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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 – Friday 15 November 2024

- Reading time is **15 minutes**: 11.45 am to 12 noon
- Writing time is **1 hour 30 minutes**: 12 noon to 1.30 pm

Approved materials

- One scientific calculator

Materials supplied

- Question and Answer Book of 24 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

The acronym CAM stands for

A. computer-aided manufacturing.

B. computer-aided machine.

C. computer-aided microphone.

D. computer-aided mobility.

Question 2

The C-type USB has become the new standard. This is mainly due to

A. worldwide compatibility.

B. durability.

C. its ability to slow data transfer and prevent overheating of the device.

D. its ability to plug into power points that are smaller.

Question 3

The RMS voltage that is delivered from a standard Australian power point is

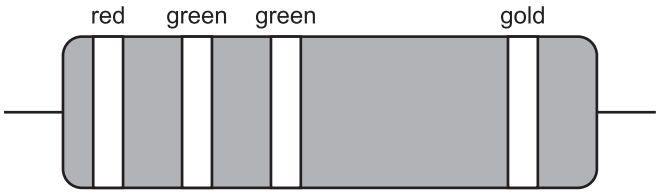
A. 110 V

B. 120 V

C. 220 V

D. 230 V

Question 4



The nominal resistance and tolerance value of the axial resistor above is

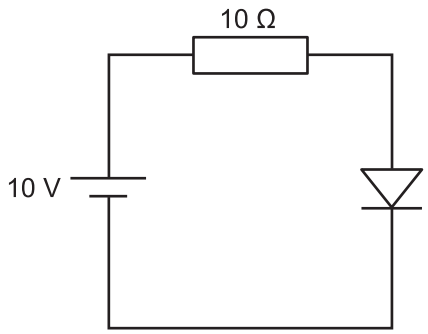
A. 255 Ω 5%

B. 255 Ω 10%

C. 2M5 Ω 5%

D. 2M5 Ω 10%

Question 5



In the circuit shown above, the current that would be expected to flow through the 10 Ω resistor is

A. 0 A

B. 2 A

C. 1.07 A

D. 0.93 A

Question 6

When the decimal number 10 is converted to a binary number, it is expressed as

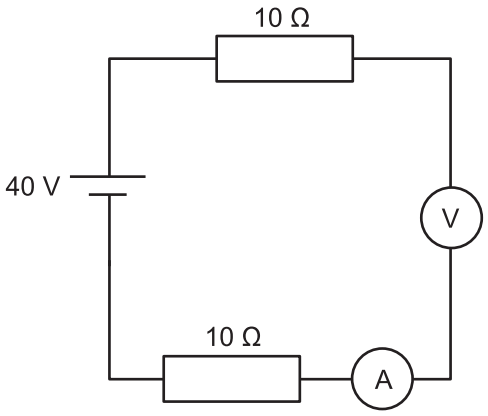
A. 1010

B. 1100

C. 1101

D. 1111

Question 7



The voltage displayed on the voltmeter (V) and the current displayed by the ammeter (A) shown in the circuit diagram above would be

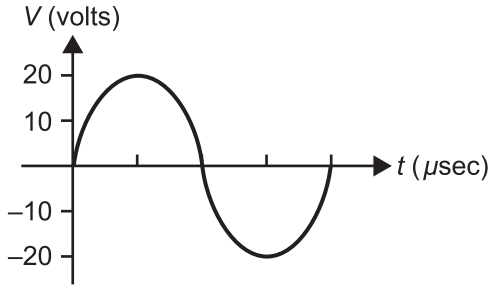
A. 40 V, 0 A

B. 40 V, 2 A

C. 0 V, 2 A

D. 0 V, 0 A

Question 8



A waveform is displayed on an oscilloscope as shown in the diagram above. The CRO settings are: 10 μs/division and 10 V/division.

The P-P voltage and the frequency of the waveform are

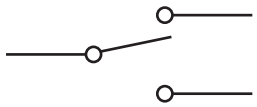
A. 20 V, 40 Hz

B. 20 V, 40 kHz

C. 40 V, 25 Hz

D. 40 V, 25 kHz

Question 9



The switch shown above is classified as a

A. DPST.

B. DPDT.

C. SPST.

D. SPDT.

Question 10

When carrying a new sealed lead-acid car battery, the most necessary PPE is

A. a helmet.

B. eye goggles.

C. woollen gloves.

D. sturdy footwear.

Question 11

A capacitance of 4p7 F can be expressed as

A. 47 pF

B. 4700 nF

C. 0.000,004,7 μF

D. 0.000,000,047 F

Question 12

The tool shown above is called

A. a metal bending tool.

B. an RJ45 cable crimping tool.

C. a pair of crosscut linesman pliers.

D. a pair of square nut adjustment pliers.

Question 13

Which of the following block charger power supply designs is the most efficient?

A. simple Zener diode power supply design

B. rectified linear power supply design

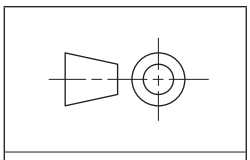
C. switch mode power supply design

D. simple half-wave rectified smoothed power supply design

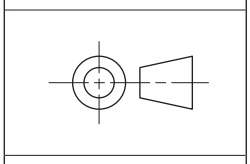
Question 14

On an engineering drawing, which one of the symbols shown below identifies the drawing as a Third Angle Orthographic Projection?

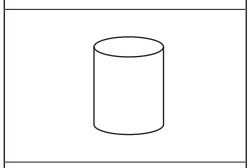
A.



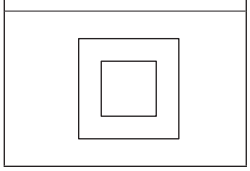
B.



C.



D.



Question 15

Which one of the following file extensions would be a valid 3D printer file?

A. .exe

B. .stl

C. .doc

D. .xls

Question 16

A 60/40 Sn/Pb solder is used for general electronic soldering.

The alloy of Sn/Pb is

A. tin/lead.

B. silver/lead.

C. silicon/potassium.

D. aluminium/copper.

Question 17

For effective soldering with 60/40 Sn/Pb solder, the tip of a soldering iron should be heated to the range of

A. 50 °C to 180 °C

B. 190 °C to 390 °C

C. 400 °C to 490 °C

D. 500 °C to 590 °C

Question 18

Which one of the following sequences represents the Integrated Technology project cycle?

A. planning → developing → executing → closing

B. developing → planning → executing → closing

C. planning → executing → developing → closing

D. developing → executing → planning → closing

Question 19

The first step in developing a risk-management plan is to

A. analyse the risks.

B. develop a risk-mitigation plan.

C. identify potential project risks.

D. estimate the likelihood of the risks occurring.

Question 20

While using a mains-powered hot air gun, you find that the power lead has plastic insulation that is damaged. Copper wire can be seen when the lead is bent at the damaged point. Immediately, you stop and unplug the hot air gun.

The next step is to

A. place the hot air gun in the garbage bin.

B. apply insulation tape over the damaged cable.

C. attach a danger tag and place it in the repair box.

D. notify the supervisor and leave it out on the bench for the technician to repair.

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 (3 marks)

In the table below, identify a benefit of the following diagnostic tools. A response may only be used once.

Diagnostic tool	Benefit
test lamp	
DMM	
CRO	

Question 2 (13 marks)

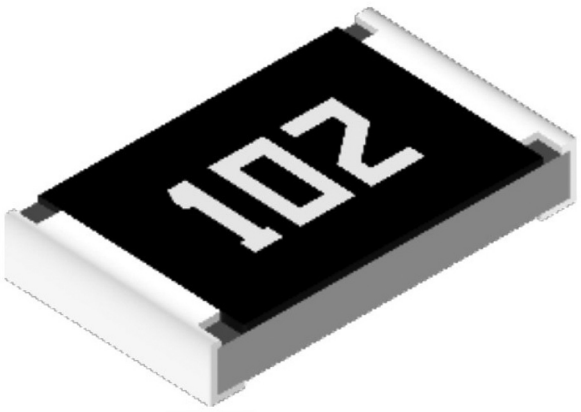


Figure 1: 102 SMD Resistor

Source: https://industrial.panasonic.com

a. Explain how exceeding the power rating of the SMD would affect the resistor. 2 marks

Question 2 continues on the next page.

b. The SMD resistor shown in Figure 1 has the numbers 102 micro-printed on it.

Conventional resistor colour codes are not used on SMD components.

Provide **two** reasons why numbers are printed on SMD resistors, rather than the conventional colour bands as used with axial resistors. 2 marks

c. What is the nominal resistance value of the 102 SMD resistor? Express the answer with the relevant multiplier and units. 2 marks

d. Different 'E series ranges' of SMD resistors provide different levels of tolerance.

What does the tolerance value mean in relation to the resistors, and how is it expressed? 2 marks

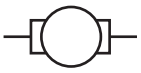
e. The nominal tolerance ranges of SMD resistors in the different E series ranges are shown in the table below.

Complete the following table by entering the missing tolerance (%) or the equivalent tolerance colour code, as required. 5 marks

E series range	Tolerance (%)	Tolerance colour code
E192		green
E96	1	
E48		red
E24	5	
E12		silver

Question 3 (9 marks)

Complete the table by naming each device, providing a short description of its function or purpose in a circuit, and naming a specific application where the device may be used.

Symbol	Device name	Device function or purpose	Specific application where device may be used
			
			
			

Question 4 (5 marks)

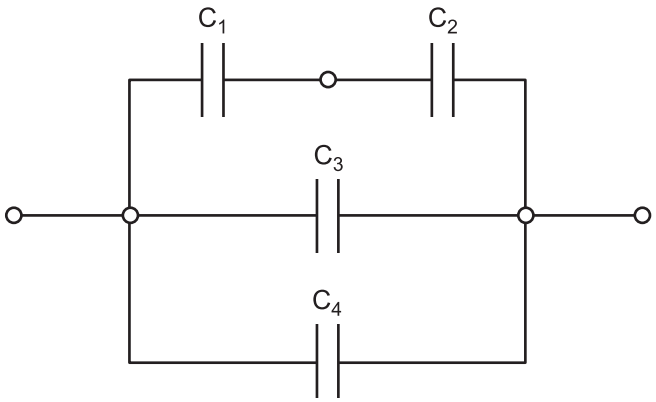


Figure 2

A combination of four of the same capacitors were temporarily used by a VET Integrated Technologies student to replace a single damaged capacitor. All four capacitors are 10 μF / 10V.

a. What is the capacitance of a new single capacitor that could replace this network?

Show your working out. 3 marks

b. What is the minimum voltage rating of a new single capacitor that could replace this network?

Justify your answer. 2 marks

Question 5 (11 marks)

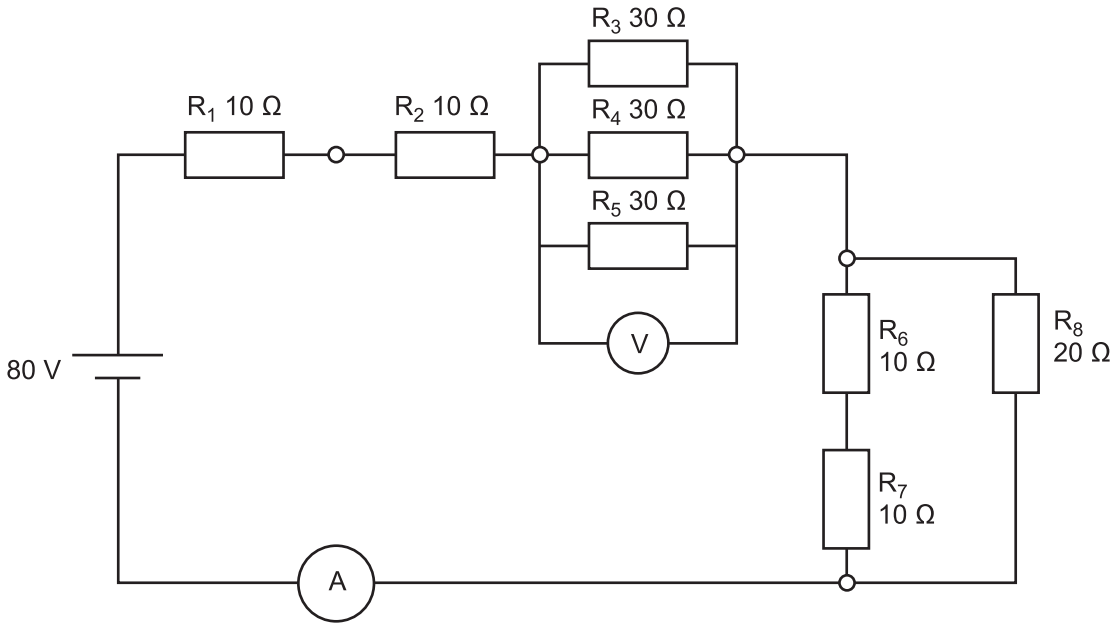


Figure 3

Figure 3 shows a circuit digram. Use this figure to answer the following questions.

a. Calculate the total resistance of the circuit.

Show all working out and include the correct unit in your answer. 5 marks

b. Determine the total current displayed on the ammeter, A.

Show all working out and include the correct unit in your answer. 2 marks

c. Determine the voltage displayed on the voltmeter, V.

Show all working out and include the correct unit in your answer. 2 marks

Question 5 continues on the next page.

d. Calculate the power used by the circuit (Figure 3) on page 13.

Show all working out and include the correct unit in your answer. 2 marks

Question 6 (14 marks)

LED flasher schematic diagram

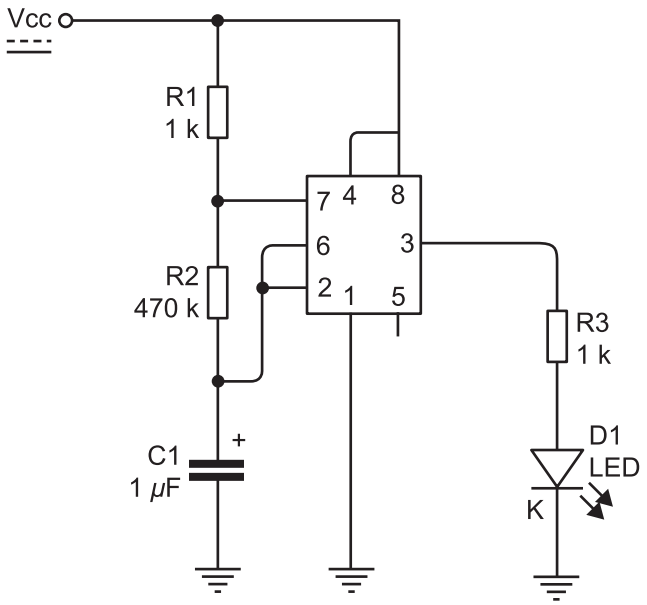


Figure 4

IC pinout

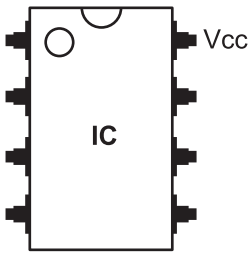


Figure 5

Figure 4 above is the schematic circuit diagram for an LED flasher, which utilises an eight-pin IC in the circuit.

Refer to the schematic circuit diagram, Figure 4, when answering the following questions.

a. This symbol ⏚ is used three times on the circuit diagram.

Identify this symbol, and indicate its function in the circuit. 2 marks

b. Which components in the circuit in Figure 4 can be changed to modify the frequency and pulse width of the LED flasher? 2 marks

Do not write in this area.

c. What does the letter K beside component D1 identify on the circuit diagram in Figure 4? 1 mark

_____

d. What is the function of R3 in this circuit? 1 mark

_____

e. The IC manufacturers identify pin number 1 on an IC in two different ways.

What are the two ways to identify pin number 1 on an IC? 2 marks

1. _____

2. _____

f. On the IC diagram, Figure 5, on the previous page, number all the pins of the IC 1 to 8. 2 marks

g. The PCB design artwork below is shown at approximately three times actual size for ease of drawing. For easier interpretation, the PCB tracks are viewed from the component side. The PCB 'screen printed' component labels are also provided.

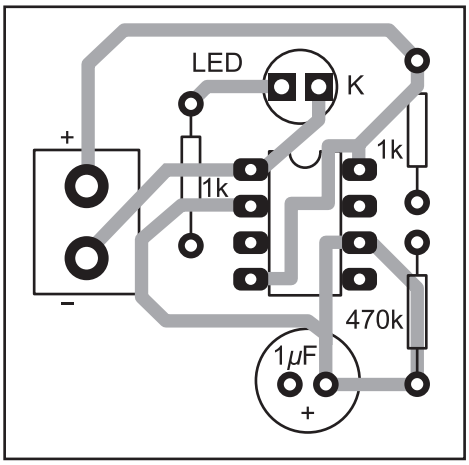


Figure 6

The LED flasher PCB artwork has four tracks that are missing. Referring to the schematic diagram (Figure 4) on page 14, draw in clearly each of the four missing tracks on Figure 6 above. Use a pencil to complete this task. 4 marks

Question 7 (6 marks)

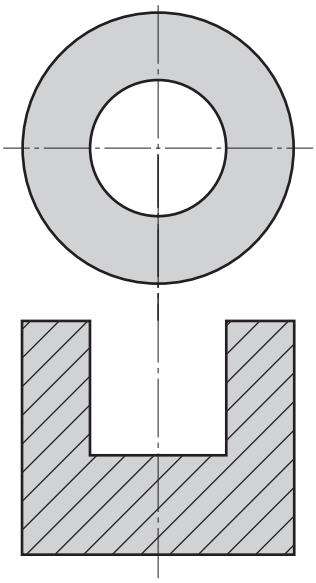


Figure 7

The engineering drawing in Figure 7 shows part of a mechanism.

Draw in six of the missing dimension lines with arrows and projection lines to provide a drawing that will allow production in the workshop. The actual measurements (mm) are not required.

Question 8 (4 marks)

There are specific steps that should be followed to complete a risk-management plan. The first and last steps are listed correctly below. However, steps 2, 3, 4 and 5 are out of order. Rearrange the steps in the correct sequence in the table below.

- Define the risks.
- Examine risk consequences.
- List all risks and assign a probability.
- Monitor and update your risk-management plan.
- Develop mitigation strategies.
- Analyse the effectiveness of the risk-management strategy.

Step order	Risk-management plan
1.	Define the risks.
2.	
3.	
4.	
5.	
6.	Analyse the effectiveness of the risk-management strategy.

Question 9 (6 marks)

Many electronic devices have both these warning symbols badged on them.

Symbol 1 **Symbol 2**

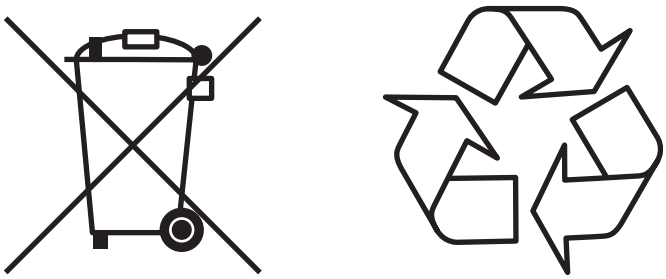


Figure 8

a. **i.** What does each symbol specifically indicate? 2 marks

Symbol 1 _____

Symbol 2 _____

ii. For Symbol 1, describe an appropriate handling procedure. 2 marks

_____

_____

b. Lithium-ion (Li-ion) battery packs, as found in mobile phones and laptops, have both these symbols badged on them.

Provide two reasons why it is critical to follow this disposal advice with Li-ion battery packs. 2 marks

1. _____

_____

_____

2. _____

_____

_____

Question 10 (9 marks)

The diagram below shows the circuit for an automatic night-time floodlight system using an LED array.

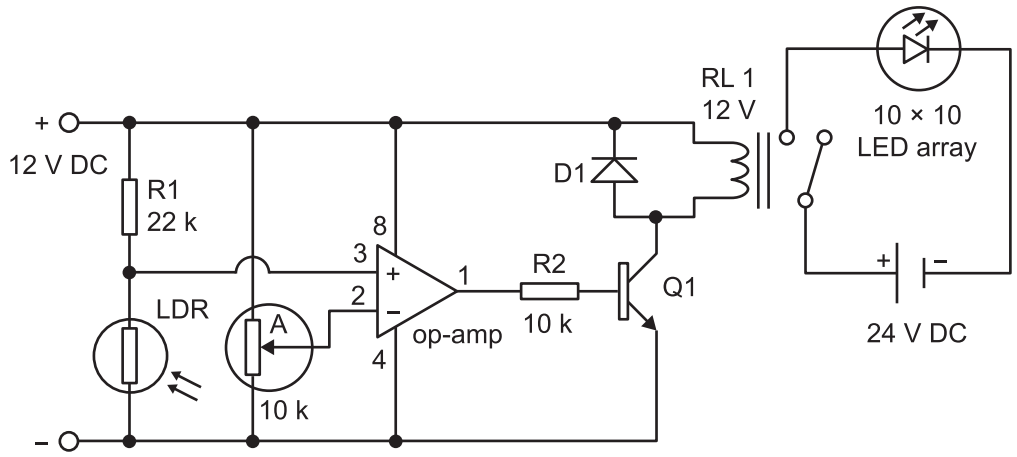


Figure 9

The IC op-amp is configured to function as a comparator in this circuit.

Component A above is circled.

a. Identify Component A, and describe what function it performs within the circuit. 3 marks

b. The circuit is powered by a 12 V DC power supply, and the LED lighting array is powered by a separate 24 V DC power supply.

List two advantages of powering the LED lighting array with this 24 V DC power supply. 2 marks

1. _____

2. _____

Question 10 continues on the next page.

c. For the system to work effectively, the following should occur.

During daytime:

- low LDR resistance, the transistor remains OFF
- relay unenergised
- LED array lighting remains OFF

At night:

- high LDR resistance, the transistor turns ON
- relay energised
- LED array lighting turns ON

Use the information above to show the functioning of the automated LED lighting by completing the flow chart below. Fill in the four blank spaces. 4 marks

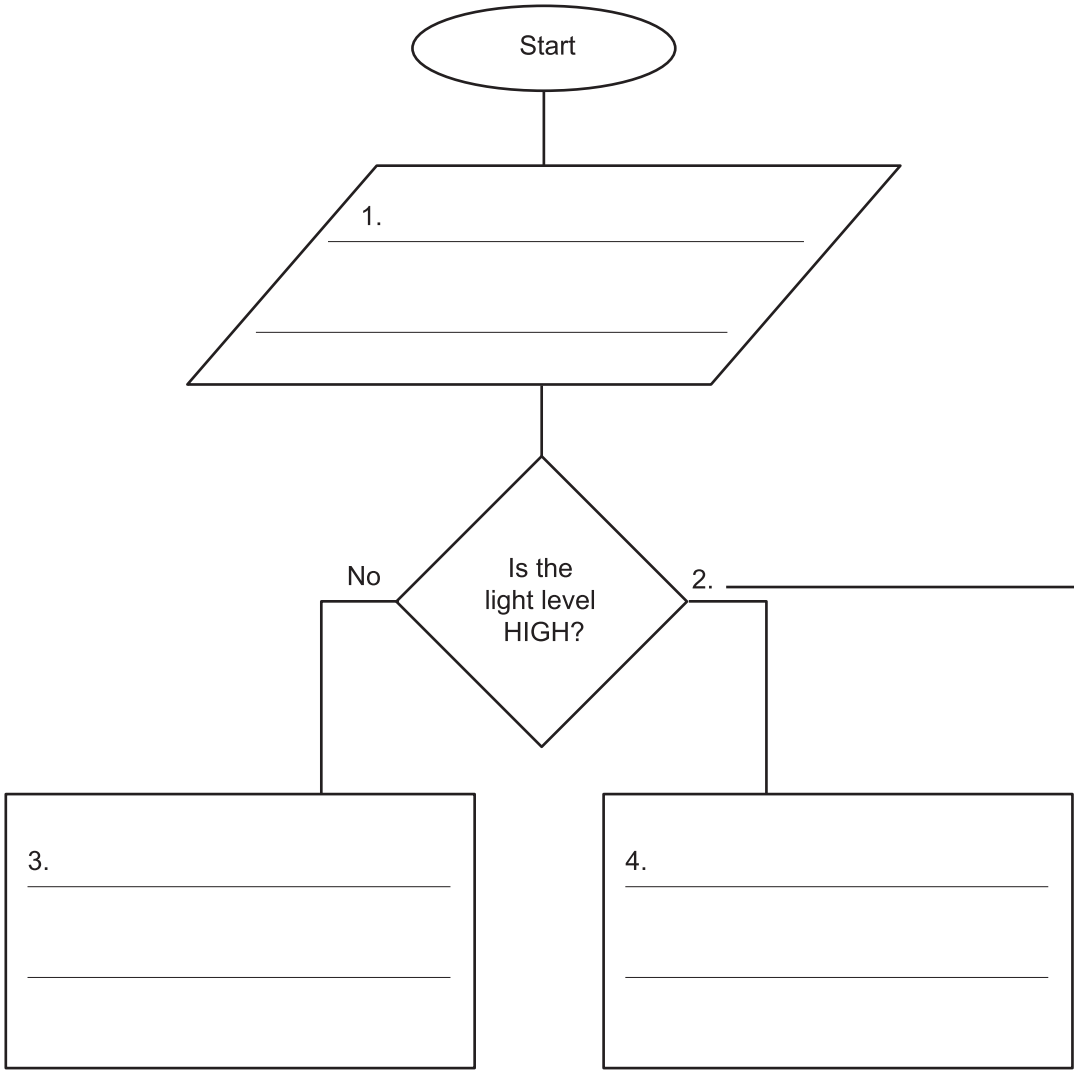


Figure 10

End of examination questions

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2024 Formula Sheet

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

You may keep this Formula Sheet.

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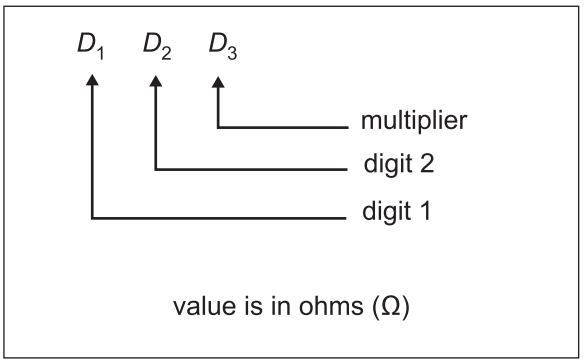
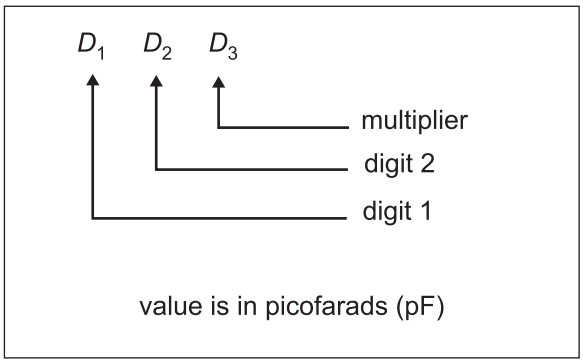
$R_T = R_1 + R_2 + R_3 + \ldots$	$f = \frac{1}{T}$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$	$\tau = C \times R$
$R_T = \frac{R_1 R_2}{R_1 + R_2}$	$A = \frac{\pi d^2}{4}$
$R = \frac{\rho l}{A}$	$C = \frac{\varepsilon A}{d}$
$V = I \times R$	$C_T = C_1 + C_2 + C_3 + \ldots$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

Resistor codes



Capacitor codes

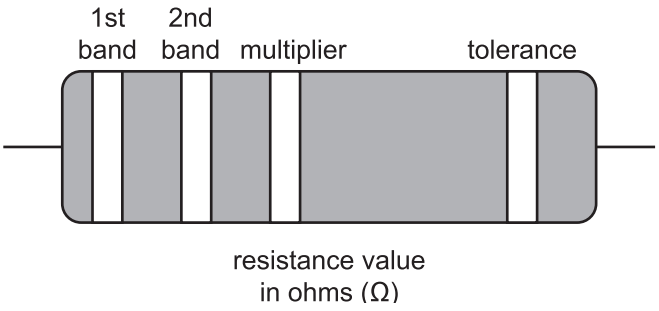


ASCII code chart (in hexadecimal)

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