2013 Technological Studies

Standard Grade – Credit

Finalised Marking Instructions

Part One: General Marking Principles for Technological Studies – Standard Grade – Credit

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.

(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 – Standard Grade – Credit

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.

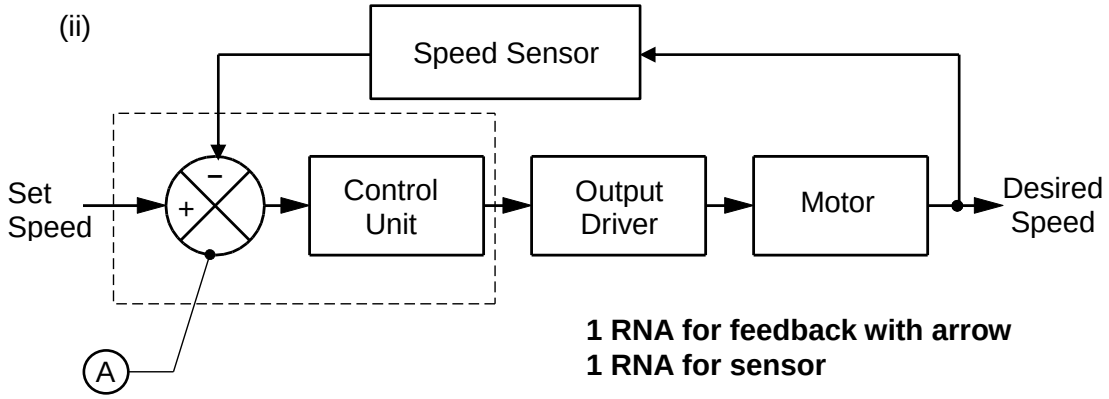
Mark Allocation

Marks	
KU	RNA

1. (a) It uses feedback **(1 KU)** to monitor the output **(1 KU).** — **2**
It compares feedback **(1 KU)/**output to the desired input **(1 KU)** — **1 0**

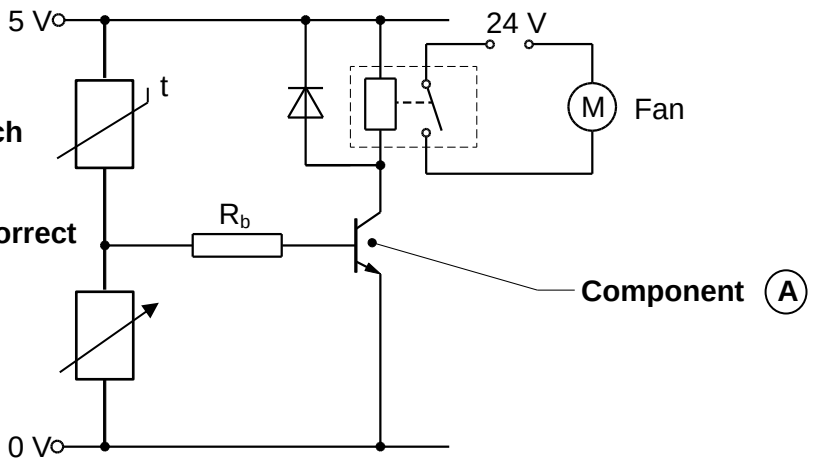
(b) (i) Error detector **1 KU** — **1 0**

(ii)



1 RNA for feedback with arrow — **2**
1 RNA for sensor — **1 0**

2. (a)



1 KU for each symbol

1 RNA for correct positions

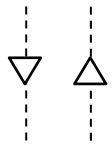
2 1 0 | **1 0**

(b) Transistor/npn Bipolar Transistor **1 KU** — **1 0**

(c) Saturated **1 KU** — **1 0**

(d) Protect the transistor (from back EMF) **1 KU** — **1 0**

(e) Prevents expensive components being damaged/quicker fault finding etc **1 KU** — **1 0**

			Marks	
			KU	RNA
3.	(a)	When Valve (A) is actuated a pilot signal **(1)** actuates Valve (C). Cylinder (1) **(1)** outstrokes and actuates **(1)** Valve (D). After a delay **(1)**, Valve (B) is actuated **(1)** and Cylinder (2) outstrokes **(1)** and actuates Valve (C) **(1)**. After a delay **(1)**, both Valves (B) and (C) are actuated **(1)** causing both cylinders to instroke **(1)**.		**5** **4** **3** **2** **1** **0**
		1 RNA for each correct statement up to 5 marks		
	(b)	(i) 5/2 **(1 KU)** Pilot **(1 KU)** Pilot **(1 KU)**	**1** **0**	
		(ii) Reservoir **1 KU**	**1** **0**	
	(c)	(i) Diaphragm **1 KU**	**1** **0**	
		(ii)  **1 KU follow through error where appropriate**	**1** **0**	
	(d)	Area = $\pi \times 25^2 - \pi \times 5^2$ **1 RNA substitution**		
		= 1884 mm^2 **1 RNA answer**		**2** **1** **0**
		or 1 RNA for an area calculation using 25 or 5 mm		
	(e)	**Main air:** Powers the cylinders **1 KU**	**2**	
		Pilot air: Actuates the valves **1 KU**	**1** **0**	

			Marks	
			KU	RNA
4.	(a)	$V = \sqrt{\frac{2Ek}{m}} = \sqrt{\frac{925000 \times 2}{600}} = 55\,m/s$		**2**
		1 RNA for substitution		**1**
		1 RNA for answer		**0**
	(b)	$\eta\ \frac{63}{150} = 0 \cdot 42\ or\ 42\%$		**2**
		1 RNA for substitution		**1**
		1 RNA for answer		**0**
	(c)	It is converted **(1)** to heat and sound **(1)** in the brakes.		**2**
		1 RNA form of energy **1 RNA cause of loss**		**1** **0**
	(d)	**Advantage** Energy source is free and readily available or pollution issues **1 KU**	**2**	
		Disadvantage Inconsistent supply as some days are cloudy **1 KU** Less efficient	**1** **0**	
	(e)	There is an existing supply chain/expensive to convert to other sources etc More efficient **1 KU**	**1** **0**	
	(f)	It reduces waste energy/it is more cost effective/they are less likely to wear out **1 KU for each, up to 2 marks**	**2** **1** **0**	
5.	(a)	Pulse Width Modulation **1 KU**	**1** **0**	
	(b)	**1 KU for identifying that mark/space ratio must change**	**2**	
		1 KU for indicating that greater ratio = greater speed	**1** **0**	

	Marks	
	KU	RNA

6. (a) (i) $R_P = \dfrac{41 \times (76 + 37)}{41 + (76 + 37)} = 30 \times 1\,\Omega$

		3
1 RNA for series calculation		**2**
1 RNA for substitution		**1**
1 RNA for answer from given working		**0**
		1
(ii) $R_T = 30{\cdot}1 + 10 = 40{\cdot}1\ \Omega$ **1 RNA for answer**		**0**
		2
(b) $I_2 = 0{\cdot}3 - 0{\cdot}22 = 0{\cdot}08$ A **1 RNA for substitution**		**1**
1 RNA for answer		**0**
(c) $V = I \times R = 0{\cdot}08 \times 37 = 2{\cdot}96$ V		**2**
OR **1 RNA for substitution**		**1**
$V_1 = 12 - 3 - 6 = 3$ V **1 RNA for answer**		**0**

7. quick_cook:

1 — **if pin 0 = 0 then quick_cook** — **Alternative: if pin 0 = 1 then jump goto quick_cook Jump:**

1 for both
- **high 6**
- **pause10000** — **1**
- **low 6**

1 — **for b0 = 1 to 5** — **any value from b0-13**

1 for both
- **high 7**
- **pause 200**
- **low 7**
- **pause 100**

1 for both

1 — **next b0** — **(Allow for next counter)**

1 — **return**

	8
	7
	6
	5
	4
	3
	2
	1
	0

Alternative:
if pin 0 = 1 thenjump
goto quick_cook
Jump:

		Marks	
		KU	RNA
8.	(a) **Z =** $(\overline{A} + \overline{B})\bullet C$ **1 RNA for NOT F^{NS}** **1 RNA for OR F^{N}** **1 RNA for AND F^{N} (including brackets)**		**3** **2** **1** **0**
	(b) **IC number: 7408,** 7404 **,** 7432 **1 RNA for both**		**1** **0**
	(c) Quad 2 input AND **1 KU**	**1** **0**	
8.	(d)		

	Logic Family	
Characteristic	**CMOS**	**TTL**
Higher power consumption		✓
Larger fan out	✓	
Easily damaged by static electricity	✓	
Can use supply voltages between 3-18 volts	✓	
Faster switching speeds		✓

		4 **3** **2** **1** **0**
	(e) Identifies the position of pin 1 **1 KU** **(NOT – shows which way round the IC goes)**	**1** **0**

Marks	
KU	RNA

9. (a)

Name	Function	Characteristic
RAM	***Stores data required when running the program***	***Data will not remain when power is switched off***
ROM	Stores PBASIC language for microcontroller operations	Data remains when power is removed
EEPROM	Stores the program	Data remains when power is removed. Data can be re-written

1 KU for each correct entry

4 3 2 1 0

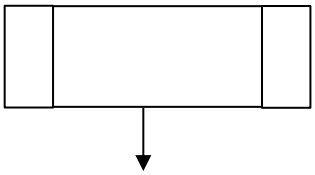
(b) Electrically Erasable Programmable Read Only Memory **1 KU**

1 0

(c) Links the microcontroller to the outside world **1 KU**

1 0

(d)



1 KU

1 0

(e) (let dirs =) %11111000

1 RNA **1 RNA**

2 1 0

				Marks	
				KU	RNA
10.	(a)	Compound Gear	**1 KU**	**1** **0**	
	(b)	Output Speed = $500 \times \left(\frac{20}{50} \times \frac{15}{45} \right) = 67 \text{ rev / min}$ **1 RNA** **1 RNA** **1 RNA for substitution** **1 RNA for answer**			
		OR			
		$500 \times 20 = T_1 \times 50$ $T_1 = 200$ rev/min	**1 RNA substitution** **1 RNA answer**		**4** **3** **2**
		$200 \times 15 = T_2 \times 45$ $T_2 = 67$ rev/min	**1 RNA substitution** **1 RNA answer**		**1** **0**
	(c)	Speed = 50 × 2 = 100 mm/min **1 RNA substitution** **1 RNA answer** **1 RNA conversion**	**0.00167 m/s**		**3** **2** **1** **0**
	(d)	Reduce the size of the pitch	**1 KU**	**1** **0**	
	(e)	It can slip	**1 KU**	**1** **0**	
	(f)	(i) Toothed (ii) VEE	**1 KU for each**	**2** **1** **0**	
	(g)	(i) Crank and Slider/Cam and Follower	**1 KU**	**1** **0**	
		(ii) Rack and Pinion	**1 KU**	**1** **0**	

[END OF MARKING INSTRUCTIONS]