2013 Technological Studies

Intermediate 2

Finalised Marking Instructions

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.
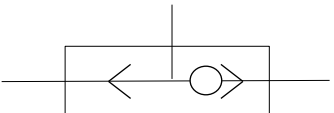
(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and 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.
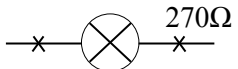
Part Two: Marking Instructions for each Question

SECTION A

Question			Expected Answer/s	Max Mark	Additional Guidance
1	a		Error detector	1	
	b	i	Negative (feedback)	1	Ignore lack/'feedback'
		ii	Maintaining desired level	1	Reducing the error
	c		The position is set. The position sensor sends the actual position to the error detector. This signal is compared with the set position. If there is an error then the control unit will switch on the motor, moving the telescope to the desired position. When there is no error detected then the motor will stop. **1 mark** for each correct statement	3	
2	a		Component ⑤ – Reservoir Valve ② – Diaphragm 3/2 valve spring return	1 1	All parts of the name for valve – 1 mark
	b		…valve ② is activated sending air to valve ③. When valve ③ is activated pilot air will be sent to valve ④, causing the cylinder to outstroke. After a set time delay, pilot air is sent to valve ④ causing the cylinder to instroke again. **1 mark** for each correct statement	4	
	c	i	Shuttle valve	1	
		ii		1	Apply FTE from (c) (i)

uestion			Expected Answer/s	Max Mark	Additional Guidance

3	**a**		main: low 6 **1 mark**
			
			        if pin 2 = 0 then main **1 mark**
			
			        high 6
			        pause 10 **1 mark**
			1 mark low 6
			        pause 20
			        goto main **1 mark**
				5	Accept binary equivalent for pins
					
					Syntax must be correct

	b	**i**	Pulse Width Modulation	1	Full name not PWM
		ii	space	1	
4	**a**		Z 0 **1 mark** each output row 1 0 1	4	
	b		 **1 mark** for each gate (correct symbol)	4	
	c		CMOS	1	

Question			Expected Answer/s		Max Mark	Additional Guidance
5	a	i	$Ek = \dfrac{1}{2}mv^2$ $= \dfrac{1}{2} \times 2500 \times 15^2$ **1 mark** $= 281250J$ (281kJ) **1 mark**		2	
		ii	$Ek = Ep = 281250J$ **1 mark (FTE)** $h = \dfrac{Ep}{mg} = \dfrac{281250}{2500 \times 9 \cdot 81}$ **1 mark** $= 11 \cdot 47m$ **1 mark**		3	Allow FTE from (a) (i)
	b	i	Wind resistance, Friction,		1	Cause only; not the form of energy lost
		ii	Streamline, lubrication		1	
6	a	i	$\dfrac{1}{R_T} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$ $\dfrac{1}{R_T} = \dfrac{1}{100} + \dfrac{1}{100} + \dfrac{1}{270}$ **1 mark** $R_T = \dfrac{1}{0 \cdot 01 + 0 \cdot 01 + 0 \cdot 0037}$ **1 mark** $= 42 \cdot 2\Omega$ **1 mark**		3	$R_T = \dfrac{R_1 R_2}{R_1 + R_2}$ $= \dfrac{100 \times 100}{100 + 100}$ $= 50\Omega$ **1 mark** $R_T = \dfrac{R_1 R_2}{R_1 + R_2}$ $= \dfrac{50 \times 270}{50 + 270}$ **1 mark** $= 42 \cdot 2\Omega$ **1 mark**
		ii	$42 \cdot 2 + 390 = 432 \cdot 2\Omega$		1	Allow FTE from (a) (i)

Question			Expected Answer/s	Max Mark	Additional Guidance
6	**a**	**iii**	$I = \dfrac{V}{R} = \dfrac{12}{432 \cdot 2}$ **1 mark** $= 0 \cdot 028 \text{A}$ **1 mark**	**2**	Allow FTE from (a) (ii)
		iv	$P = IV = 0 \cdot 028 \times 12$ **1 mark** $= 0 \cdot 34 \text{W}$ **1 mark**	**2**	Allow FTE from (a) (iii)
	b		 accept indication anywhere on 270Ω lamp branch	**1**	

Question	Expected Answer/s	Max Mark	Additional Guidance
7	Start is train sensed N Y lower barrier * is limit switch pressed N **1 mark** Y barrier stop • is train sensed Y **1 mark** N wait 10 seconds * barrier up * wait 3 seconds * barrier stop • **1 mark** for loop to main ***1 mark** both waits •**1 mark** both barrier stops **1 mark** for correct symbols ***1 mark** both barrier movements	**7**	Decision loops must include (yes or no indication) If PBASIC commands are used ignore syntax but pin must be correct. (Pause 10000 and pause 3s = 1 mark)

Question			Expected Answer/s	Max Mark	Additional Guidance
8	a	i	Compound (gear train)	1	
		ii	Higher gear ratio achieved without very large gears (more compact)	1	
	b	i	$\text{Velocity Ratio} = \dfrac{\text{Input Speed}}{\text{Output Speed}}$ $= \dfrac{30}{1440}$ **1 mark** $= 0\cdot02:1$ **1 mark** Or 1:48 (accept 1:50)	$= \dfrac{0\cdot02:1}{-}$ 2	Answer from given working (allowing for rounding of VR)
		ii	$\dfrac{0\cdot02}{1} = \dfrac{8}{A} \times \dfrac{8}{48}$ **1 mark** $0\cdot02 = \dfrac{8}{A} \times 0\cdot1667$ $0\cdot1199 = \dfrac{8}{A}$ $A = \dfrac{8}{0\cdot1199}$ **1 mark** $= 64$ teeth **1 mark**	3	Answer from given working (allowing for rounding of VR)

SECTION B

Question			Expected Answer/s	Max Mark	Additional Guidance
9	a		…the resistance of the LDR increases, increasing the value of voltage V_1. As V_1 increases past 0·7v the transistor saturates, activating the relay. When the start switch is pressed the motor will start. **1 mark** for each correct statement	4	
	b	i	400Ω (0.4k Ω)	1	
		ii	Light Dependant Resistor	1	
	c	i	$I_B = \dfrac{I_c}{h_{FE}}$ $= \dfrac{48mA}{80}$ **1 mark** $= 0·6mA$ **1 mark**	2	
		ii	$V = IR$ $= 0·0006 \times 1000$ $= 0·6V$ **1 mark** $V_1 = 0·6 + 0·7$ $= 1·3V$ **1 mark**	2	Allow FTE from (c) (i)
	d	i	Single Pole Double Throw	1	
		ii	To allow a low voltage/current electronic circuit to control a high current/voltage electrical circuit.	1	

Question			Expected Answer/s	Max Mark	Additional Guidance
9	**e**		$A = \dfrac{\pi d^2}{4}$ $= \dfrac{3\cdot14 \times 30^2}{4}$ **1 mark** $= 706\cdot5\text{mm}^2$ $F = PA$ $= 0\cdot5 \times 706\cdot5$ $= 353\cdot25\text{N}$ **1 mark**	2	
	f	**i**	$A = \dfrac{F}{P}$ $= \dfrac{343\cdot44}{0\cdot5}$ $= 686\cdot88\text{mm}^2$	1	Allow FTE from (e)
		ii	$A_{\text{effective}} = A_{\text{piston}} - A_{\text{rod}}$ $A_{\text{rod}} = 706\cdot5 - 686\cdot88$ $= 19\cdot62\text{mm}^2$ **1 mark** $d = \sqrt{\dfrac{4A}{\pi}} = \sqrt{\dfrac{4 \times 19\cdot62}{3\cdot14}}$ $= 4\cdot99\text{mm}$ **1 mark**	2	Allow FTE from (e) and (f)(i)
		iii	$\sum CWM = \sum ACWM$ $343\cdot44 \times 50 = R \times 200$ **1 mark** $R = 85\cdot86\text{N}$ **1 mark**	2	

Question			Expected Answer/s	Max Mark	Additional Guidance
9	**g**		Effective Area is smaller	**1**	Answer to be in the form of a description
10	**a**	**i**	A 1 $\quad\quad\quad\quad\quad$ 1000rev/min B 24 $\dfrac{1000\text{rev/min}}{24}=41\cdot667\,\text{rev/min}$ **1** C 12 $\quad\quad\quad\quad\quad$ 41·667rev/min **1** D 36 $\dfrac{12}{36}\times41\cdot67=13\cdot889\,\text{rev/min}$ **2** $\quad\quad\quad\quad$ **(1)** $\quad\quad$ **(1)**	**4**	Apply FTE for speed of D using value given for gear C
		ii	$C=\pi d$ $\quad=3\cdot14\times500$ $\quad=1570\text{mm}$ or $\quad\quad1\cdot57\text{m}$ $\quad\quad\quad\quad$ **1 mark** $\dfrac{13\cdot889}{60}=0\cdot23\text{rev/sec}$ $\quad$ **1 mark** $0\cdot23\times1\cdot57=0\cdot36\text{m/s}$ $\quad$ **1 mark**	**3**	Allow FTE from (a) (i)
	b		Worm	**1**	
	c		$Z=A\cdot\left(\overline{B}+\overline{C}\right)$ $\quad\quad\quad$ **·** $\quad\quad$ **1 mark** $\quad\quad\quad\quad\quad\quad\quad\quad$ **+** $\quad\quad$ **1 mark** $\quad\quad\quad\quad$ Both $\left(\overline{B}\quad\overline{C}\right)$ **1 mark**	**3**	

Question			Expected Answer/s	Max Mark	Additional Guidance
10	**d**		**1 mark** for each gate **1 mark** for all power connections	**4**	
	e	**i**	7404: Hex Invertor **1 mark** 7408: Quad 2input AND gate **1 mark**	**2**	Fully stated description for the IC number
		ii	TTL	**1**	
		iii	5V (+/- 0.25V)	**1**	No FTE
		iv	to show where pin 1 is	**1**	

	Question		Expected Answer/s	Max Mark	Additional Guidance

11	**a**	**i**	$E_e = Pt$ $t = 3 \times 60$
			                    $= 180$ secs
			
			     $= 42000 \times 180$ **1 mark**
			
			     $= 7560$kJ **1 mark**
				2	

		ii	$E_p = mgh$
			
			     $= 1000 \times 9 \cdot 81 \times 500$ **1 mark**
			
			     $= 4905$kJ **1 mark**
				2	

		iii	$\eta = \dfrac{E_{out}}{E_{in}}$
			
			     $= \dfrac{4905000}{7560000}$ **1 mark**
			
			     $= 0 \cdot 648$
			or
			     $= 65\%$ **1 mark**
				2	Allow FTE from (a) (i) and/or (ii)

	b	**i**	friction at moving parts	**1**	Not type of energy lost
		ii	Lubricate gears, bearings or 'slipper' materials used	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
11	c		Warning: for b0 = 1 to 20 **1 mark** high 7 pause 250 — **1 mark** high — **1 mark** low low 7 **1 mark** for both pauses pause 250 — next b0 **1 mark** return **1 mark**	**6**	For counter = 1 to 20 Next counter
	d	i	10 seconds	**1**	
		ii	Gosub (warning)	**1**	Ignore label
	e		Shorten the length of the program/allow similar programs to be used repeatedly in the same program	**1**	
	f	i	Electronic Erasable Programmable Read Only Memory	**1**	
		ii	Information can be re-written / non-volitile	**1**	
		iii	ROM / RAM	**1**	

[END OF MARKING INSTRUCTIONS]