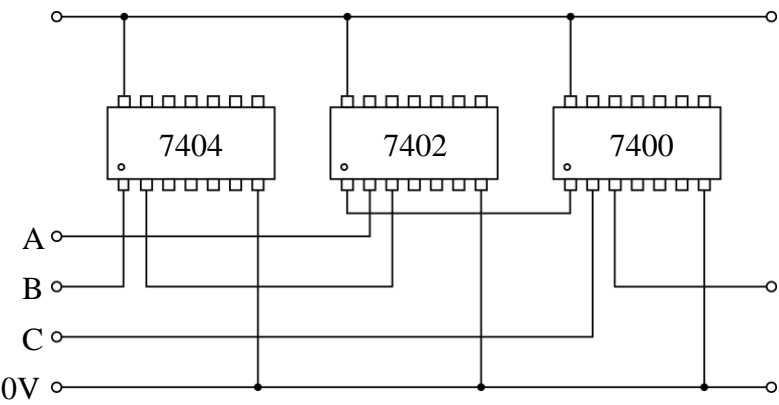
(20)

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	(a)		$V.R = \frac{40}{1} \times \frac{120}{20}$ <p style="text-align: right;">(1 mark)</p> $= 240:1$ <p style="text-align: right;">(1 mark)</p> $\text{output velocity} = \frac{3000}{240}$ <p style="text-align: right;">(1 mark)</p> $= 12.5 \text{ rev/min}$ <p style="text-align: right;">(1 mark)</p>	4	
10.	(b)		Worm.	1	Not worm wheel
10	(c)	(i)	X Pawl (1 mark) Y Ratchet (1 mark)	2	Incorrect order 1 mark
10.	(c)	(ii)	 Anti-clockwise	1	
10.	(d)	(i)	$E_w = F \times D$ $= 4905 \times 100$ $= 490500\text{J}$ <p style="text-align: right;">(1 mark)</p> $F = mg$ $= 500 \times 9.81$ $= 4905\text{N}$ <p style="text-align: right;">(1 mark)</p>	3	
10.	(d)	(ii)	$\eta = \frac{E_{\text{out}}}{E_{\text{in}}}$ $E_{\text{in}} = \frac{490500}{0.35}$ $= 1401428.6\text{J}$ <p style="text-align: right;">(1 mark)</p> <p style="text-align: right;">(1 mark)</p>	2	Allow FTE from (d) (i)
10.	(d)	(iii)	$P = \frac{E_e}{t}$ $= \frac{1401428.6}{60}$ $= 23357\text{W}$ <p style="text-align: right;">(1 mark)</p> <p style="text-align: right;">(1 mark)</p> $E_e = Pt$ $1 \text{ min} = 60 \text{ secs}$ <p style="text-align: right;">(1 mark)</p>	3	Allow FTE from (d) (ii)

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	(e)	(i)	Heat or sound.	1	
10.	(e)	(ii)	Oil / Lubricate.	1	
10.	(f)		Advantage – easily transported / reliable source. (1 mark) Disadvantage – will eventually run out / pollution. (1 mark)	2	

(20)

Question		Expected Answer(s)	Max Mark	Additional Guidance																											
11.	(a)	<p>Valve (1) ... pilot air is sent to valve (5) activating it. This sends main air to cylinder (A) causing it to outstroke and activate valve (3). This will send pilot air to activate valve (6). This will cause cylinder (B) to outstroke activating valve (4). Valve (4) will send pilot air to activate valve (5) causing cylinder (A) to instroke, activating valve (2). This will send pilot air to activate valve (6), causing cylinder (B) to instroke.</p> <p>(1 mark) for each correct statement.</p>	5																												
11.	(b)	<p>(1 mark)</p> <p>A diaphragm valve could be used which would sense a change in air pressure</p> <p>(1 mark)</p>	2	Air bleed -1 mark.																											
11.	(c)	 <p>Unidirectional restrictor symbol (1 mark)</p> <p>Position (1 mark)</p> <p>Orientation (1 mark)</p>	3																												
11.	(d)	<table border="1"> <thead> <tr> <th>P</th> <th>Q</th> <th>Z</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td></tr> </tbody> </table> <p>(1 mark) each column</p> <p>A NOR P Q NAND C</p>	P	Q	Z	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	0	1	0	0	1	3	Allow FTE.
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Question			Expected Answer(s)	Max Mark	Additional Guidance
11.	(e)		 <p>(1 mark) per correct wiring of gate.</p>	3	
11.	(f)	(i)	7400 – Quad 2 input NAND (1 mark) 7404 – Hex Inverter (1 mark)	2	
11.	(f)	(ii)	TTL.	1	
11.	(f)	(iii)	5v (± 0.25)	1	

(20)

[END OF MARKING INSTRUCTIONS]