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PROCESSING LABEL HERE

Write your **student number** in the boxes above. **Letter**

VET Integrated Technologies

Question and Answer Book

VCE Examination – Thursday 6 November 2025

- Reading time is **15 minutes**: 9.00 am to 9.15 am
- Writing time is **1 hour 30 minutes**: 9.15 am to 10.45 am

Approved materials

- One scientific calculator

Materials supplied

- Question and Answer Book of 28 pages
- Detachable Formula Sheet in the centrefold
- Multiple-Choice Answer Sheet

Instructions

- Follow the instructions on your Multiple-Choice Answer Sheet.
- At the end of the examination, place your Multiple-Choice Answer Sheet inside the front cover of this book.
- Detach the Formula Sheet from the centre of this book during reading time.

Students are **not** permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents

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Section A – Multiple-choice questions

Instructions

- Answer **all** questions in pencil on your Multiple-Choice Answer Sheet.
- Choose the response that is **correct** or that **best answers** the question.
- A correct answer scores 1; an incorrect answer scores 0.
- Marks will **not** be deducted for incorrect answers.
- No marks will be given if more than one answer is completed for any question.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

What does the acronym WHS stand for in an integrated technologies environment?

A. work, health and security

B. work, health and safety

C. wires, health and safety

D. work, home and security

Question 2

A 'white card' issued by a registered training organisation (RTO) indicates the holder

A. has undertaken construction induction training.

B. is allowed to serve alcohol in a hotel.

C. can drive machinery on worksites.

D. is licensed to disconnect and reconnect mains-powered plant equipment.

Question 3

How many twisted pairs of wires are contained within a CAT 6 ethernet cable?

A. 2

B. 4

C. 6

D. 8

Question 4

Which technology can potentially provide an internet connection with the highest speed?

A. FTTB

B. FTTC

C. FTTN

D. FTTP

Question 5

Extra-low voltage (ELV) is defined as ripple-free direct current (DC) and root mean square (RMS) alternating current (AC).

Which voltage ranges do ELV DC and RMS AC fall within, respectively?

A. 120 V DC, 50 V AC

B. 12 V DC, 12 V AC

C. 24 V DC, 6 V AC

D. 12 V DC, 12 V AC

Question 6

Decimal number 15 expressed in binary-coded decimal (BCD) is

A. 0000 1111

B. 1111 0000

C. 1000 0101

D. 0001 0101

Question 7

The blue insulated wire in an Australian flexible electrical cord is

A. positive.

B. negative.

C. active.

D. neutral.

Question 8

The nominal AC electrical frequency delivered from a standard Australian power point is

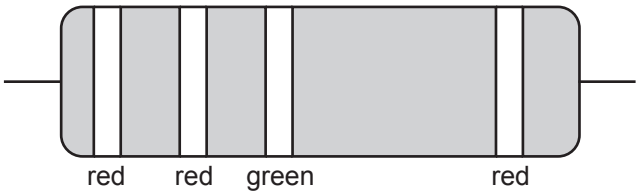
A. 50 Hz

B. 60 Hz

C. 1 kHz

D. 50 kHz

Question 9



The nominal resistance and tolerance value of the axial resistor shown above are

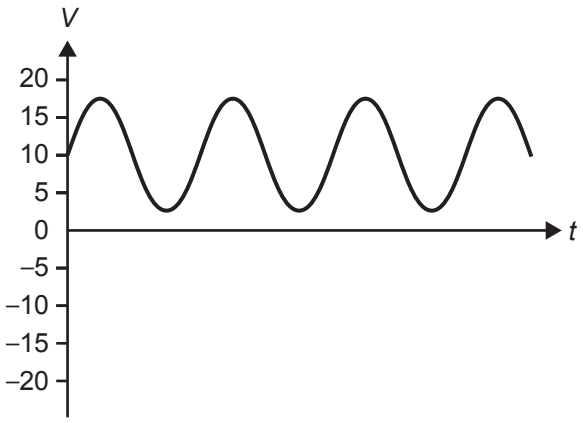
A. 2M2 Ω, 5%

B. 22M Ω, 2%

C. 2M2 Ω, 2%

D. 220 kΩ, 5%

Question 10



The waveform shown above is best described as a

A. square wave AC.

B. triangular DC.

C. pulsating DC.

D. sawtooth AC.

Question 11

The preferred way to express a 3300 kΩ resistor is

A. 3300 Ω

B. 3M3 Ω

C. 330,000 Ω

D. 33M Ω

Question 12

In the process of soldering through using a reflow oven, the 'tombstone effect' is a common problem when passing a printed circuit board (PCB) containing surface-mount device (SMD) components.

This refers to the reflow oven

A. baking the PCB, making it grey.

B. creating long cracks across the PCB.

C. causing the SMD components to sit up vertically.

D. causing the loaded PCB to warp significantly.

Question 13

A capacitance measurement of 0.0047 nF can be expressed as

A. 0.00000047 μF

B. 0.000047 μF

C. 47 pF

D. 4p7 F

Question 14

One disadvantage of using cloud-based storage is that

A. the device being used needs to be connected to a network.

B. low data security is offered only by cloud-based storage.

C. the battery power life of the connected device is drastically reduced.

D. the incidence of data corruption is significantly increased.

Question 15

A sine wave signal measures 100 mV peak-to-peak.

What would be the measured RMS voltage?

A. 14.14 mV

B. 35.4 mV

C. 63.7 mV

D. 70.7 mV

Question 16

A device that could be used to convert sound waves into electrical signal waves is a

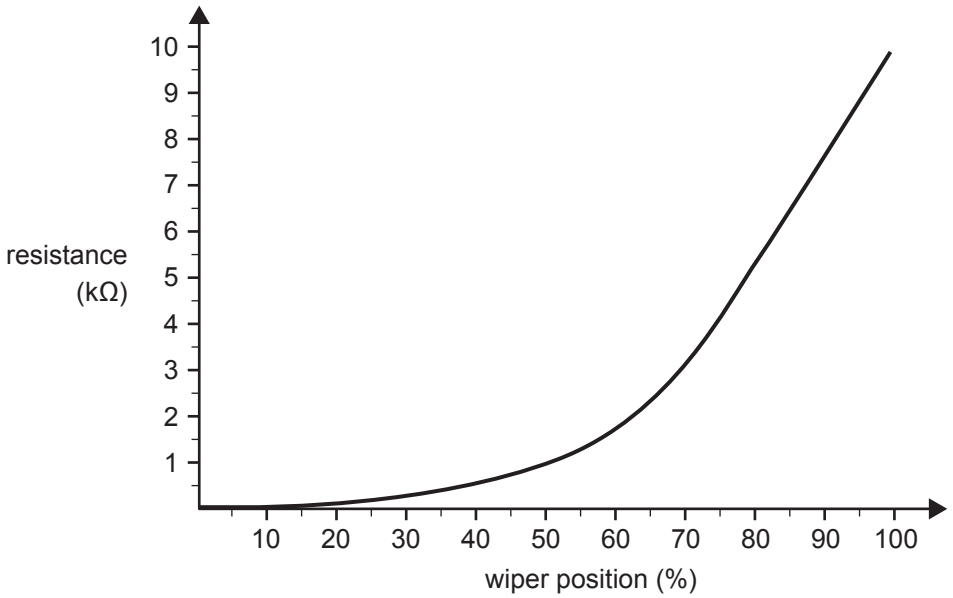
A. battery.

B. loudspeaker.

C. rectifier.

D. amplifier.

Question 17



The graph above represents the performance of which component?

A. a linear trim potentiometer

B. a windscreen wiper motor

C. a logarithmic potentiometer

D. a 10 kΩ high-impedance loudspeaker

Question 18

An engineering drawing is scaled at 10:1.

What does this mean?

A. The dimensions of the drawing are 10 times smaller than the actual item.

B. The dimensions of the drawing are 10 times larger than the actual item.

C. The dimensions of the drawing are in millimetres.

D. The dimensions of the drawing are in inches.

Question 19

Why is it important to ensure security updates are regularly installed on computers and mobile devices?

A. to ensure the most current character fonts are available

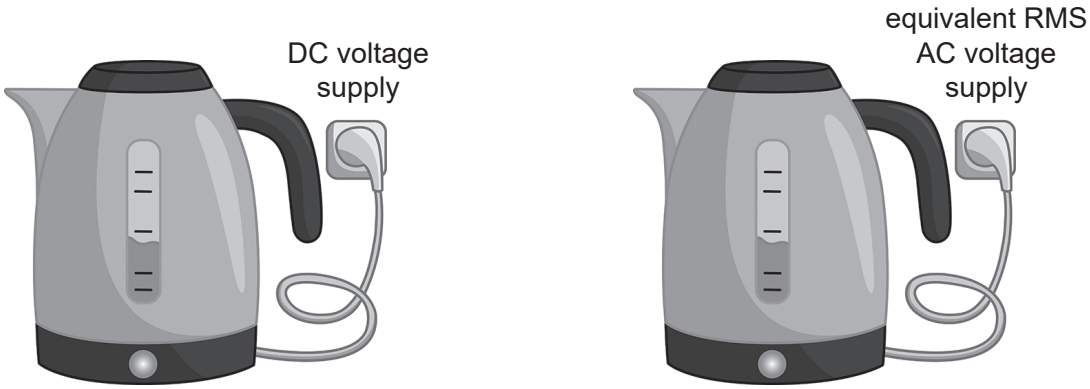
B. to update the screensaver to the newest one available

C. to update the virus and malware scanning software

D. to ensure the available storage space does not go to waste

Question 20

Two identical electrical kettles take the same amount of time to boil water. The first kettle uses a DC supply and the second uses an RMS AC supply that provides the same average power.



Source: Adapted from YuliDor/Shutterstock.com

If the supplied DC voltage is 100 V, then the peak and RMS AC voltages supplied will be

	Peak AC voltage	RMS AC voltage
A.	100 V	200 V
B.	200 V	100 V
C.	100 V	141.4 V
D.	141.4 V	100 V

End of Section A

Section B

Instructions

- Answer **all** questions in the spaces provided.
- Write your responses in English.
- Formulas must be relevant to the calculations. Calculations must be shown.
- All units must be specified using the correct engineering notation in the answers.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (10 marks)

The symbols in Figure 1 represent different functions within flow charts. A letter (A–F) has been assigned to each symbol.

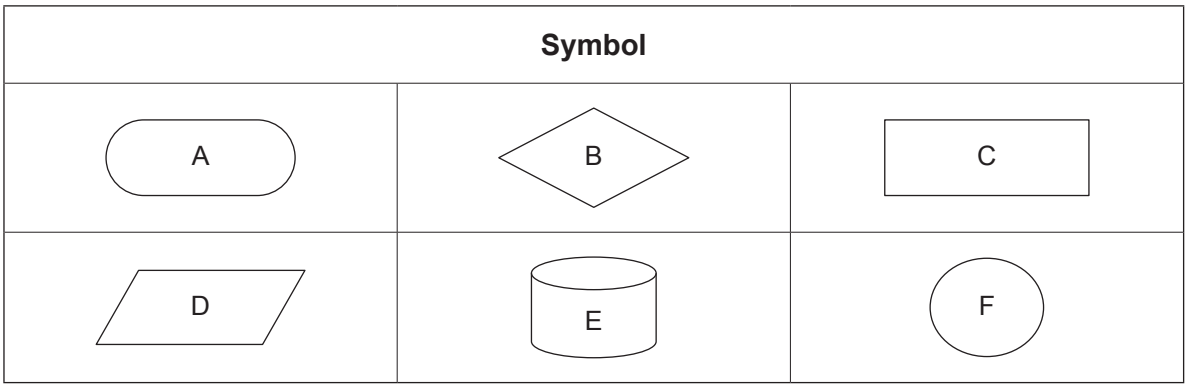


Figure 1

a. Complete the table below by matching each symbol in Figure 1 to the correct function. 6 marks

Function of symbol	Symbol (letter)
process	
input or output	
terminator (start or stop)	
connector (to another flow)	
decision	
database	

b. Describe a situation in which the decision symbol would be used in a flow chart. 2 marks

c. Provide two examples of situations in which using the connector symbol would be beneficial. 2 marks

1.

2.

Use the following information to answer Questions 2–4.

A model railway crossing is shown in Figure 2.

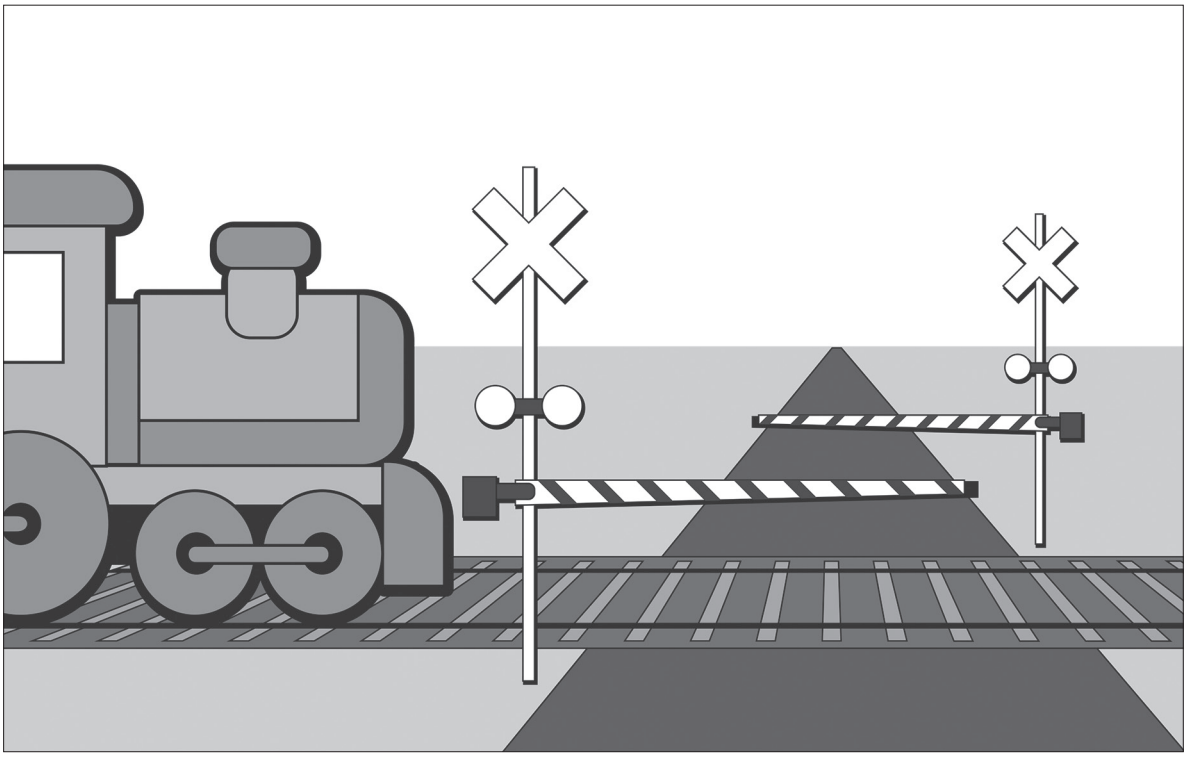


Figure 2

Question 2 (6 marks)

The model railway crossing allows a train to approach the crossing from either direction. Proximity detectors are placed on the track at three different locations to indicate the presence of the approaching model train. In relation to the crossing, proximity detectors are at:

- Location 1 – on the left approach
- Location 2 – on the crossing
- Location 3 – on the right approach.

a. Name **one** component device that could be placed on the track locations to detect the presence of the model train. 1 mark

b. State a common electrical power supply output that can be used to operate model trains. 1 mark

c. The model railway crossing has flashing lights only at the crossing. A simple flasher circuit with two light-emitting diodes (LEDs) is utilised.

Using Figure 3, determine the four missing tracks and draw these tracks on the component side of the PCB on Figure 4. 4 marks

Schematic diagram of circuit

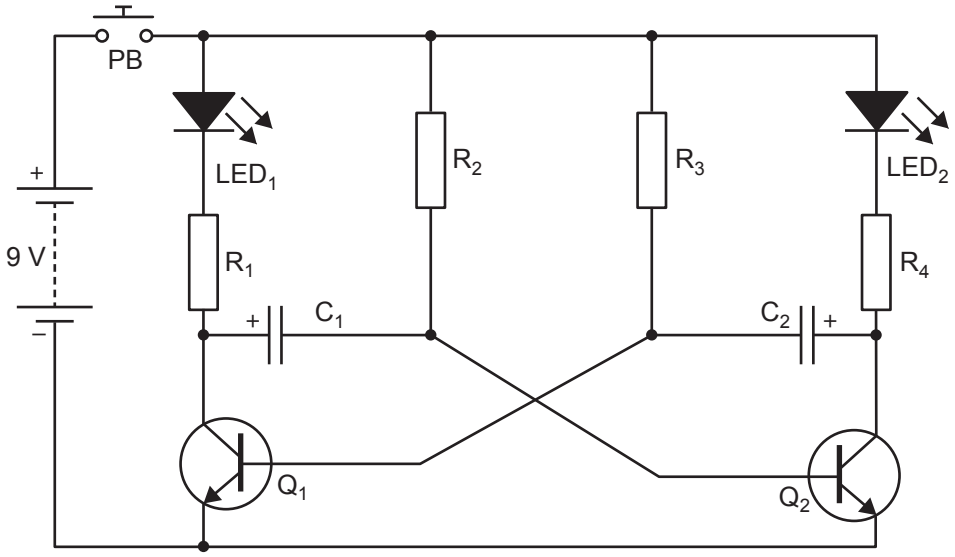


Figure 3

LED flasher circuit PCB

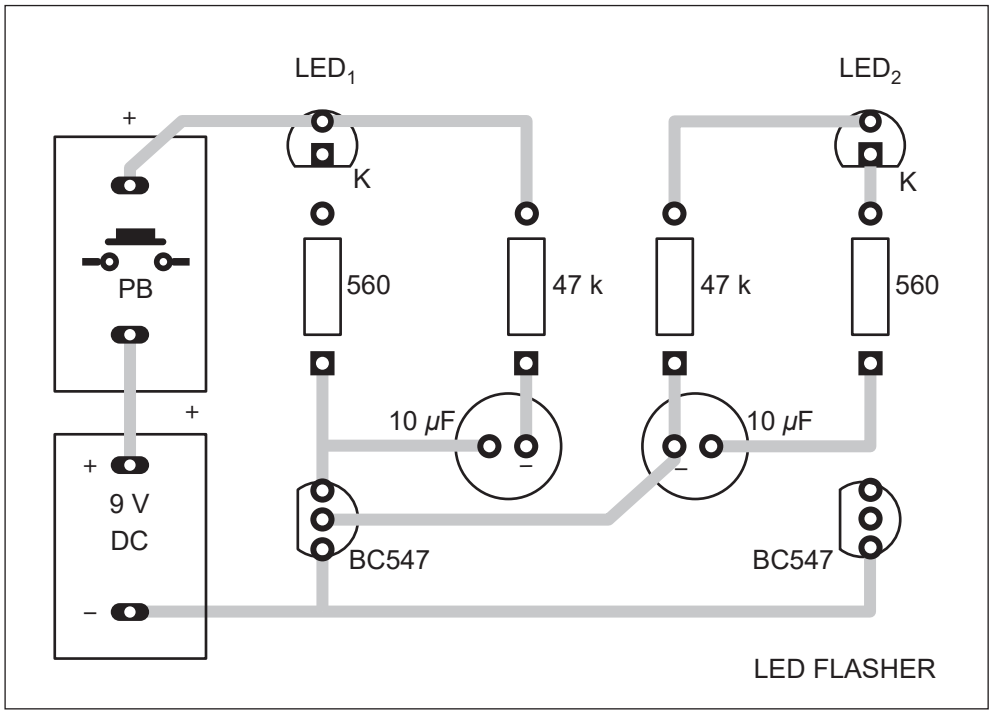


Figure 4

Question 3 (19 marks)

The model railway crossing is upgraded with a microcontroller, flashing lights, an electronic bell and boom gates.

The microcontroller is activated when the model train occupies any three parts of the track:

- Location 1 – on the left approach
- Location 2 – on the crossing
- Location 3 – on the right approach.

Timing features

- The approaching model train will activate the flashing lights, the bell and the boom gates.
- When activated, the lights will flash and the bell will sound for 5 seconds before the boom gates lower, and both will remain on when the boom gates are down.
- The boom gates are down for 10 seconds before the model train enters the crossing.
- The boom gates must remain down until the model train has cleared the crossing.
- The lights will flash and the bell will sound for 5 seconds after the boom gates have been raised.

The circuit schematic diagram for the microcontroller is shown in Figure 5.

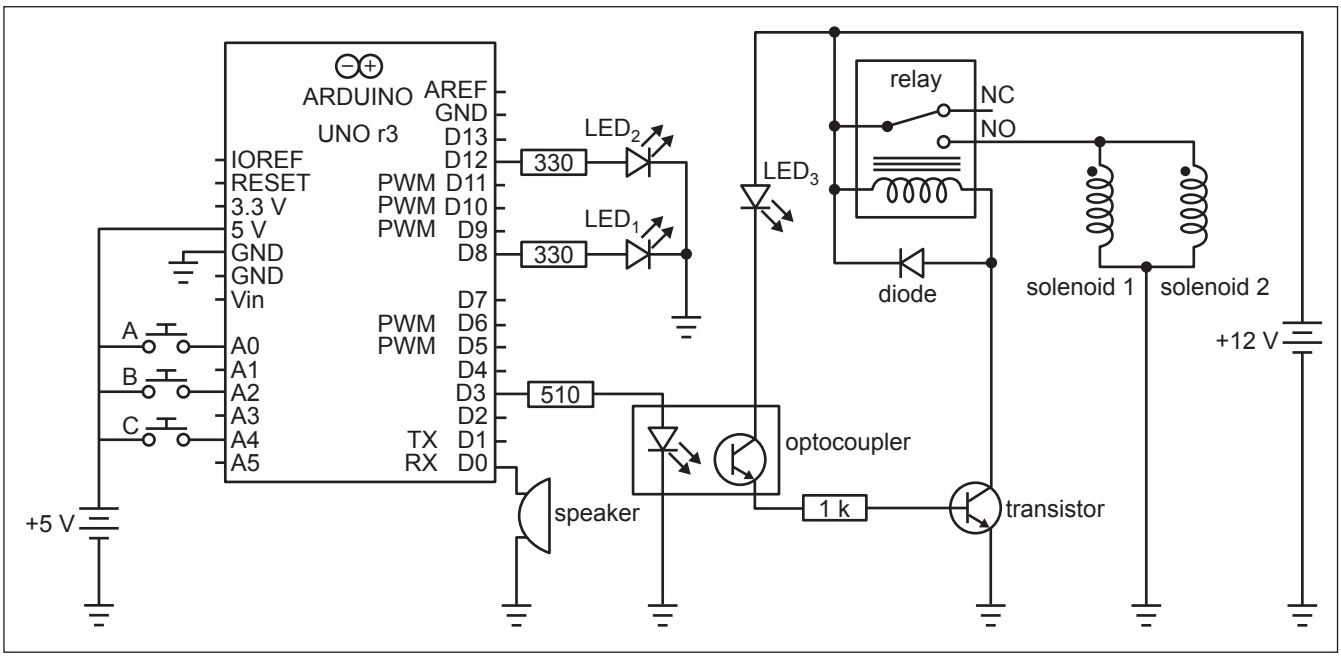


Figure 5

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The relay in Figure 5 energises the solenoids, lowering the gates and holding them down.

a. Describe the purpose and function of the optocoupler used in this circuit. 4 marks

Purpose _____

_____

Function _____

_____

b. What is the function of the 510 Ω resistor connected to output D3? 1 mark

_____

c. What is the electronic term that describes how the diode is connected across the relay coil? 1 mark

_____

d. Describe why a diode is often used with this type of connection across a relay coil. 2 marks

_____

_____

Question 3 continues on the next page.

Voltage drop (V_d) measurements

- phototransistor – 300 mV
- LED – 1.5 V
- transistor (base to emitter) – 700 mV

e. Given the V_d across the components listed above, determine the current flowing through the 1 kΩ resistor. In your response, show the formula used and all working. Express your answer in the preferred sub-unit. 5 marks

f. What is the purpose of LED_3 connected to the optocoupler? 1 mark

g. State why a relay would be used to operate both boom gate solenoids instead of the microcontroller outputs being used directly. 1 mark

h. What do NC and NO on the relay output contacts stand for and when do these apply? 4 marks

NC _____

NC application _____

_____

NO _____

NO application _____

_____

Question 4 (6 marks)

The command instructions for the railway crossing's timing sequence are listed below, but are not in order:

A. Boom gates are raised.
B. Boom gates are lowered.
C. Lights and bell deactivated.
D. Model train detected approaching crossing.
E. Model train is on the crossing.
F. Activate lights and bell.

Complete the flow chart in Figure 6 by entering the correct letter (A–F) from the timing sequence above for the missing command instructions.

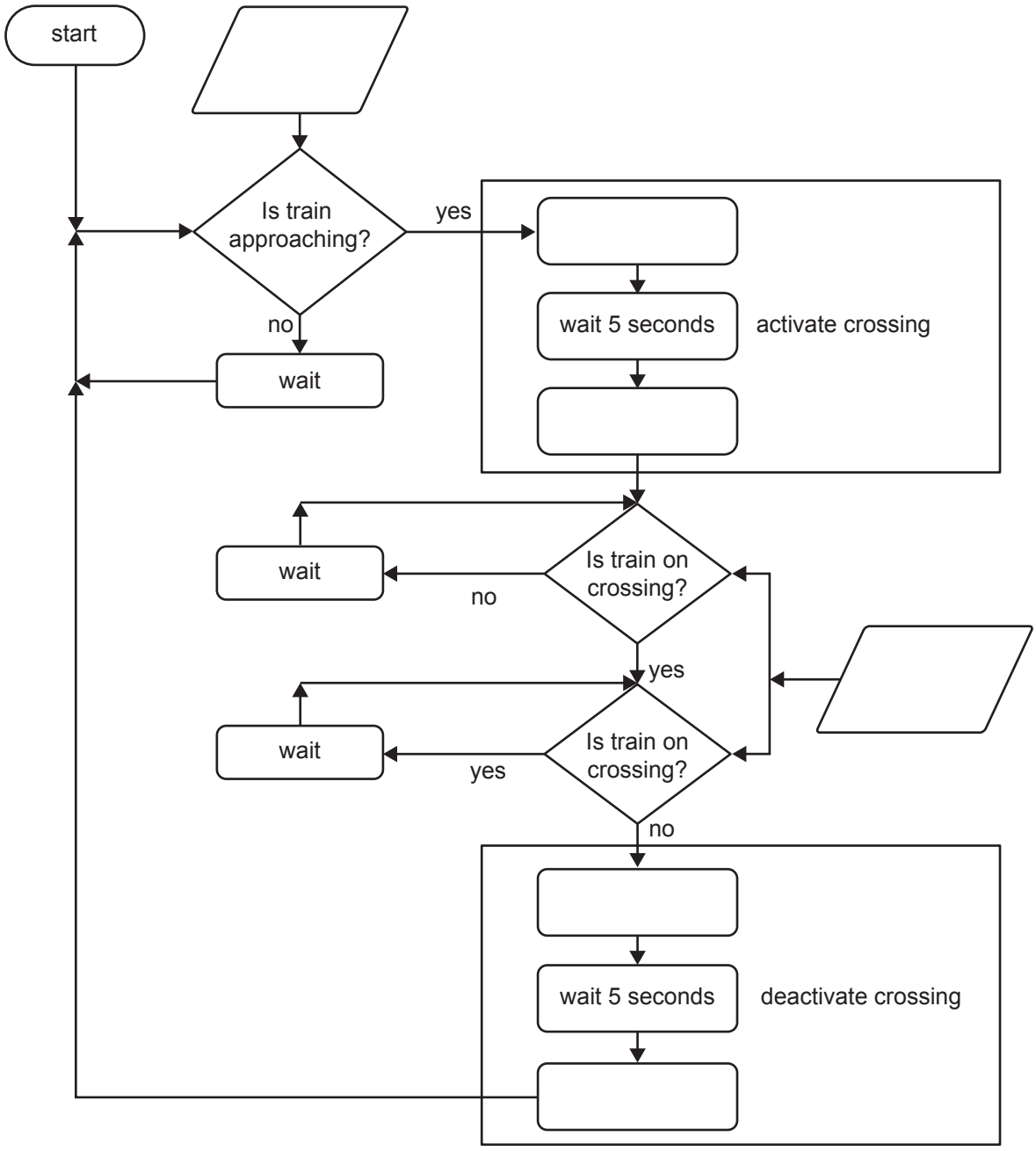

Figure 6

Question 5 (5 marks)

A voltmeter registers 0 V between test points A and C, and also measures 0 V between those same two test points after the connection has been broken between points A and B.

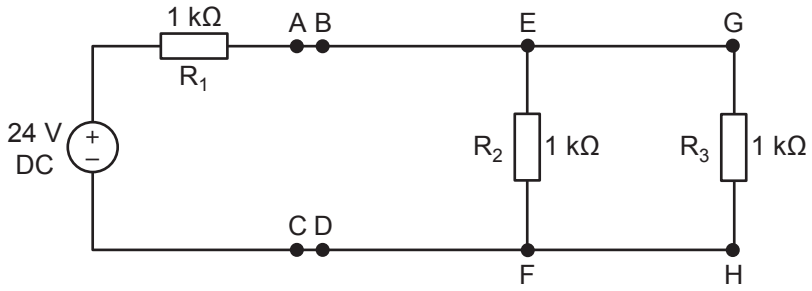

Figure 7

Referring to Figure 7, consider the likelihood of each fault specified in the table below occurring for this circuit. Consider each fault one at a time (that is, no coincidental faults).

Complete the table with 'yes' or 'no' to indicate whether each fault could independently account for all measurements in this circuit. Rows 1 and 5 have been completed as examples.

Fault	Possible fault (yes or no)
R_1 open	yes
R_2 open	
R_3 open	
R_1 shorted out	
R_2 shorted out	no
R_3 shorted out	
power supply failed	

Use the following information to answer Questions 6 and 7.

Figure 8 represents a mains-powered 240 V electric blanket that utilises a heat selector switch with three heat settings. The blanket contains two separate 200 Ω electric heating elements. The three heat settings – high (H), medium (M) and low (L) – are achieved by connecting the two elements in different configurations:

- parallel – elements 1 and 2 are connected in parallel
- series – elements 1 and 2 are connected in series
- single – only element 1 is connected, element 2 remains off

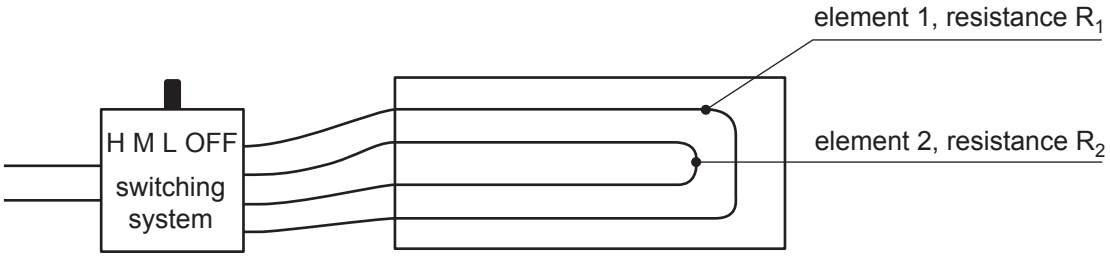

Figure 8

Question 6 (13 marks)

a. **i.** In the table provided, determine the total resistance of the elements connected in the three different configurations. Show all working and express your answers using the correct unit of measurement. 6 marks

ii. Based on the determined resistance values, state the corresponding heat level setting for each configuration in the table provided. 3 marks

Element connection configuration	Total resistance calculation for each configuration	Heat level setting (high, medium or low)
parallel – elements 1 and 2 are connected in parallel		
series – elements 1 and 2 are connected in series		
single – only element 1 is connected, element 2 remains off		

b. Calculate the power output when the electric blanket is operating on the high setting. Show all working and express your answer using the correct unit of measurement. 4 marks

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Question 7 (10 marks)

A second electric blanket uses a microprocessor controller, instead of a heat selector switch with three heat settings.

a. State three benefits of using a microprocessor controller instead of a heat selector switch with three heat settings. 3 marks

1. _____

2. _____

3. _____

b. Figure 9 shows a symbol printed on the microprocessor controller.

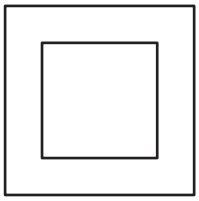


Figure 9

Identify the meaning of the symbol and describe what this means for the appearance of the mains power plug used in any appliance. 3 marks

_____

_____

_____

c. An intermittent electrical fault occurs.

Explain the meaning of the term 'intermittent electrical fault' with regard to a circuit or device. 2 marks

_____

_____

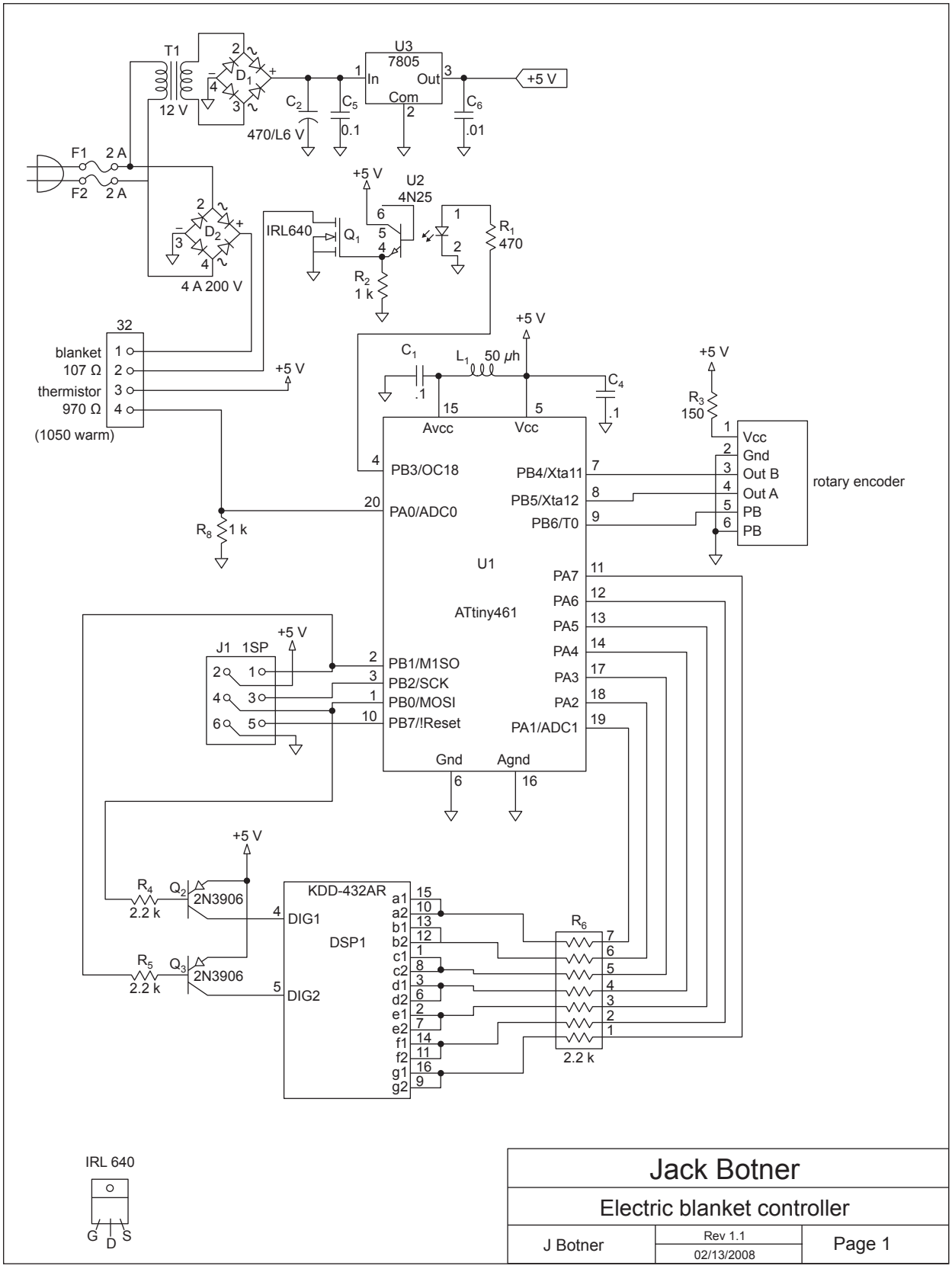
d. Provide two possible common causes of intermittent electrical faults on this microprocessor controller electric blanket. 2 marks

1. _____

2. _____

Question 8 (11 marks)

A circuit schematic diagram for an electric blanket microprocessor controller is shown in Figure 10.



Source: Adapted from J Botner, 'Electric blanket controller', <www.qsl.net/v/ve3lny/blanketcontroller.html>

Figure 10

Do not write in this area.

a. In Figure 10 there is a connection to a thermistor that is located inside the blanket itself.
What is the purpose of the thermistor? 1 mark

Figure 11 shows a close-up of a component device from Figure 10.

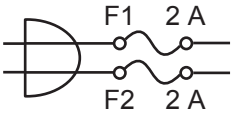


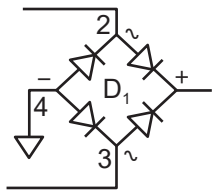
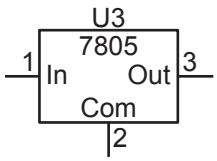
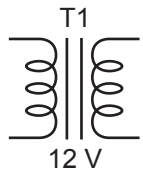
Figure 11

b. What are the two input components shown in Figure 11? 1 mark

c. Explain why two of these input components would be used rather than only one. 2 marks

d. The table below shows three component devices from Figure 10.

Complete the table by naming each component device and stating its function. 6 marks

Component device	Name	Function
		
		
		

e. Figure 12 shows a close-up of a component device from Figure 10.

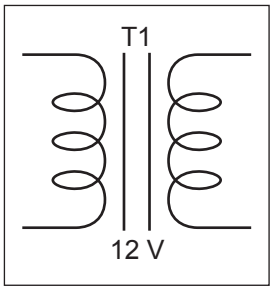


Figure 12

What do the two vertical lines in Figure 12 represent? 1 mark

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End of examination questions

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VET Integrated Technologies

2025 Formula Sheet

Please remove from the centre of this book during reading time.

You may keep this Formula Sheet.

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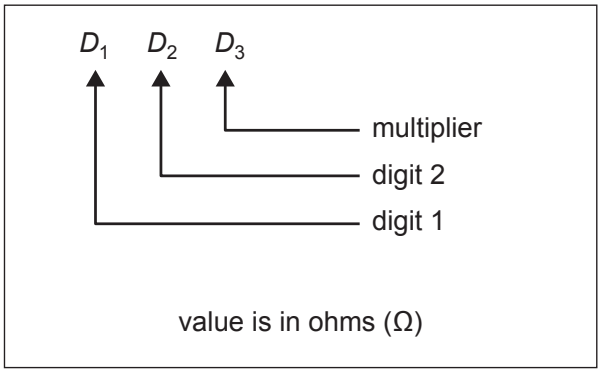
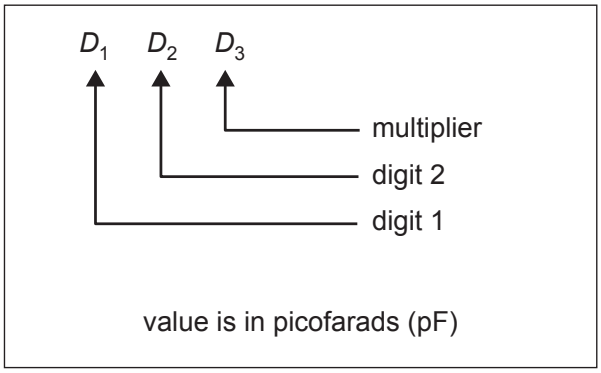
$R_T = R_1 + R_2 + R_3 + \ldots$	$f = \frac{1}{T}$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$	$\tau = C \times R$
$R_T = \frac{R_1 R_2}{R_1 + R_2}$	$A = \frac{\pi d^2}{4}$
$R = \frac{\rho l}{A}$	$C = \frac{\varepsilon A}{d}$
$V = I \times R$	$C_T = C_1 + C_2 + C_3 + \ldots$
$P = V \times I \qquad P = \frac{V^2}{R}$	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots$
	$Q = V \times C$
$V_{max} = V_{peak}$	$W = \frac{1}{2} C V^2$
$V_{step} = \frac{V_{max}}{2^n - 1}$	$W = P\,t$
turns ratio $= \frac{N_1}{N_2}$	1 ampere hour (Ah) = 1 A of amount drawn for one hour
$v = V_{max} \sin\theta$	$i = I_{max} \sin\theta$
$V_{av} = 0.637 \times V_{max}$	$V_{RMS} = 0.707 \times V_{max} \qquad V_{RMS} = \frac{V_{max}}{\sqrt{2}}$
$f = \frac{1}{t}$	$L_T = L_1 + L_2 + L_3 + \ldots$
$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \ldots$	$f_0 = \frac{1}{2\pi\sqrt{LC}}$ Hz (resonant frequency)
transformer ratios $\frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S}$	$\lambda = \frac{c}{f}$ m where λ is in metres, f is in Hertz and c is the speed of light (3×10^8 ms^{-1})
$\eta = \frac{p_{in} - \text{losses}}{p_{in}} \times 100$ (η = efficiency in %)	$\eta = \frac{\text{power out} \times 100}{\text{power in}}$ %
$\tau = \frac{L}{R}$	

Resistor codes



Capacitor codes

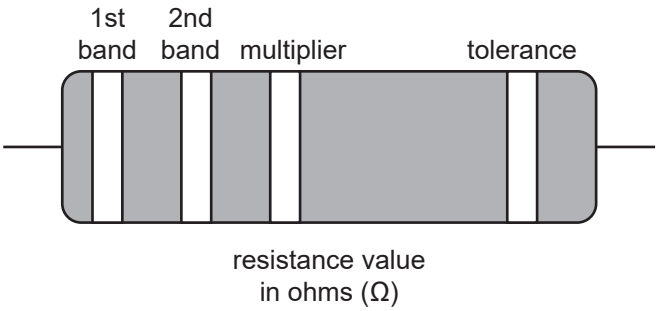


ASCII code chart (in hexadecimal)

Least significant nybble

Most significant nybble	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

Resistor colour codes



Colour	Value	Multiplier	Tolerance
black	0	10^0	
brown	1	10^1	1%
red	2	10^2	2%
orange	3	10^3	
yellow	4	10^4	
green	5	10^5	0.5%
blue	6	10^6	0.25%
violet	7	10^7	0.1%
grey	8	10^8	0.05%
white	9	10^9	
gold		10^{-1}	5%
silver		10^{-2}	10%

End of Formula Sheet