2014 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

SECTION A

Question			Expected Answer/s	Max Mark	Additional Guidance
1	**a**	**i**	ALU – Arithmetic Logic Unit **(1 mark)** EEPROM – Electronic Erasable Programmable Read Only Memory **(1 mark)**	**2**	Full and correct name
1	**a**	**ii**	EEPROM - Stores program **(1 mark)** RAM - working memory / stores temporary programs data **(1 mark)**	**2**	Functional related statement not characteristics
1	**b**	**i**	let dirs.=% 11011000	**1**	
1	**b**	**ii**	Binary number	**1**	
2	**a**	**i**	E_h = CmΔt (26°-22° = 4°C) **(1 mark)** = 4190 × 1200 × 4 **(1 mark)** = 20112000J (20.1MJ) **(1 mark)**	**3**	
2	**a**	**ii**	$E_{in} = \frac{E_{out}}{\text{Efficiency}}$ $= \frac{20112000}{0{\cdot}82}$ **(1 mark)** = 24526829·27J (24.5MJ) **(1 mark)**	**2**	Allow FTE (a)(i)
2	**a**	**iii**	$I = \frac{Ee}{tv}$ $= \frac{24526829 \cdot 27}{3600 \times 230}$ **(1 mark)** = 29·62A **(1 mark)**	**2**	Allow FTE (a)(ii)
2	**b**		Reduce heat loss (Insulate walls, cover when not in use, smaller water surface area – must include location) – 1 Use a more efficient motor/pump – 1 Use/improve bearings, material (slipper), lubricate etc) – 1 Clean filter (reducing resistance to water flow)	**2**	Any appropriate descriptive response

<table>
<tr><th colspan="3">Question</th><th>Expected Answer/s</th><th>Max Mark</th><th>Additional Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>
<table>
<tr><th>P</th><th>Q</th><th>Z</th></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
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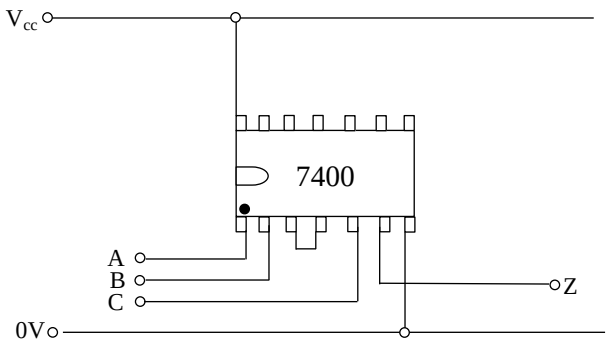
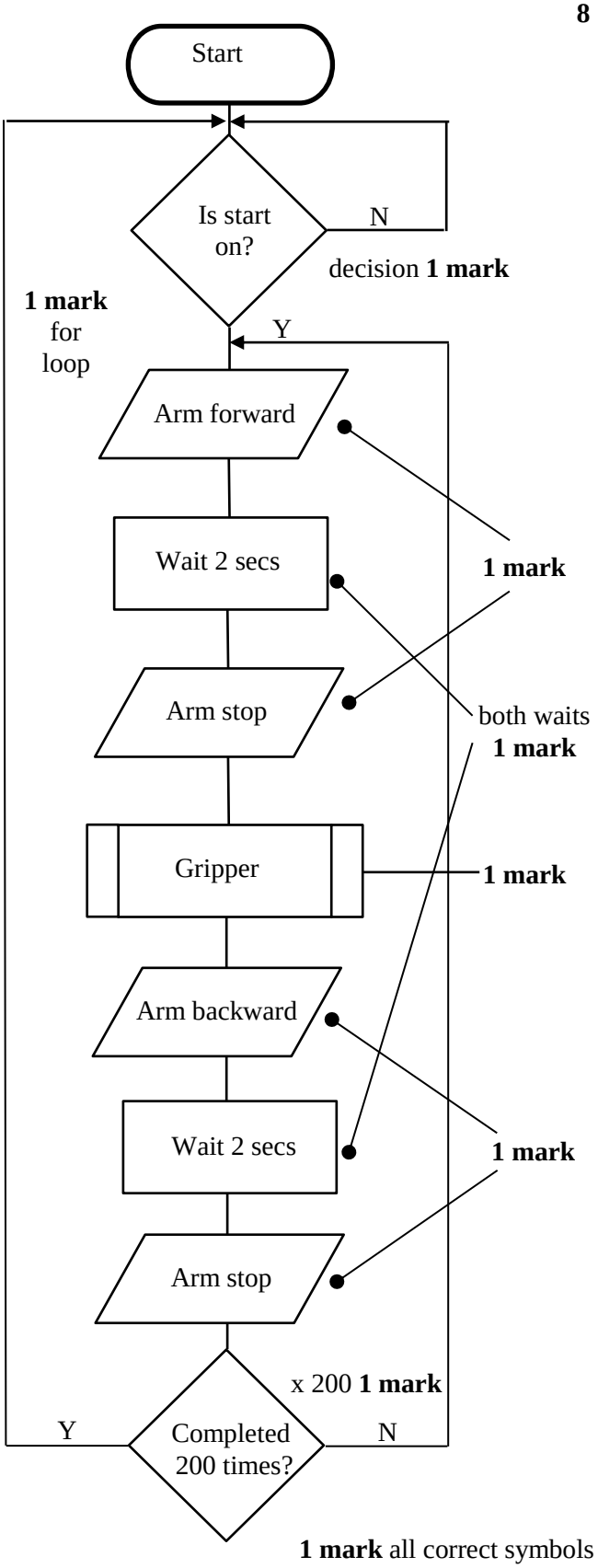
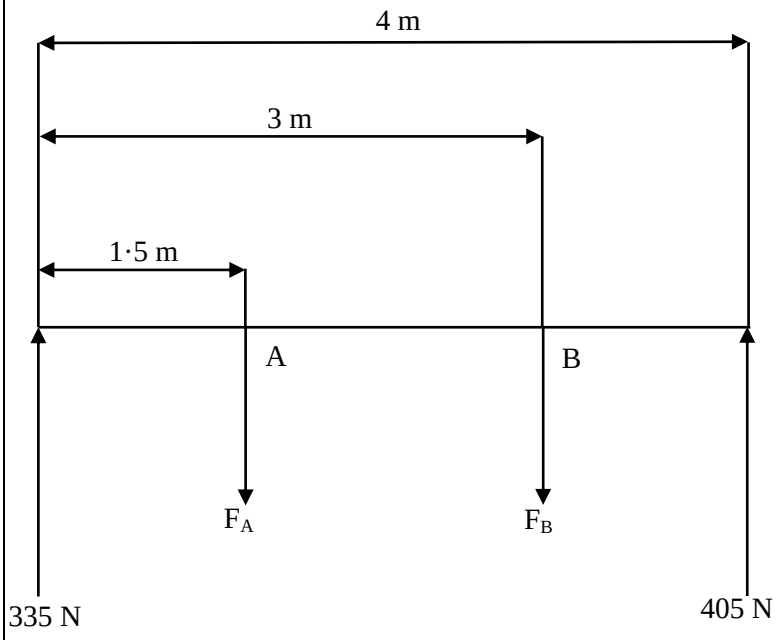
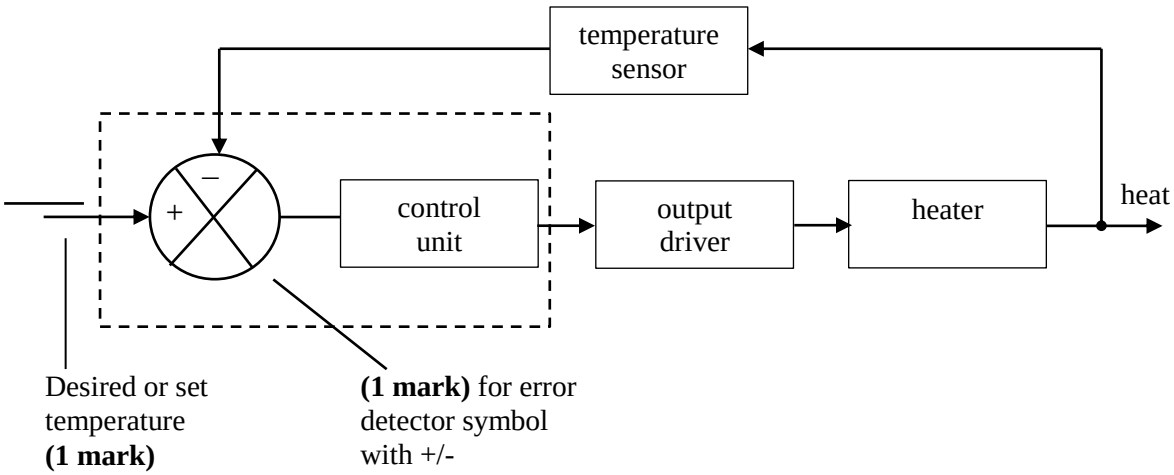
<tr><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
</table>
1 mark for each correct column
</td><td>3</td><td>FTE in column Z
(ORing P & Q)</td></tr>
<tr><td>3</td><td>b</td><td>i</td><td>


1 mark for inputs and output from a gate (2 max)
1 mark for both power rails (1)
</td><td>3</td><td></td></tr>
<tr><td>3</td><td>b</td><td>ii</td><td>Quad 2 input NAND gate</td><td>1</td><td>Full and correct (any order)</td></tr>
<tr><td>4</td><td>a</td><td></td><td>① Pilot 5/2 valve spring return (1 mark)
④ Reservoir (1 mark)</td><td>2</td><td>Full and correct (any order)</td></tr>
<tr><td>4</td><td>b</td><td></td><td>To create an adjustable (1) time delay (1).</td><td>2</td><td>Descriptive response</td></tr>
<tr><td>4</td><td>c</td><td>i</td><td>$A_{rod} = 3{\cdot}14 \times 4^2 = 50{\cdot}24\ mm^2$ (1 mark) $A_{piston} = 3{\cdot}14 \times 20^2 = 1256\ mm^2$ (1 mark)
$A_{effective} = 1256 - 50{\cdot}24$
$= 1205{\cdot}76\ mm^2$ (1 mark from working)</td><td>3</td><td></td></tr>
<tr><td>4</td><td>c</td><td>ii</td><td>$P = \frac{F}{A}$
$= \frac{844}{1205{\cdot}76}$ (1 mark)
$= 0{\cdot}69\ N/mm^2$ (1 mark)</td><td>2</td><td>Allow FTE from (c)(ii)</td></tr>
</table>

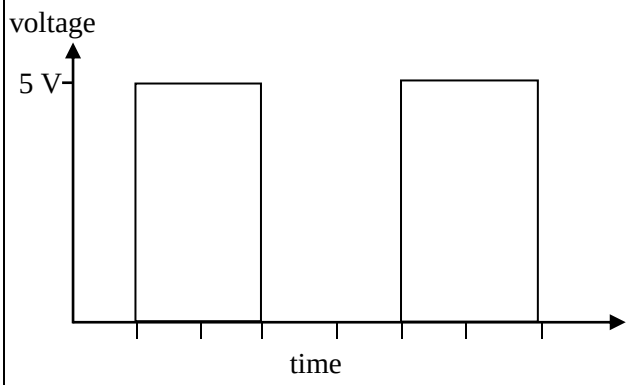
Question			Expected Answer/s	Max Mark	Additional Guidance
5	**a**		Yellow Violet Brown	**1**	Ignore tolerance colour if stated
5	**b**	**i**	$I = \frac{V}{R} = \frac{2 \cdot 63}{470}$ **(1 mark)** $= 0 \cdot 0056$ A (5.6mA) **(1 mark)**	**2**	
5	**b**	**ii**	$R = \frac{V}{I} = \frac{3}{0 \cdot 0056}$ **(1 mark)** $= 535 \cdot 7\ \Omega$ **(1 mark)**	**2**	Allow FTE (b)(i)
5	**b**	**iii**	$535 \cdot 7 - 470 = 65 \cdot 7\ \Omega$	**1**	Allow FTE (b)(ii)
5	**b**	**iv**	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{65 \cdot 7} = \frac{1}{100} + \frac{1}{270} + \frac{1}{R_3}$ **(1 mark)** $0 \cdot 015 = 0 \cdot 01 + 0 \cdot 0037 + \frac{1}{R_3}$ $R_3 = \frac{1}{0 \cdot 0013}$ **(1 mark)** $= 769 \cdot 23\ \Omega$ **(1 mark)**	**3**	Allow FTE (b)(iii)

Question			Expected Answer/s	Max Mark	Additional Guidance
6			 **1 mark** all correct symbols	8	Ignore any extra boxes

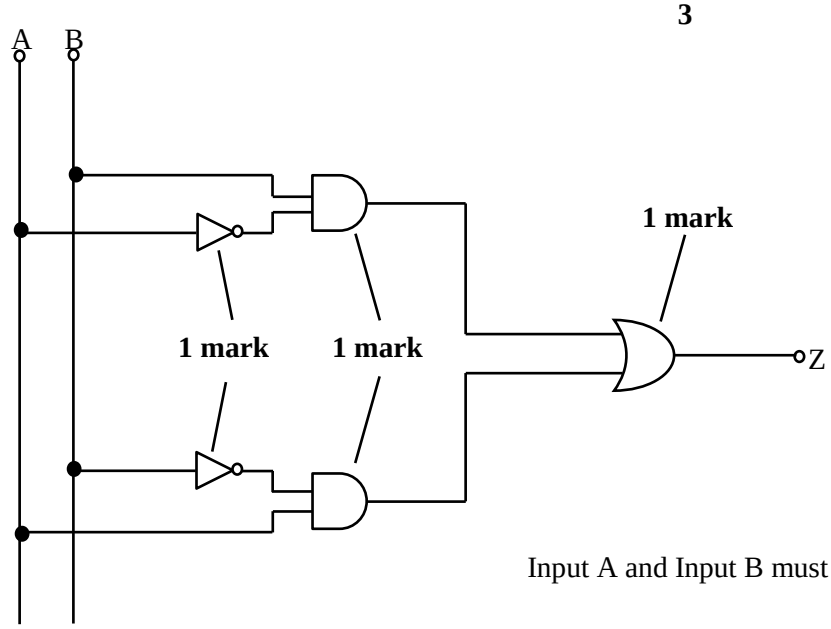
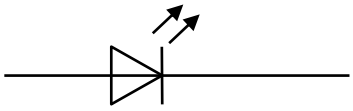
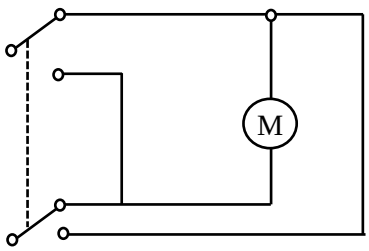
Question			Expected Answer/s	Max Mark	Additional Guidance
7	a		 All Forces (direction & magnitude where known) **(1 mark)** All Distances (ignore units) **(1 mark)**	2	
7	b	i	$\Sigma CWM = \Sigma ACWM$ $335 \times 3 = (F_A \times 1{\cdot}5) + (405 \times 1)$ **(1 mark)** $1005 - 405 = F_A \times 1{\cdot}5$ $F_A = \frac{600}{1{\cdot}5}$ **(1 mark)** $= 400$ N **(1 mark answer from working)**	3	
7	b	ii	$\Sigma F_V = 0$ $F_B = 335 + 405 - 400$ **(1 mark)** $= 340$ N **(1 mark answer from working)**	2	Allow FTE from (b) (i)

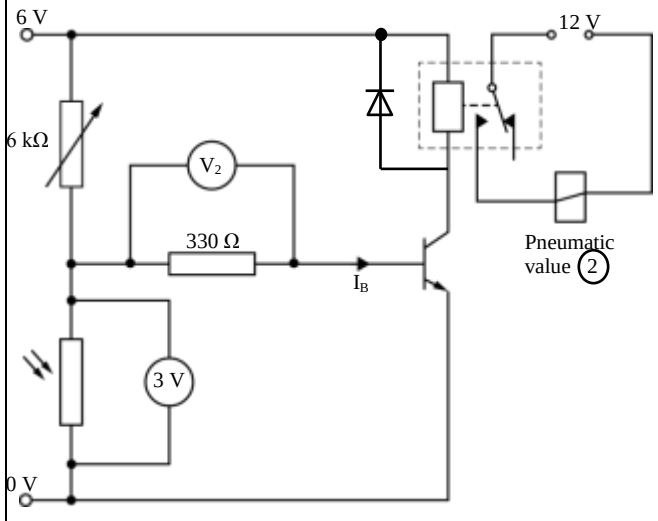
Question			Expected Answer/s	Max Mark	Additional Guidance
8	**a**			**2**	
8	**b**		The temperature is set. This is then compared with the actual temperature. If there is a difference/error a signal will be sent to the driver The driver will power the heater raising the temperature. **1 mark – control unit: input to / comparing** **1 mark – feedback operation** **1 mark – driver / heater operation**	**3**	Descriptive responses

SECTION B

Question			Expected Answer/s	Max Mark	Additional Guidance
9	**a**		doorclose: for b0 = 1 to 255 **(1 mark)** if pin 3 = 1 then label **(1 mark)** pause 500 **(1 mark)** next b0 **(1 mark)** label: high 7 **(1 mark)** if pin 2 = 0 then label **(1 mark)** low 7 **(1 mark)** return **(1 mark)**	**8**	For… next loop (counter or candidate defined variable – accept 0 to 254) Correct syntax Ignore additional commands
9	**b**	**i**	Pulse Width Modulation	**1**	
9	**b**	**ii**	 **(1 mark)** for correct ratio **(1 mark)** for digital signal using 5V and 0V levels	**2**	
9	**b**	**iii**	No loss of torque / simple program / easy to alter speed	**1**	
9	**c**		$\frac{36}{1} \times \frac{90}{30}$ **(1 mark) (1 mark)** = 108 : 1 (0.0093) **(overall ratio 1 mark)** $\frac{2000}{108}$ = 18.5 rev/min (18 rev/min) **(1 mark)**	**4**	Alternative working 2000/36 = 55 rev/min **- 2** 55 x (30/ 90) = 18.5rev/min **- 2**

Question			Expected Answer/s	Max Mark	Additional Guidance
9	**d**	**i**	Worm (gear)	**1**	Not worm wheel
9	**d**	**ii**	Worm can only turn wheel / acts as a brake / high torque	**1**	
9	**d**	**iii**	Rack Pinion **(1 mark each)**	**2**	Any order
10	**a**	**i**	$E_k = \frac{1}{2}\,mv^2$ $= \frac{1}{2} \times 25 \times 0{\cdot}5^2$ **(1 mark)** $= 3{\cdot}125$ J **(1 mark answer from working)**	**2**	
10	**a**	**ii**	$F = \frac{2E_s}{x}$ $(E_k = E_s = 3{\cdot}125$ J) **(1 mark)** $= \frac{2 \times 3{\cdot}125}{0{\cdot}08}$ **(1 mark)** $= 78{\cdot}13$ N **(1 mark answer from working)**	**3**	Allow FTE from (a) (i)
10	**b**	**i**	Heat / sound (energy)	**1**	Not kinetic or Strain
10	**b**	**ii**	Reduces the force / less impact / parcel less likely to be damaged **(1 mark for a correct statement)**	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
10	**c**	**i**	 Input A and Input B must be wired to gates	**3**	
10	**c**	**ii**	$(\bar{A} \cdot B)$ + $(A \cdot \bar{B})$ = Z **1 mark** **1 mark** **1 mark**	**3**	Allow FTE from (c)(i)
10	**d**	**i**	18 V	**1**	Accept 15V
10	**d**	**ii**	Affected by static / slower switching speed / unused inputs must be connected	**1**	
10	**e**		 **(1 mark)** symbol **(1 mark)** orientation	**2**	
10	**f**	**i**	Double Pole Double Throw	**1**	
10	**f**	**ii**	 **(1 mark)** for each complete connection (fwd / bck)	**2**	

Question			Expected Answer/s	Max Mark	Additional Guidance
11	**a**	**i**	② Solenoid **(1 mark)** ③ Push button **(1 mark)**	**2**	
11	**a**	**ii**	AND (control)	**1**	
11	**b**		Circuit operates in a set order/sequence	**1**	Descriptive response
11	**c**		Valve ③ is activated sending pilot air to valve ④ . Thus causes cylinder Ⓐ to outstroke actuating valve ⑧ . This sends pilot air to valve ⑥ causing cylinder Ⓑ to outstroke activating valve ⑦ . This sends air to valve ⑥ causing cylinder Ⓑ to instroke, sending pilot air to valve ④ . This causes cylinder Ⓐ to instroke reseting the system. Each relevant descriptive statement **(1 mark)**	**6**	
11	**d**	**i**	5 kΩ	**1**	
11	**d**	**ii**	$V_1 = \frac{5}{11} \times 6$ **(1 mark)** $= 2{\cdot}7$ V **(1 mark answer from working)**	**2**	Allow FTE from (d) (i)
11	**e**	**i**	 **(1 mark)** for symbol and orientation **(1 mark)** for postition	**2**	Not LED
11	**e**	**ii**	Adjust the 'switch on' value /light level	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
11	**f**	**i**	$3 - 0{\cdot}7 = 2{\cdot}3$ V **(1 mark) (1 mark)**	**2**	
11	**f**	**ii**	$I_b = \frac{V}{R}$ $= \frac{2{\cdot}3}{330}$ **(1 mark)** $= 0{\cdot}0069$ A **(1 mark)**	**2**	Allow FTE (f)(i)

[END OF MARKING INSTRUCTIONS]