VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Print exam correction: Section A, Q4, negative symbol added to lower axis numerals

Victorian Certificate of Education
2023

Letter

STUDENT NUMBER

VCE VET INTEGRATED TECHNOLOGIES

Written examination

Wednesday 1 November 2023

Reading time: 11.45 am to 12.00 noon (15 minutes)
Writing time: 12.00 noon to 1.30 pm (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	13	13	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied
- Question and answer book of 21 pages
- Detachable insert of miscellaneous formulas in the centrefold
- Answer sheet for multiple-choice questions

Instructions
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
- All written responses must be in English.

At the end of the examination
- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- You may keep the detached insert.

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

SECTION A – Multiple-choice questions

Instructions for Section A

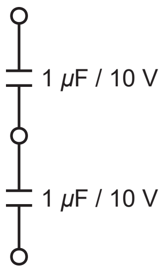
Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be 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

The nominal value and its tolerance of the resistor in the figure above is

A. 120 Ω 5%
B. 120 Ω 10%
C. 1 kΩ 5%
D. 1 kΩ 10%

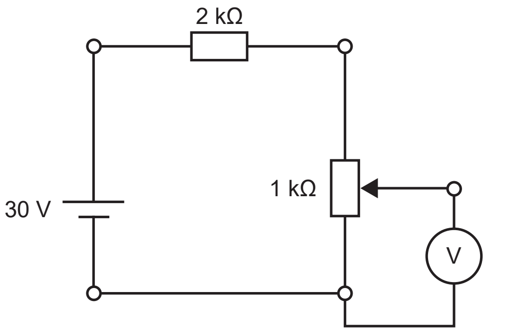
Question 2



Two capacitors rated 1 μF / 10 V are connected in a network as shown above.
The equivalent capacitance and its voltage rating for a single replacement capacitor is

A. 2 μF / 5 V
B. 2 μF / 10 V
C. 1 μF / 15 V
D. 0.5 μF / 20 V

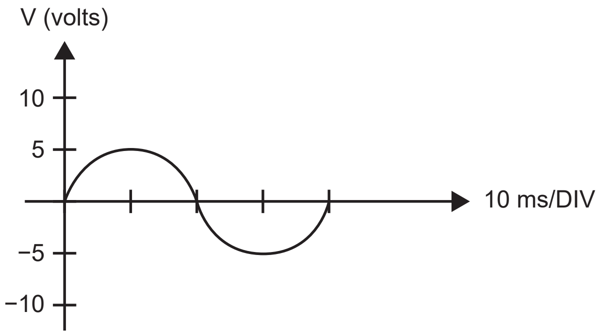
Question 3



The minimum and the maximum voltages that can be displayed by the voltmeter in the figure above are

A. 0 V, 10 V
B. 10 V, 20 V
C. 10 V, 30 V
D. 20 V, 30 V

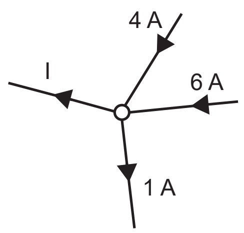
Question 4



The diagram above shows a signal displayed by an oscilloscope.
The peak voltage and the frequency for this signal are

A. 5 V, 25 Hz
B. 10 V, 25 Hz
C. 5 V, 40 Hz
D. 10 V, 40 Hz

Question 5



The current I in the figure above is

A. 1 A
B. 7 A
C. 8 A
D. 9 A

Question 6
The decimal number of the binary number 10100 is

A. 14
B. 16
C. 20
D. 10100

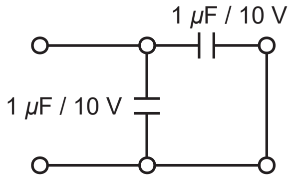
Question 7
An electric motor has an input power of 180 W and an output power of 170 W.
The efficiency of the motor is closest to

A. 71%
B. 75%
C. 90%
D. 95%

Question 8
When operating a drill press the most necessary personal protective equipment (PPE) is

A. a hair net.
B. goggles.
C. leather boots.
D. leather gloves.

Question 9

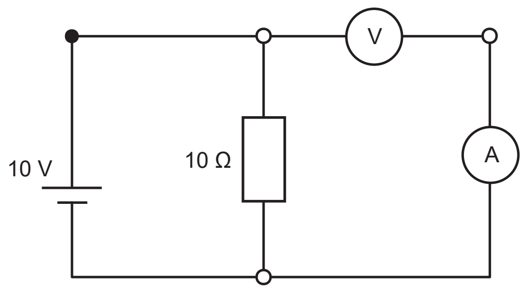


Two capacitors rated 1 μF / 10 V are connected in a network as shown above.

The equivalent capacitance and its voltage rating for a single replacement capacitor is

A. 1 μF / 10 V
B. 1 μF / 20 V
C. 2 μF / 10 V
D. 2 μF / 20 V

Question 10



In the electric circuit above, the voltage displayed by the voltmeter V and the current displayed by the ammeter A are

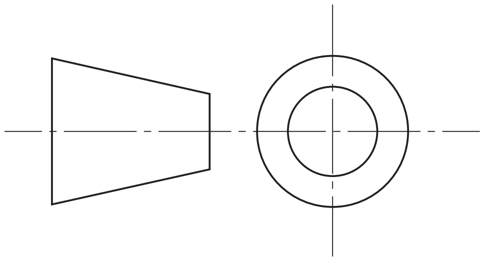
A. 0 V, 0 A
B. 0 V, 1 A
C. 10 V, 0 A
D. 10 V, 1 A

Question 11

A standard function in three-dimensional (3D) modelling software is to

A. format text for documents.
B. edit images to correct for lighting.
C. perform repetitive mathematical calculations only.
D. document the form and the dimensions of a component.

Question 12



On an engineering drawing, what does the symbol shown above indicate?

A. first-angle projection
B. second-angle projection
C. third-angle projection
D. fourth-angle projection

Question 13
The purpose of a project-management action plan is to

A. create a budget for the project.
B. identify the project's objectives and goals.
C. evaluate the success of the project.
D. communicate with stakeholders.

Question 14
What is the first step in creating a project-management action plan?

A. identify stakeholders
B. define project scope
C. develop a budget
D. assign team roles

Question 15
What is the primary purpose of a project schedule in a project-management action plan?

A. to assign project tasks
B. to track project progress
C. to identify project risks
D. to communicate with stakeholders

Question 16
The purpose of a risk-management plan in a project-management action plan is to

A. identify and mitigate project risks.
B. assign tasks to team members.
C. create a budget for the project.
D. track project progress.

Question 17

The purpose of a communication plan in a project-management action plan is to

A. ensure that project stakeholders are kept informed.

B. identify and mitigate project risks.

C. assign tasks to team members.

D. track project progress.

Question 18

The purpose of parametric modelling in computer-aided design (CAD) is to

A. create a physical prototype.

B. create complex designs quickly and easily.

C. allow for collaboration on a design project.

D. adjust the design based on changes to a set of parameters.

Question 19

The equivalent decimal value of the hexadecimal number AC is

A. 1013

B. 1012

C. 1011

D. 172

Question 20

What is the difference between risk avoidance and risk mitigation?

A. Risk avoidance is eliminating the risk altogether, while risk mitigation is reducing the likelihood or impact of the risk.

B. Risk avoidance is increasing the risk, while risk mitigation is reducing the likelihood or impact of the risk.

C. Risk avoidance is accepting the risk, while risk mitigation is reducing the likelihood or impact of the risk.

D. Risk avoidance is ignoring the risk, while risk mitigation is reducing the likelihood or impact of the risk.

END OF SECTION A
TURN OVER

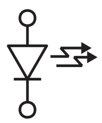
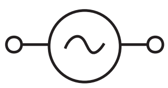
SECTION B

Instructions for Section B

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

Question 1 (6 marks)
The table below shows three symbols for electrical and electronic components.

Complete the table by naming each component and by providing a short description of its function or purpose in a circuit.

Symbol	Component's name	Function or purpose in a circuit
		
		
		

Question 2 (10 marks)

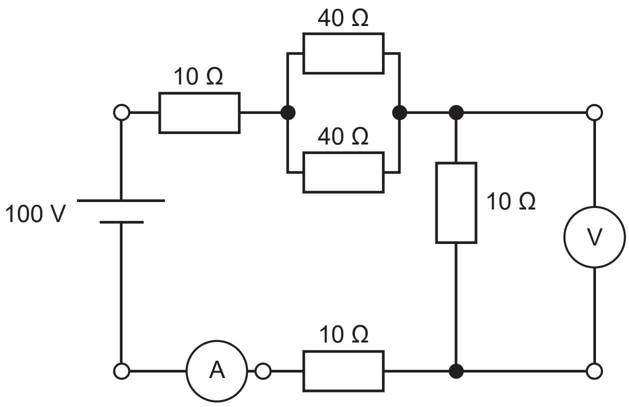


Figure 1

Figure 1 shows a circuit diagram.

a. Calculate the total resistance of the circuit. Show your working and include the correct unit in your answer. 4 marks

b. Determine the current displayed by the ammeter (A). Show your working and include the correct unit in your answer. 2 marks

c. Determine the voltage displayed by the voltmeter (V). Show your working and include the correct unit in your answer. 2 marks

d. Calculate the power generated by the power supply. Show your working and include the correct unit in your answer. 2 marks

Use the following information to answer Questions 3 and 4.

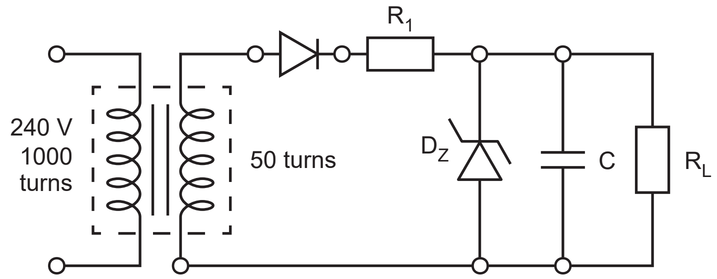


Figure 2

Question 3 (6 marks)

Figure 2 shows the schematic of an electric circuit.

a. What is the function of the circuit? 1 mark

b. Calculate the voltage across the secondary coil of the transformer. Show your working and include the correct unit in your answer. 3 marks

c. Calculate the peak voltage across the secondary coil of the transformer. Show your working and include the correct unit in your answer. 2 marks

Question 4 (4 marks)

Design the printed circuit board (PCB) artwork for the circuit shown in Figure 2. Use the layout in Figure 3 to complete your design.

PCB artwork

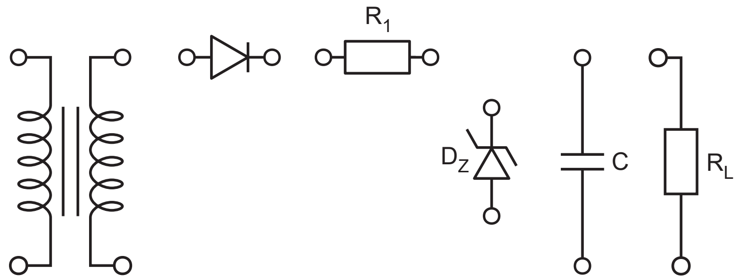


Figure 3

Question 5 (6 marks)

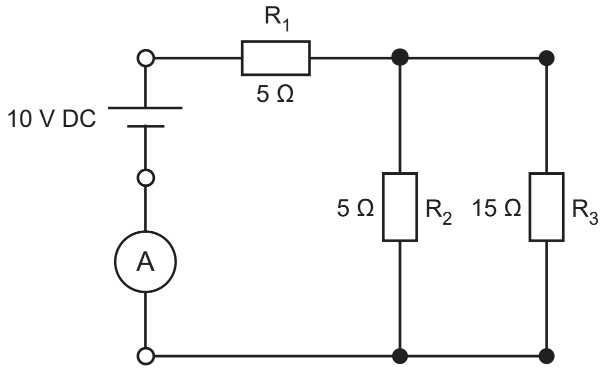


Figure 4

Figure 4 shows the schematic of an electric circuit consisting of a 10 V_{DC} power supply, two 5 Ω resistors and a 15 Ω resistor.

After a period of correct functioning, one of the components of the circuit becomes faulty and the ammeter (A) displays a current of 0.5 A.

a. Calculate the total resistance of the faulty circuit in Figure 4. 2 marks

b. Which resistor in the circuit is faulty? Show your working. 4 marks

Question 6 (4 marks)

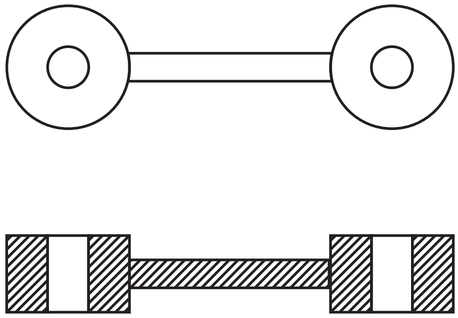


Figure 5

Figure 5 shows a part of a mechanism. On Figure 5, draw arrows to show at least **four** of the missing dimension lines that would be required to produce this part in a workshop.

Question 7 (4 marks)

A group of students are designing a project to create a battery bank able to deliver a voltage of 18 V_{DC}. They have decided to use 6 V_{DC} batteries. An individual battery provides 150 Ah.

a. How many batteries do they need? 1 mark

____

____

b. What would the students have to do to increase the capacity of the battery bank to 300 Ah? 1 mark

____

____

c. In the space below, draw the batteries and the connections required to build the 300 Ah battery bank. 2 marks

Use the following information to answer Questions 8–13.

A farmer wants to increase the yield of crops in a greenhouse by controlling the environmental conditions to extend the growing season.

Your group has been asked to design, build and commission the greenhouse control system based on the following client interview.

Client Interview

Designer: Can you tell me what environmental variables you want to control?

Client: Yes, of course. We want a control system that will help us manage the temperature, humidity, and light levels in our greenhouse.

Designer: Can you tell me the target ranges for each of these variables?

Client: Yes, we want to maintain:

- temperature of 21 °C ± 2 °C
- humidity of 65% ± 10%
- light levels of 10 000 lux ± 1000 lux

Designer: Understood. What types of equipment do you want to use for the control system?

Client: We will use heaters and cooling fans to increase and decrease the temperature. We will use water sprayers to increase humidity and dehumidifiers to decrease humidity. Grow lights and shutters will increase and decrease the lux/light levels. As the system will be solar powered, we would prefer equipment powered by 12 V_{DC}, and, due to the size of the greenhouse, a water pump should deliver at least 3200 L/hour.

Designer: Thank you for that information. Based on what you've told me, I think we can create a control system that meets your needs.

Client: Thanks for your help.

Question 8 (6 marks)

a. Complete the table below using the information from the client interview. 3 marks

Environmental variable	Hardware used to decrease variable	Hardware used to increase variable
temperature		
humidity		
light		

b. Complete the table below using the information from the client interview. 3 marks

Set point variable	Set point	Lower limit	Upper limit
temperature			
humidity			
light			

Question 9 (12 marks)

You have been asked to complete a block diagram and an action plan for the greenhouse control system.

a. Why would you use a hardware block diagram in the project planning phase? 1 mark

____

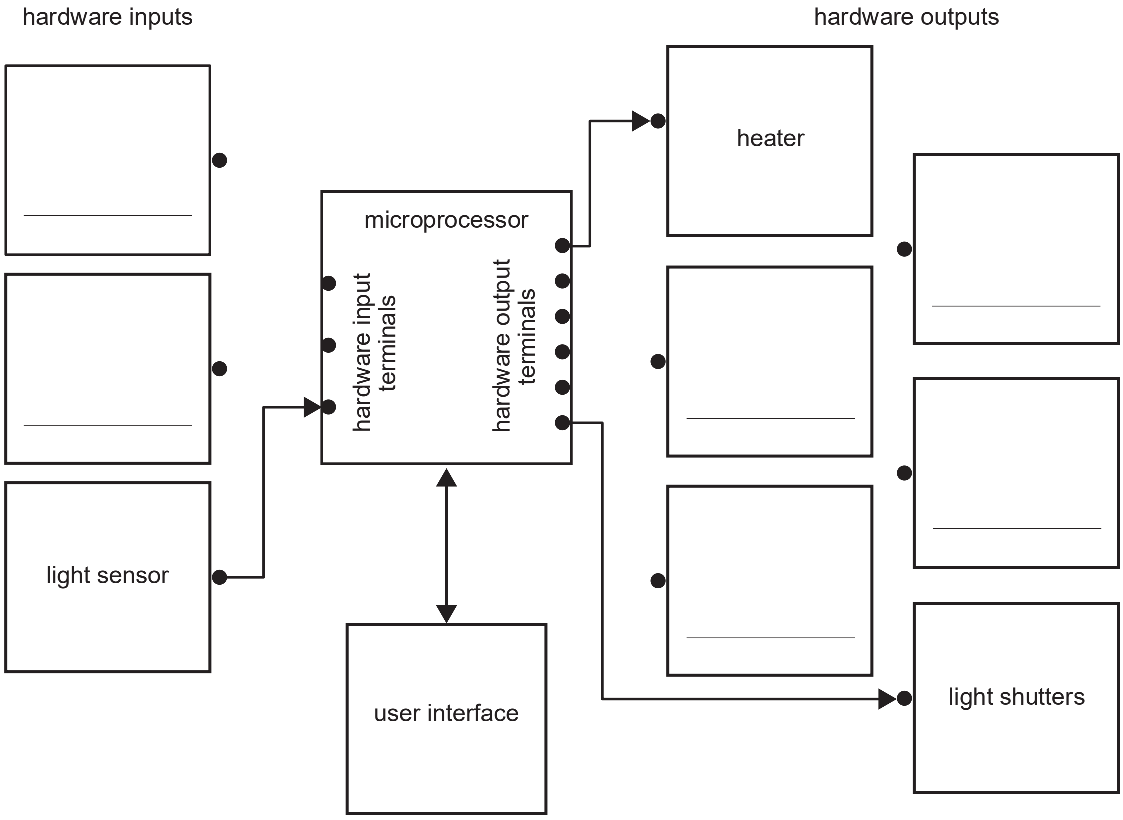
____

b. Complete a block diagram of the greenhouse control system.

i. Identify and label the blank blocks. 3 marks

ii. Draw links between blocks where required, using arrows to indicate direction of data flow. 3 marks

Greenhouse hardware block diagram



DO NOT WRITE IN THIS AREA

c. You have been tasked with writing an action plan.

Complete the table by writing the following steps in the correct order. 5 marks

- design the control system
- test and validate the system
- monitor and adjust the system
- install and set up the control system
- select and purchase equipment
- define the project goals and requirements

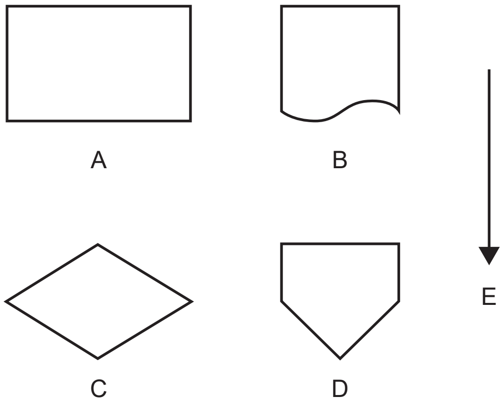
Order	Action plan steps
1	
2	
3	
4	
5	
6	

Question 10 (8 marks)

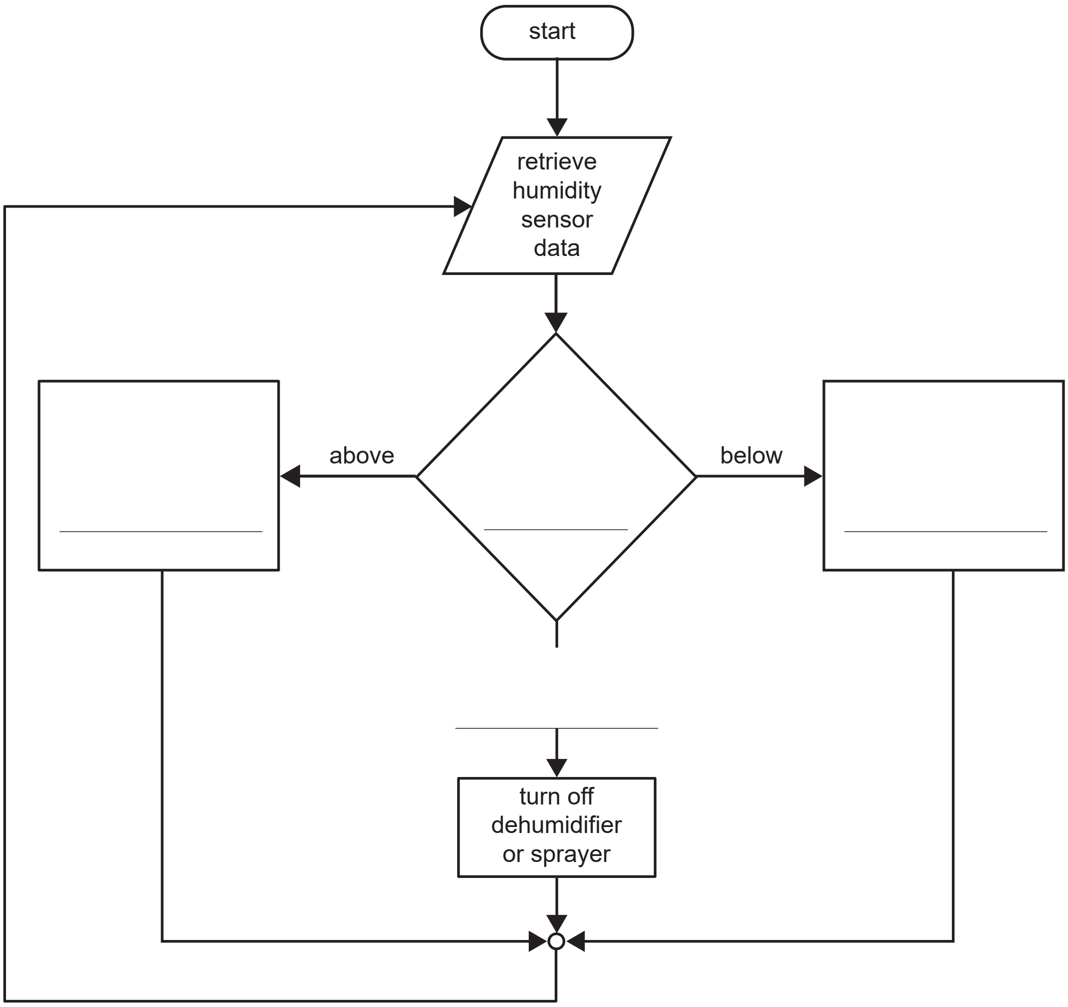
You have been asked to complete a flow chart to represent the greenhouse control system.

a. Identify the following flow chart symbols (A, B, C and D) by matching them with the appropriate definition in the table. 4 marks

document	
process	
flow of information	
off-page reference	
decision	



b. Complete the following humidity control flowchart. 4 marks



Question 11 (8 marks)

Your supervisor asks you to write a risk assessment and mitigation strategy on the greenhouse project.

a. For the two activities listed, identify

- a hazard involved with each activity
- a risk-control measure you should put in place.

An example activity has already been completed in the table below. 4 marks

Activity	**Hazards**	**Risk-control measures**
	List **one** hazard that could occur while performing the activity.	List **one** control measure to remove or minimise the risk.
using a computer for project planning	• eye strain	• good ergonomics
connecting the pump to the power and control system		
installing grow lights to greenhouse roof		

b. Unexpected situations may occur during the greenhouse project that will negatively impact the outcomes and/or timelines.

List **two** negative situations that may occur and detail what mitigation strategies you would put in place. 4 marks

Unexpected situation	**Mitigation strategies**

DO NOT WRITE IN THIS AREA

Question 12 (3 marks)

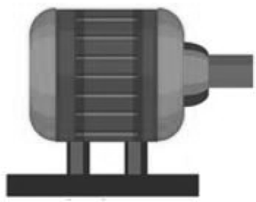
The client stated that the greenhouse will be solar powered and has therefore requested that, where possible, the control system equipment be powered by 12 V_{DC} and, due to the size of the greenhouse, the water pump should deliver at least 3200 L/hour.

a. On the following list of available equipment, circle the most appropriate pump. 1 mark

A.

Flow: 3400 L/hour
Power: 50 W
Voltage: 12 V DC
Speed: 4600 RPM

B.



Flow: 50 L/min
Power: 350 W
Voltage: 240 V AC
Speed: 4000 RPM

C.

Flow: 50 L/min
Power: 50 W
Voltage: 12 V DC
Speed: 4600 RPM

Source: adapted from ONYXprj/Shutterstock.com

b. Justify the pump you have selected above, with respect to the project specifications. 2 marks

DO NOT WRITE IN THIS AREA

Question 13 (3 marks)

Maintenance tasks are categorised based on their frequency and can be classified as daily, monthly, or annually.

Identify the frequency of the following activities.

Maintenance activity	Frequency (daily, monthly, annually)
Conduct a thorough inspection of the entire system and equipment.	
Check the water levels in any water sprayers or dehumidifiers and refill as necessary.	
Calibrate the sensors to ensure accurate readings.	

END OF QUESTION AND ANSWER BOOK

VCE VET INTEGRATED TECHNOLOGIES

Written examination

FORMULA SHEET

Instructions

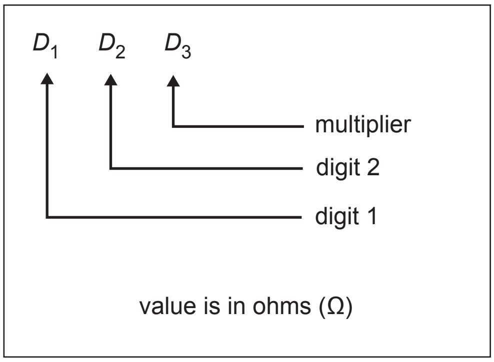
Please remove from the centre of this book during reading time.
This formula sheet is provided for your reference.

VCE VET Integrated Technologies formulas

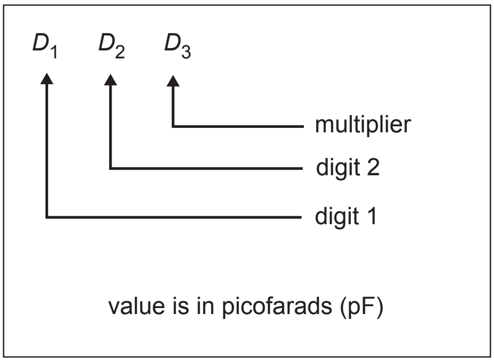
$R_T = R_1 + R_2 + R_3$	$f = \frac{1}{T}$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	$\tau = C \times R$
$R_T = \frac{R_1 R_2}{R_1 + R_2}$	$A = \frac{\pi d^2}{4}$
$R = \frac{\rho l}{A}$	$C = \frac{\varepsilon A}{d}$
$V = I \times R$	$C_T = C_1 + C_2 + C_3$
$P = V \times I$	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$
$V_X = V_S \left(\frac{R_X}{R_T} \right)$	$Q = V \times C$
$V_{max} = V_{peak}$	$W = \frac{1}{2} C V^2$
$V_{step} = \frac{V_{max}}{2^n - 1}$	$W = P\,t$
turns ratio = $\frac{N_1}{N_2}$	1 ampere hour (Ah) = 1 A of amount drawn for one hour
$v = V_{max} \sin \theta$	$i = I_{max} \sin \theta$
$V_{av} = 0.637 \times V_{max}$	$V_{RMS} = 0.707 \times V_{max}$ $\quad V_{RMS} = \frac{V_{max}}{\sqrt{2}}$
$f = \frac{1}{t}$	$L_T = L_1 + L_2 + L_3$
$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$	$f_0 = \frac{1}{2\pi\sqrt{LC}}$ 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})
$\eta = \frac{\text{pin} - \text{losses}}{\text{pin}} \times 100$ (η = efficiency in %)	$\eta = \frac{\text{power out} \times 100}{\text{power in}}$%
$\tau = \frac{L}{R}$	

Resistor codes



Capacitor codes



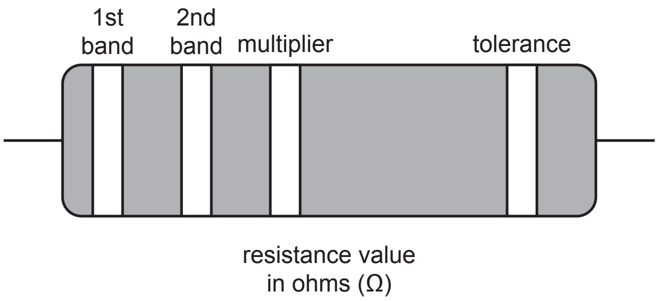
ASCII code chart (in hexadecimal)

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