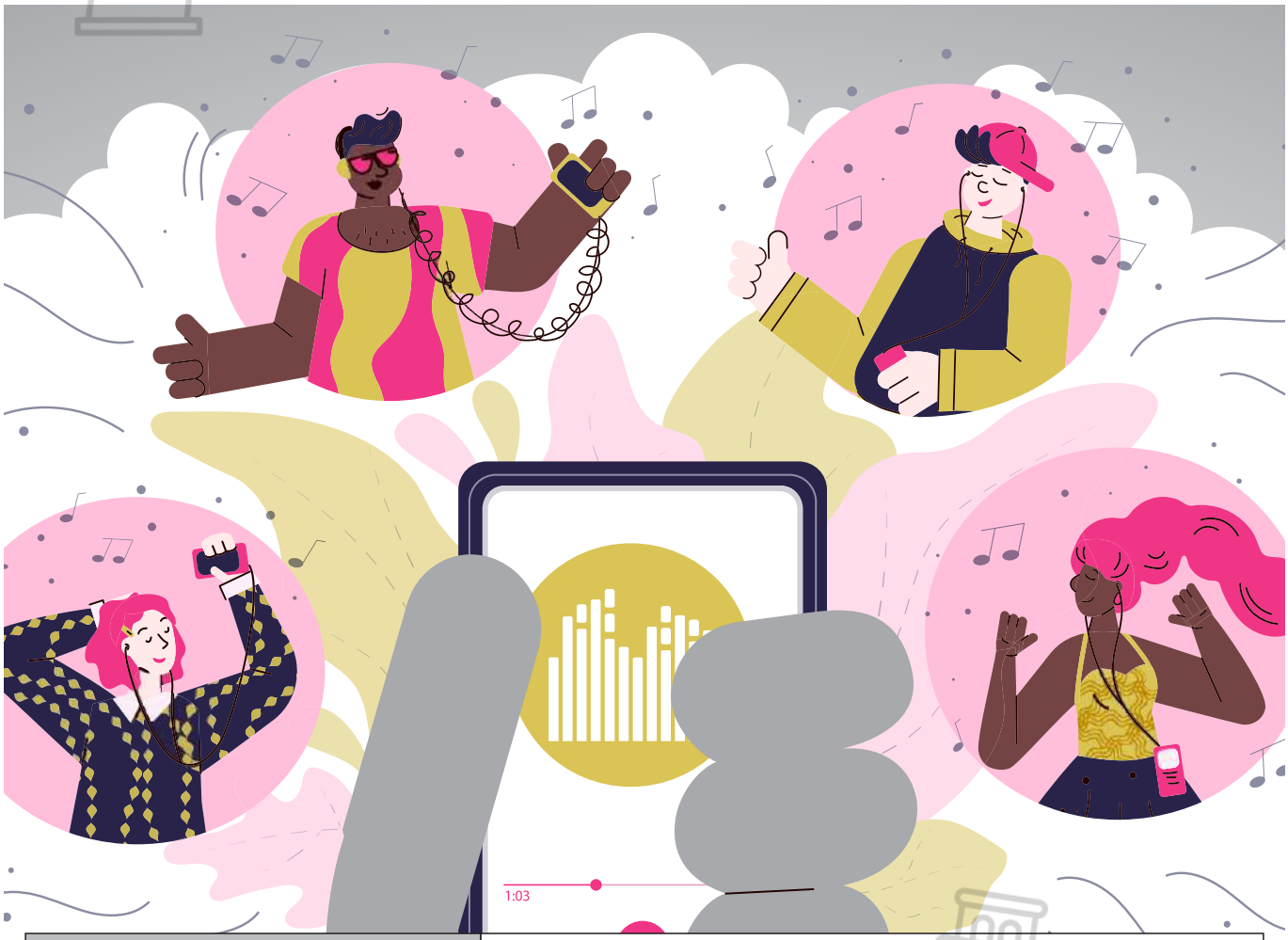
GEC INTEGRATED GRADE 9 PROJECT

LEARNER'S WORKBOOK



Name of School	
Name of Learner	
Class	

3 ENTREPRENEURSHIP
EMPLOYABILITY
EDUCATION

PROJECT-BASED LEARNING | TECH, MATH & NS

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Read to Lead
A Reading Nation is a Leading Nation

2030 NDP

GRADE 2025 9

Summary of Worksheets

Worksheet Number	Subject Total Mark / Worksheet Mk	MATH (50)		NS (30)		TECH (70)	
		Ex	Mod	Ex	Mod	Ex	Mod
3	15						
4	5						
5.1	3						
5.2	3						
5.3	2						
5.4	5						
5.5	7						
8a	44						
8b	32						
8c	24						
9	20						
10	35						
Total							

Please note:

Worksheet 5.4

TECH teachers administer, mark the task and share the marks with the NS teacher.

POSSIBLE SCENARIOS

NOTE: Below, you will find two different scenarios. Select ONE scenario that will be used for the completion of the project.

SCENARIO 1:

Amy works in a small clothing shop, and she loves to read. She often gets so engrossed in her book that she doesn't notice when clients enter the store. Help Amy to build a small door alarm that sounds a buzzer and indicates by means of a LED when clients enter.

SCENARIO 2:

Khotso sometimes looks after his sick grandmother in the afternoons. When he plays soccer with his friends outside the house, he cannot hear when she calls for him. Please help him to design and build a device so he can hear and see when his grandmother is calling him when she needs him.
Present your solution to an audience. Explain your output using graphs and calculated values.

REQUIREMENTS FOR THE DEVICE / PROTOTYPE / MODEL.

- The structure (house) should protect the components of the electronic circuit.
- The electronic components should be securely joined to the baseboard.
- The batteries should be replaced easily.
- The cost of the electronic circuit of the device / prototype / model should not exceed R50.
- The size of the structure (house) the electronic circuit should be 150 mm x 100 mm x 20 mm.

1.1 Identify the problem from the selected scenario.

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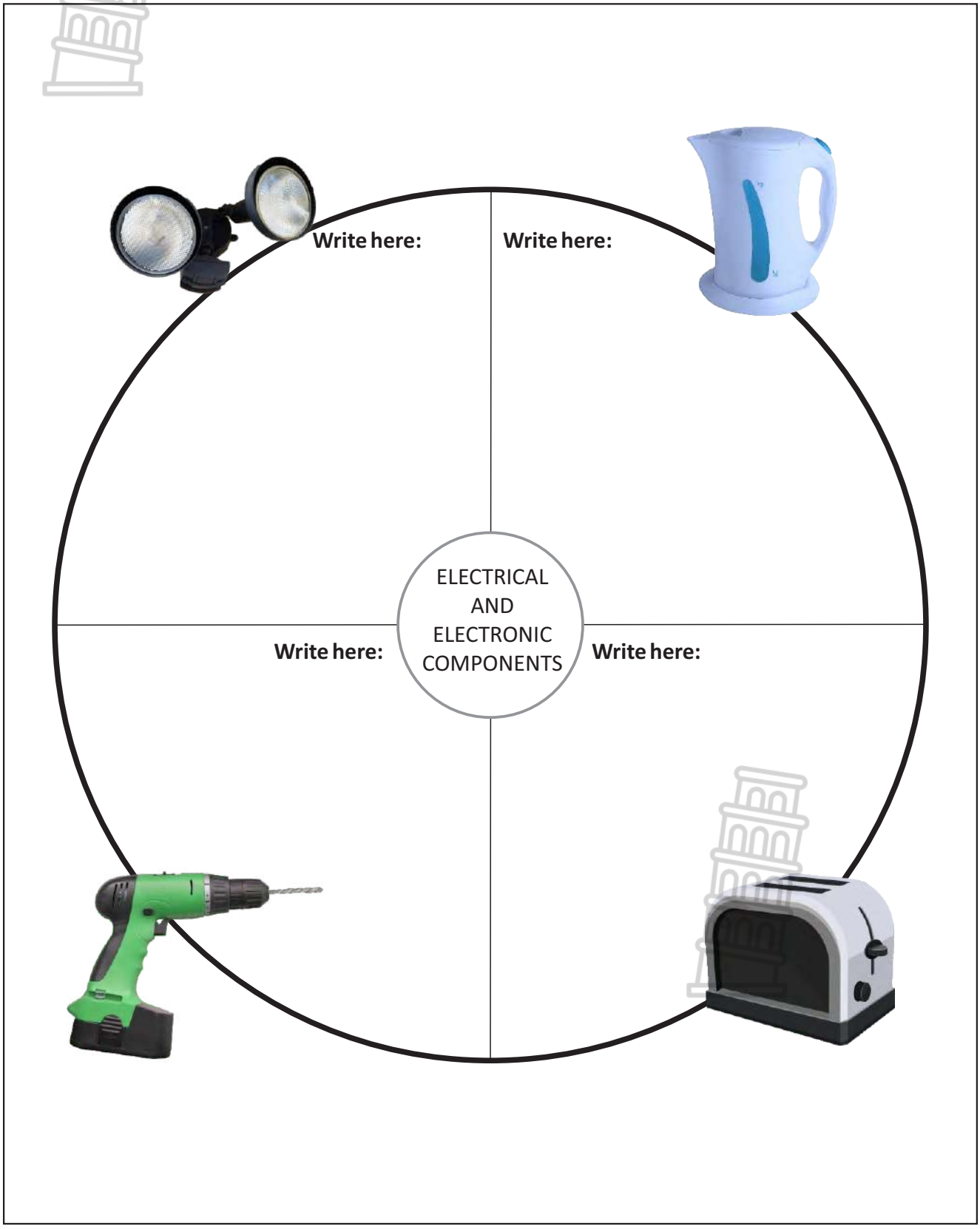
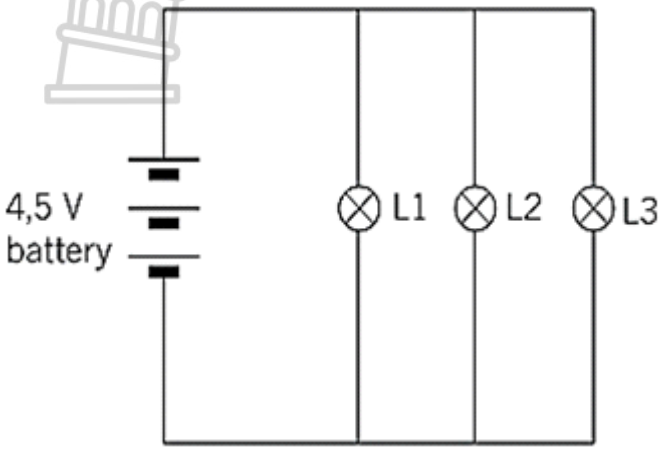
Worksheet 1 - NS & TECHNOLOGY - INFORMAL

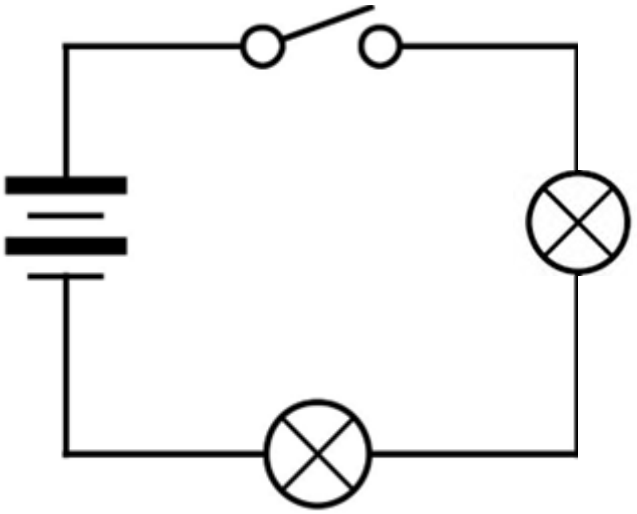
Different electrical appliances are illustrated below. Identify the electrical components (NS) and electronic components (Tech). List the components used in the different appliances in the open spaces provided.



Worksheet 2 - NS [INFORMAL]

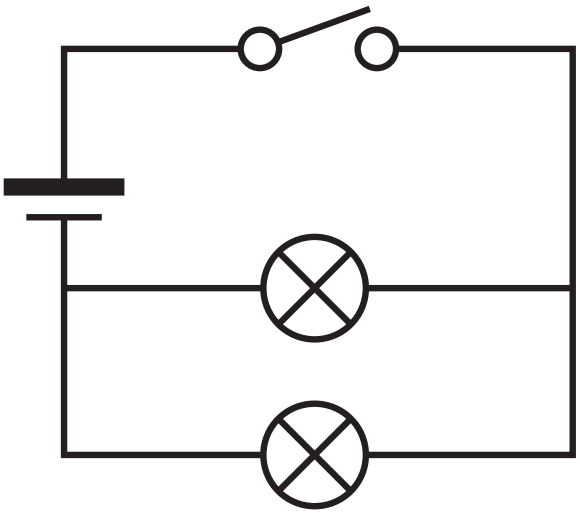
Look at the simple circuit diagrams below. Can we tell if the components (bulbs) are connected in series or parallel? (1) Name the type of circuit. (2) Label the components on the circuit diagram. (3) Show in which direction the current flows.

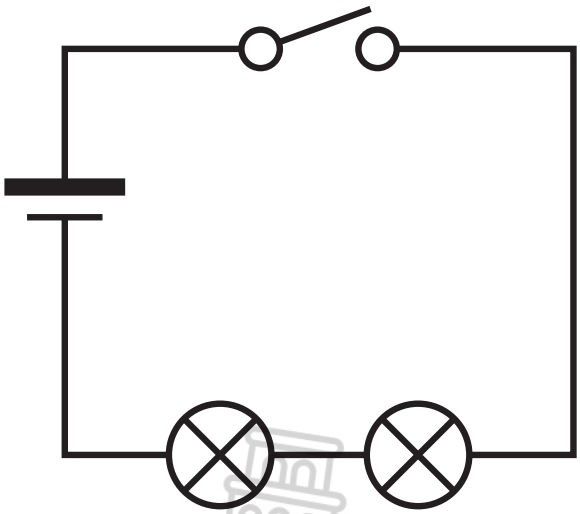




Type of circuit: .....

Type of circuit: .....





Type of circuit: .....

Type of circuit: .....

COMPONENT	CIRCUIT DIAGRAM SYMBOL
Wire	
Resistor	or
Light bulb	

COMPONENT	CIRCUIT DIAGRAM SYMBOL
Cell	
Battery	
Switch	

Worksheet 3 - TECHNOLOGY - FORMAL [Investigation skills]

Study the electronic / electrical components below. Identify the component, draw the symbol and give the function of each component in the provided spaces.

ELECTRONIC / ELECTRICAL COMPONENT	NAME OF COMPONENT	SYMBOL	FUNCTION
3.1 	.... (1)	(1)	.... (1)
3.2 	.... (1)	(1)	.... (1)
3.3 	.... (1)	(1)	.... (1)
3.4 	.... (1)	(1)	.... (1)
3.5 	.... (1)	(1)	.... (1)

[15]

Research questions can help to direct your research and make you think deeper about ordinary problems.

AIM FOR NATURAL SCIENCES PROJECT / INVESTIGATION:
Amy and Khotso want to find out how they can make the buzzer sound louder.

They want to determine how the number of cells in series will affect the loudness of their buzzers **OR** how the input-voltage affects the output power of the buzzer.

STEP 1 – INVESTIGATIVE QUESTION

Formulate an INVESTIGATIVE QUESTION based on the aim of the project.

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..... (3)

STEP 2 – HYPOTHESIS

Formulate a HYPOTHESIS for this investigation.

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..... (2)

[5]

WORKSHEET 5 - TECH (5.1-5.5) FORMAL (DESIGN SKILL)

5.1 Write a design brief for the identified problem mentioned in the scenario. (3)

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5.2 List **THREE** specifications from the scenario. (3)

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5.3 List **TWO** constraints from the scenario. (3)

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5.4 Draw a labelled circuit diagram to solve the identified problem from the selected scenario.

(5)

5.5 Draw a 3D isometric freehand sketch of the housing structure that will enclose the electronic circuit. Use labels and notes to explain your design. Make sure your idea meets all the given specifications and constraints.

(7)

[20]

Worksheet 6a - TECH [INFORMAL] Group activity

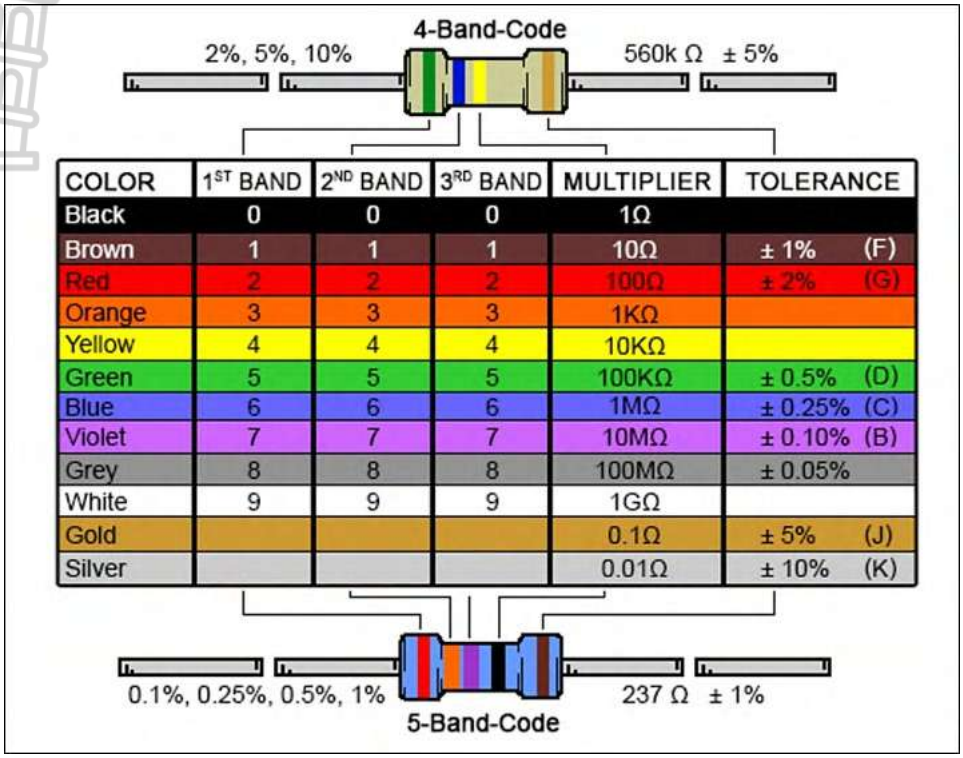
Use the space below to:

1) Identify the problems you must address to build a functional device and list the decisions your groups need to make.
2) List possible solutions.
3) List the tools, resources and materials to build, or alternatives to ensure that the project is functional.

1) PROBLEM YOU NEED TO SOLVE/ DECISION YOU HAVE TO TAKE	2) POSSIBLE SOLUTIONS	3) TOOLS, RESOURCES AND MATERIALS
Example: Where will we get a battery?	Look in old toys, look for old radios that still have batteries.	batteries, rechargeable batteries, solar batteries

Worksheet 6b - TECHNOLOGY: [INFORMAL]

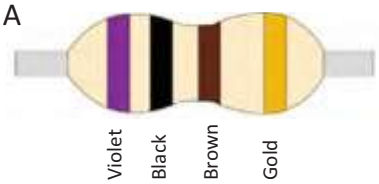
Answer the following questions using the conversion table below:



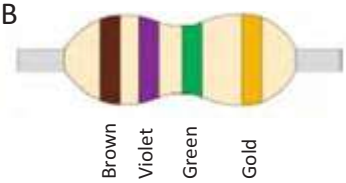
COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

1. Calculate the value of the following resistors:

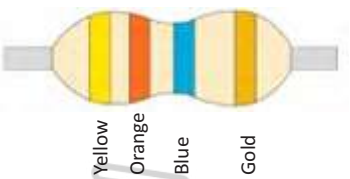
A



B



C



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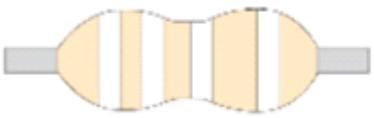
2. Provide the colour codes for the following resistors. If you don't have coloured pencils or pens, write the colour of each band below it (see example in Worksheet 6b 1.)

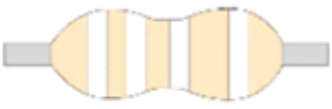
A

7500Ω



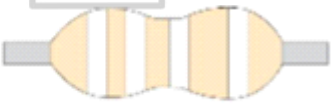
B

2600kΩ



C

0,57mΩ



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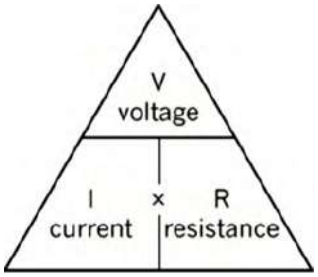
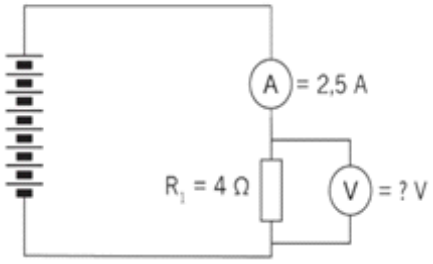
Worksheet 6b - TECHNOLOGY: [INFORMAL]

In the formula for Ohm's Law:

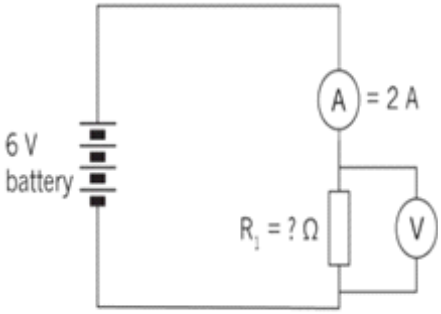
- V is the **potential** or **voltage difference** measured in volts,
- **I** is **current** measured in amps, and
- **R** is **resistance** measured in ohms.



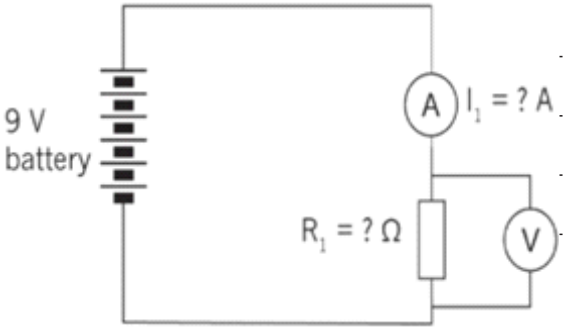
3. Calculate the value of the voltage supply in the circuit below if the resistor has a value of 4 Ω and the current through the resistor is 2,5 A.



4. Calculate the resistance of the resistor.

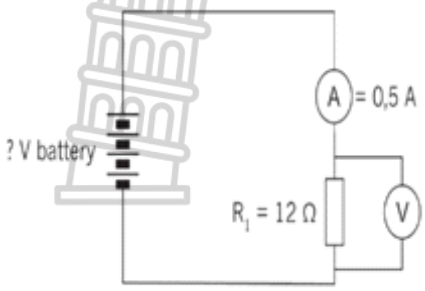


5. If two more cells are added to the circuit, will the current increase or decrease? Check your prediction using the formula.

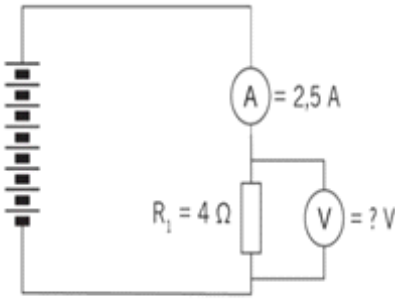


Worksheet 6b - TECHNOLOGY: [INFORMAL]

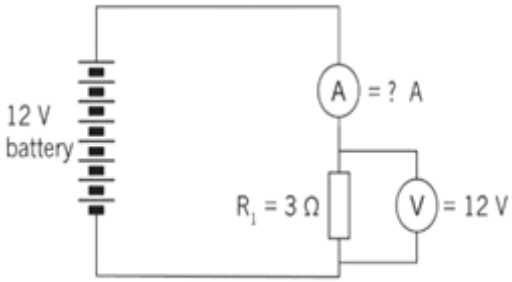
6. Calculate the battery voltage for the circuit below.



7. Calculate the voltage across R_1.



8. Calculate the current.



Worksheet 6b - TECHNOLOGY: [INFORMAL]

9. Given V = 10 V and R = 1 kΩ, what will the value of the current be in a circuit?

10. Given V = 20 V and R = 5 kΩ, solve for the current.

11. A tumble dryer in a laundry service uses a 220 V power source. The coil of the heater provides an average resistance of 12 Ω. What is the current flowing through the heating coils?

12. A 9 V battery maintains a current of 3 A through a radio. What is the resistance in the circuit?

13. Describe the function of a diode in your own words.

Worksheet 6b - TECHNOLOGY: [INFORMAL]

14. List at least four places where LEDs are used. Don't use the examples already given.

15. How can you make sure that a diode is correctly connected?

16. Draw the circuit symbols for a diode and for an LED.

Diode

LED

Worksheet 7 - TECHNOLOGY – GROUP WORK [INFORMAL]

7.1 Use the criteria below to analyse and evaluate the individual designs according to the requirements mentioned in the scenario. Suggest improvements and select the final idea. Aspects to evaluate each members device:

A. Size:
B. Stability of structure:
C. Are the electronic components securely joined to the base board?
D. Will the batteries be easily replaced?

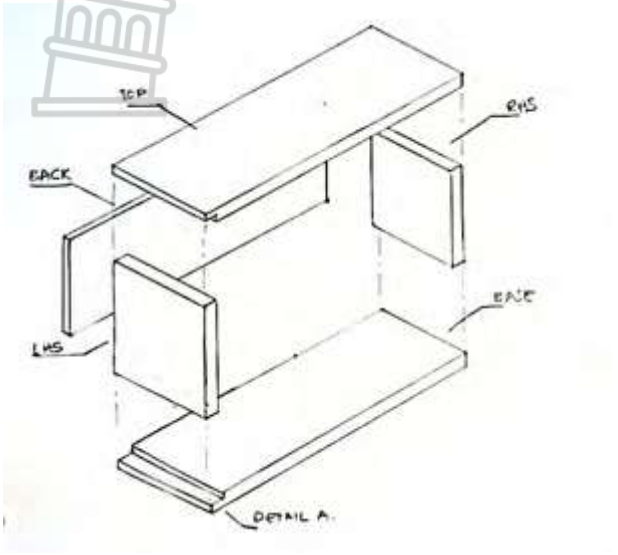
NAMES OF MEMBERS	SUGGESTIONS IN WHICH THE DESIGN CAN BE MODIFIED TO IMPROVE IT
1 _____	A. _____ B. _____ C. _____ D. _____
2 _____	A. _____ B. _____ C. _____ D. _____
3 _____	A. _____ B. _____ C. _____ D. _____
4 _____	A. _____ B. _____ C. _____ D. _____
5 _____	A. _____ B. _____ C. _____ D. _____

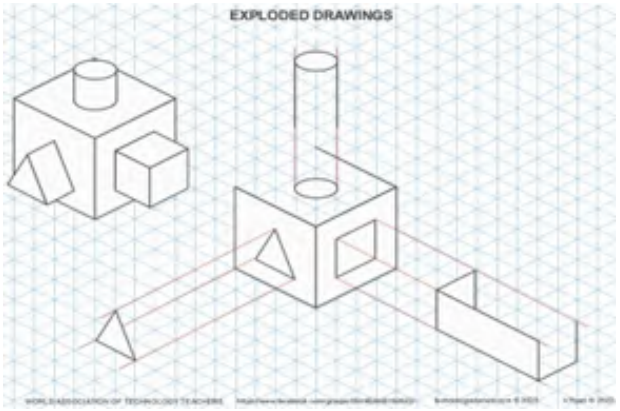
Worksheet 7 - TECHNOLOGY – GROUP WORK [INFORMAL]

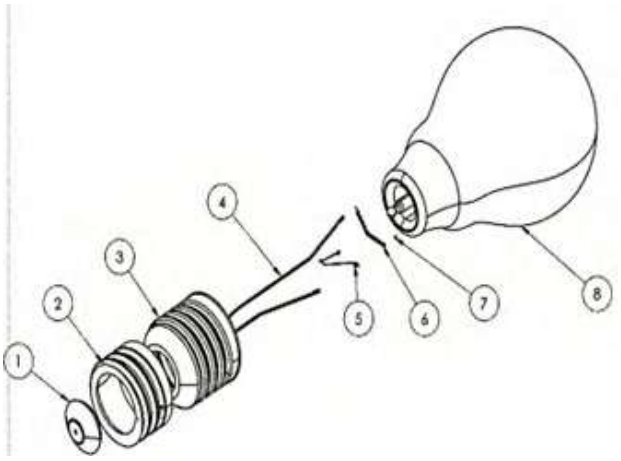
7.2 We have decided on _____'s design as the best solution to the identified problem.

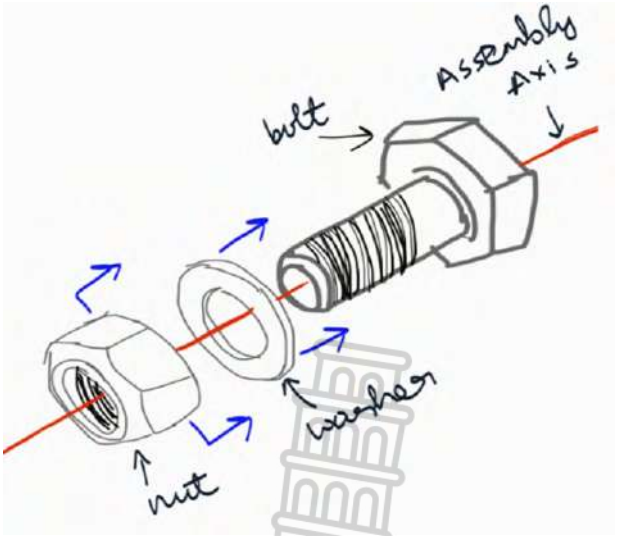
REASONS for our choice:

7.3 Below are examples of drawings in exploded view:









Worksheet 7 - TECHNOLOGY – GROUP WORK [INFORMAL]

7.3.1 Draw an exploded view of the housing structure. Label the different parts of the drawing.

Activity 1 : Group work

1.1 Below you will find a table showing some of the possible tools, equipment and prices as obtained from a hardware store to build the circuit. The last two columns indicate the number of items required and the cost.

Item No.	Tool / Equipment	Price per item (including 15% VAT)	Number required	Cost
1	Glue Gun	.....	5	.....
2	Glue sticks 50g	R170	.....	R2 210
3	Battery pack of 60 (Penlight batteries	R189	5	.....
4	Battery holder	R15,88	.....	R794
5	LED (pack of 300)	R199	3	.....
6	Buzzer	R14,95	.....	R373,75
7	Connecting wire per meter	.....	30	R61,50
8	Resistor (pack of 10)	R7,62	10	.....
9	Paint per litre	.....	8	R588
		Total		.....

Glue Gun (VAT Included: R 300 SPECIAL: 10% off

a) Complete the table by calculating the missing values (amount and quantity where applicable) (11)

b) Complete the total cost of all the items in the table above (1)

c) How much VAT, at 15%, was paid in total? (3)

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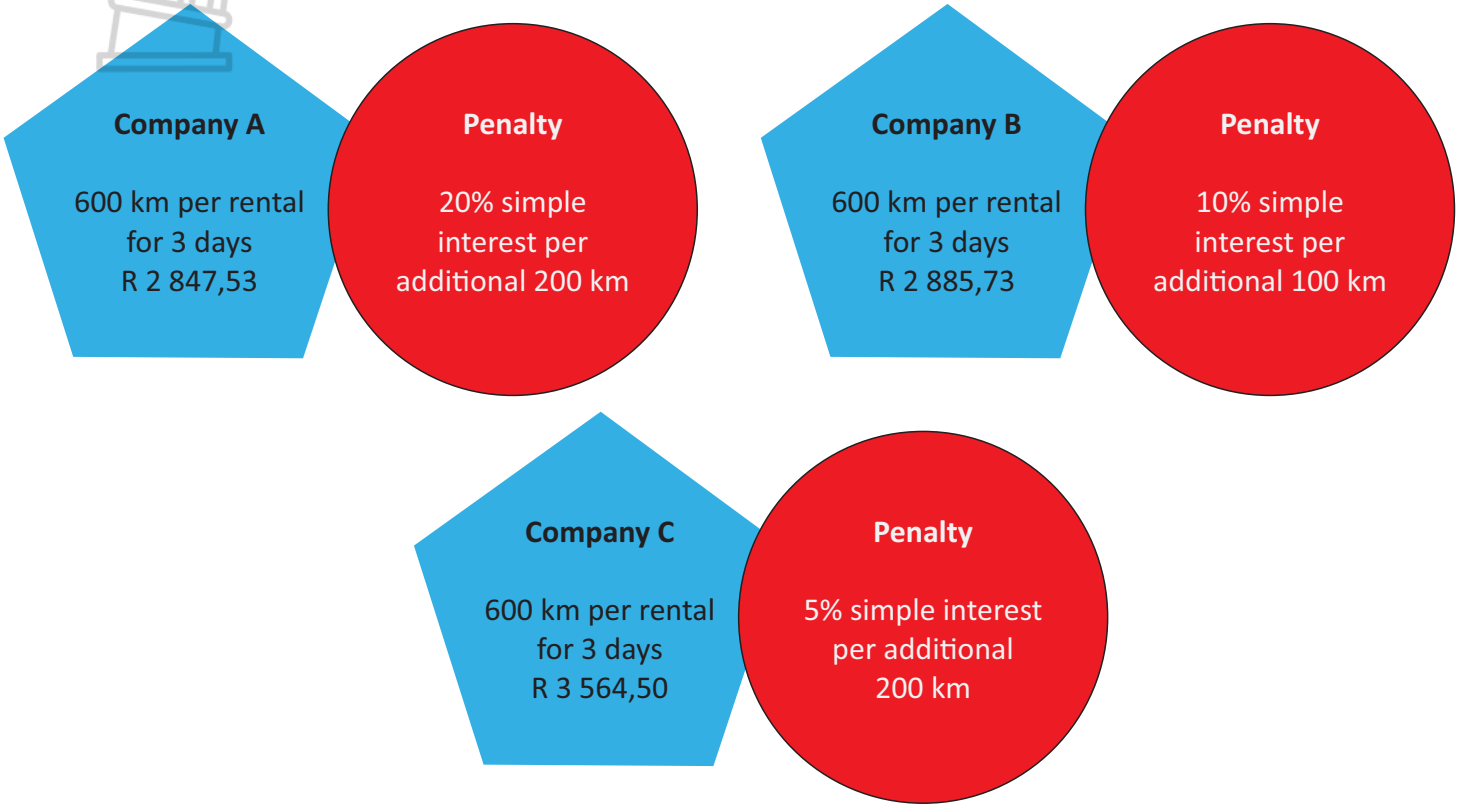
Activity 2: Individual work

2.1 The material needs to be delivered to the school. The principal offers to assist but needs to rent a vehicle. You must advise the school principal which option on car rentals is better. Below are the prices for car rentals.



The estimated distance to be traveled is 800 km.
Calculate the costs for each company. Show all calculations.

Company A (4)	Company B (3)	Company C (3)

2.2 Which option will you advise the school principal to choose? (1)

2.3 The amount of money you have fundraised as a class is R 1 350 less than the total amount for the material/ equipment, excluding the car hire. How much more money do you need to include the car hire? (4)

2.4 Suppose your class teacher offers to get a loan on your behalf for the amount required in 2.3.

a) Calculate the accrued amount on the loan, if interest is compounded at a rate of 12% per annum over 36 months? (3)

b) What is the interest amount? (1)

2.5 What will be the monthly repayment of the amount in 2.4 a)? (2)

Activity 3: Individual work

3.1 Use the flyers in Activity 2 to determine your second choice of the car rental if your first choice as a group is no longer available. Calculate:

a) How much money would you require for your second option if the amount of money you have fundraised as a class amounts to R 7 137,45. (2)

b) Simple interest of the amount in 3.1 a) above at a rate of 12% per annum over 2 years if your class teacher offers to get a loan on your behalf. (3)

c) What will be the monthly repayment of the amount in 3.1 b)? (3)

Worksheet 8b - MATHS

Activity 1: Group work

1.1 State Ohm's Law and write the formula down, showing the relationship between V (voltage), I (current) and R (resistance). (3)

1.2 Calculate the following:

a) Calculate the voltage if the current is 6 A and the resistance is 56 Ω. (3)

b) Calculate the current, if the voltage is 1 350 V and the resistance is 200 Ω. (3)

c) If the current is 8 A and the voltage is 480 V, calculate the resistance. (3)

Activity 2: Group work

2.1 Study the table below if the values for the Voltage (V) and the Current (I) for your circuit were as indicated below and answer the questions that follow:

Voltage (V)	3	6	9		15	
Current(I)	0,5	1		2		3

a) Complete the table. (4)

b) Show that the relationship between V and I is given by a constant R. (2)

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2.2 Use the grid provided to answer the questions that follow:

a) Plot the graph showing the relationship above where V is on the *y*-axis and I is on the *x*-axis. (6)

b) Is the graph of the relationship between V and I an example of direct or indirect proportion? Justify your answer. (2)

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c) Use any two points from table/graph to determine the gradient of the graph, hence the equation in the form of $y = mx + c$ (4)

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d) Write V in terms of I by using the equation above? (2)

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Worksheet 8c - MATHS

Activity 1: Group work - Design a housing structure for a similar model.
A company has asked you to design a housing structure to fit or display a similar device circuit that you have designed.

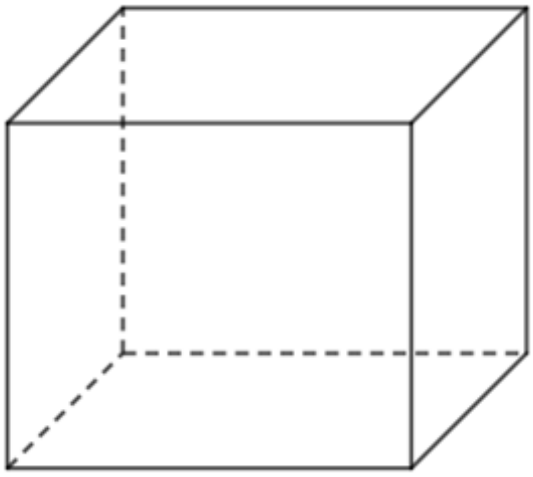
They have these prerequisites:

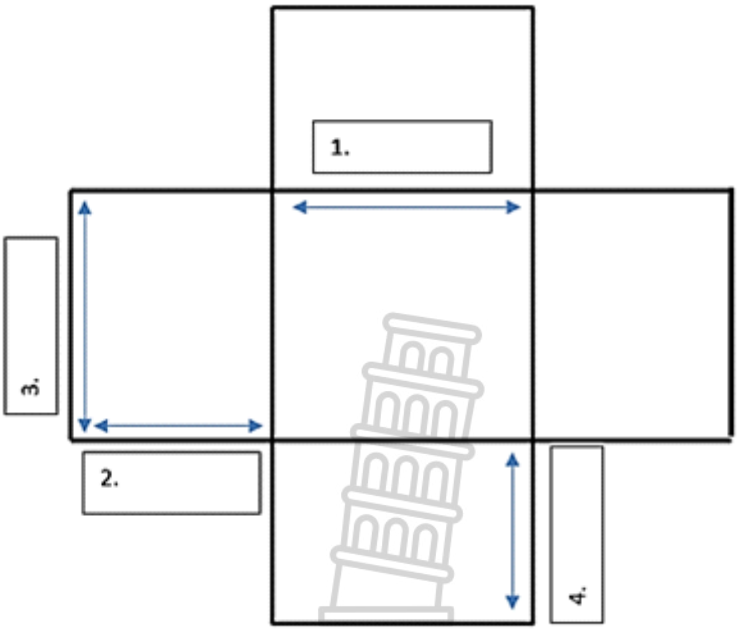
- The faces of the housing structure must be rectangular, and the housing structure must be open on the top for people to easily see the circuitry device.
- One pair of opposite faces of the housing structure must have circular openings that will serve as handles.
- The openings must be on the faces with dimensions of 60 cm by 80 cm.

Consider the following specifications when designing the housing structure:

- The height of the housing structure should be 60 cm.
- The length and breadth of the housing structure is 20 cm more than the height.
- The distance between the circumference of the circular openings and the vertex of the box should be 43 cm.
- The centre of the circle should be at the midpoint of the diagonal.

1.1 Below is a 3D sketch of the housing structure. Next to it is the net of the housing structure with some missing information/ dimensions.

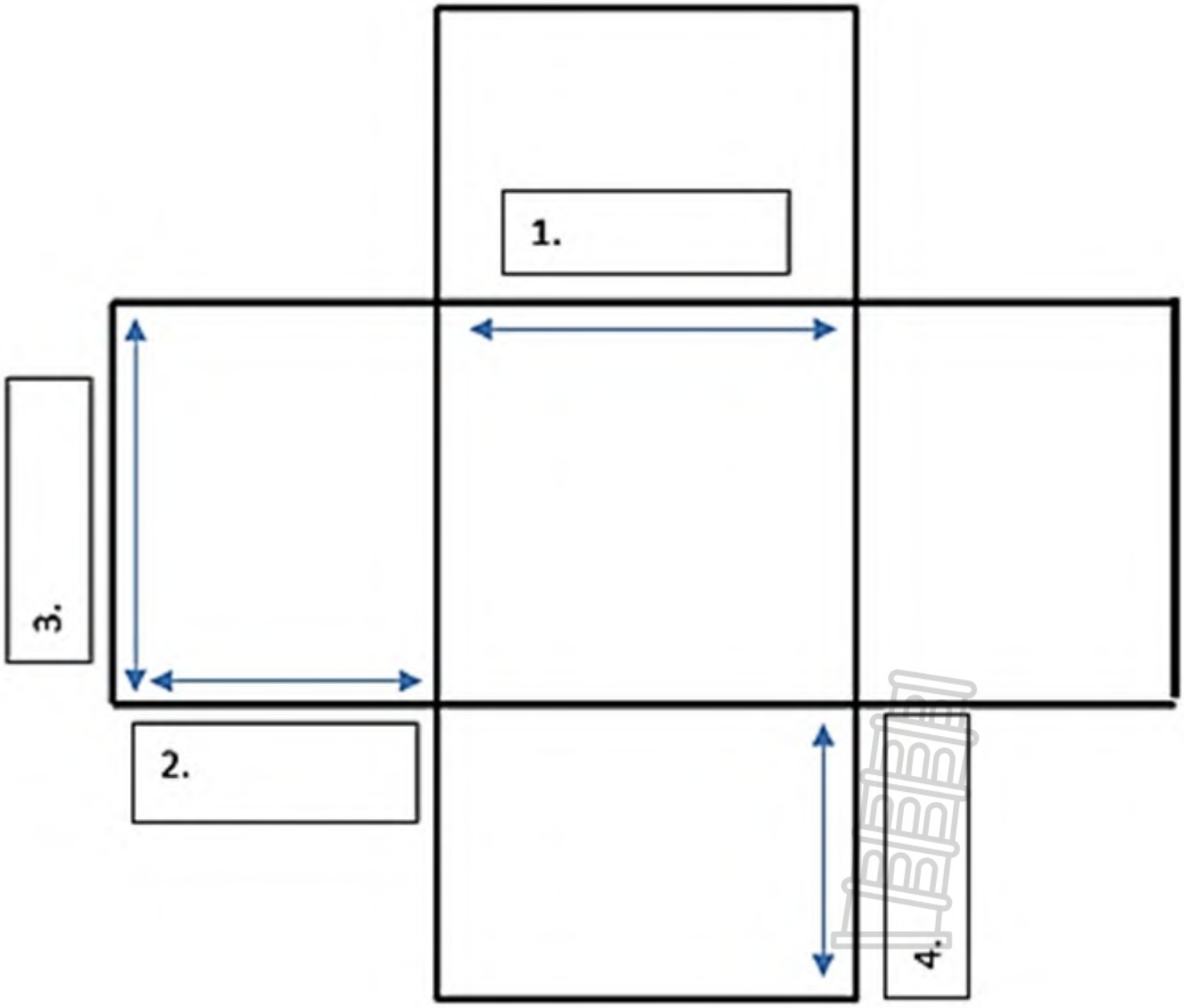




Worksheet 8c - MATHS

a) Use the 3D sketch and the given specifications to fill in all the missing dimensions of the edges of the net below. (4)

b) Draw in the circular openings on the correct sides in the net of the housing structure. Show the dimensions of circle on the sketch. (3)



1.2 Calculate the following:

a) The length of the diagonal of the face containing the circular openings. (3)

b) The radius of the circular openings. (2)

c) The area of the two circular openings. (3)

d) The area of the bottom face. (2)

e) The total surface area of the housing structure. Give your answer in m^2. (7)

STEP 3 - IDENTIFY THE VARIABLES

Identify the independent, dependent and controlled variables from the investigative question and the hypothesis (refer to worksheet 4).

Independent variable: _____(1)

Dependent variable: _____(1)

Controlled variable: _____(1)
[3]

STEP 4 – OUTPUT POWER VS INPUT VOLTAGE AND GRAPHICAL REPRESENTATION

STEP 4.1 – OUTPUT POWER VS INPUT VOLTAGE (CALCULATIONS)

Can you calculate the output of your device? Do the calculations below and plot the output on a graph. If you don't have access to a multimeter / ammeter / voltmeter, use these values (see next page.) Draw a conclusion about the relationship between the variables.

Given:
A 20 Ω-buzzer is connected to different input voltages in a circuit; 3 V, 6 V and 9 V. The loudness or output-power of the buzzer is determined.

Make use of the following two formulae to do the necessary calculations and to complete the table:

1. $\mathbf{R = \frac{V}{I}}$ **where:**

   R is the **resistance** of the buzzer in ohm (Ω),
   V is the **potential difference** or the **input-voltage** of the battery in volt (V),
   I is the **current** flowing through the buzzer in ampere (A).

   When the formula is re-arranged (the subject is changed), then $\mathbf{I = \frac{V}{R}}$

2. $\mathbf{P = VI}$ where:

   P is the **output-power** of the buzzer in watt (W),
   V is the **potential difference** or the **voltage** of the battery in volt (V),
   I is the **current** flowing through the buzzer in ampere (A).

Table of current and output-power for a buzzer connected to different voltages:

Input-voltage, V (V)	$I = \frac{V}{R}$ (A)	P = VI (W)	Loudness of the buzzer
3 V	$I = \frac{V}{R}$ $I = \frac{3\ V}{20\Omega}$ = 0,15 A	P = VI = 3 V x 0,15 A = 0,45 W	Loud
6 V			(1)
9 V			(1)

(2)

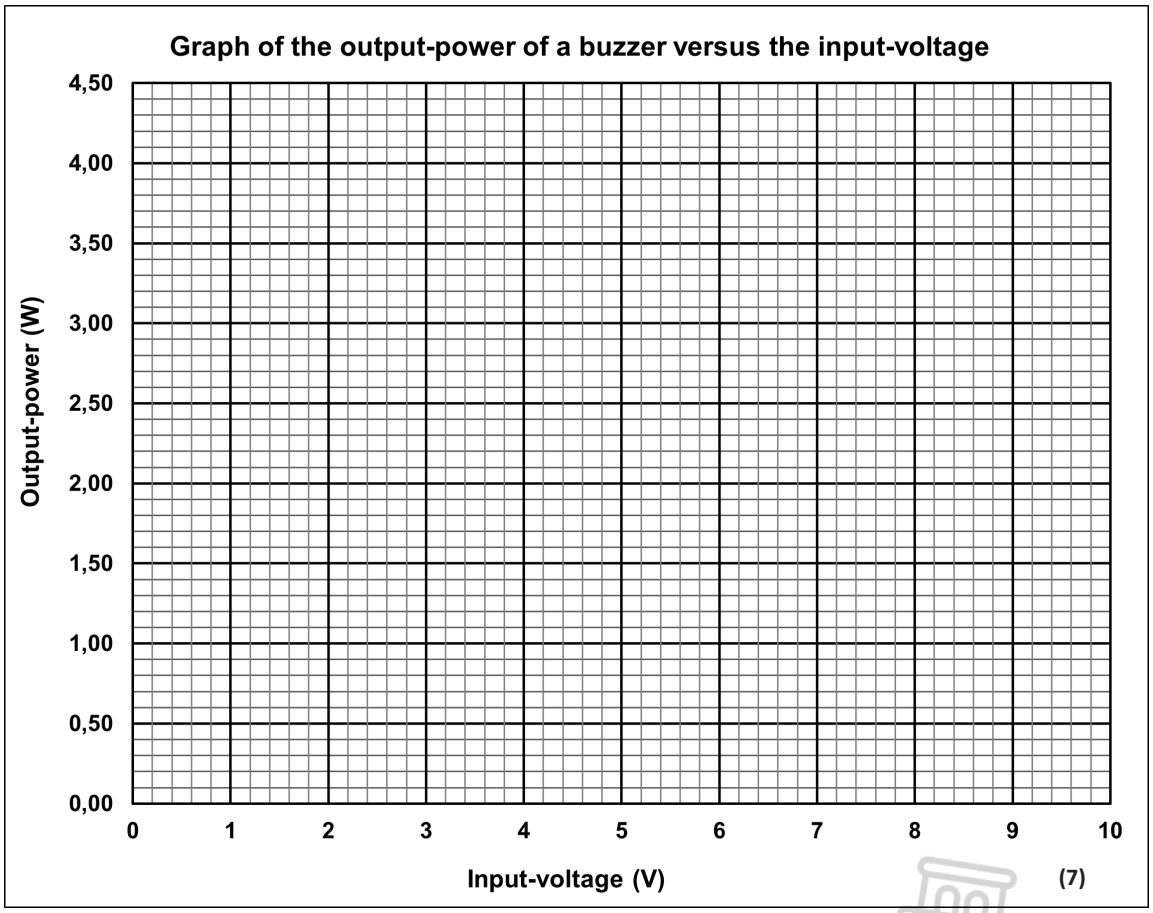
STEP 4.2 – GRAPHICAL REPRESENTATION OF THE RESULTS

Use the graph paper below to draw a graph to represent the data in the table above.

Explain why the graph should be drawn from the origin, (0;0).

.....

.....



(7)

STEP 5 – CONCLUSION

Evaluate your hypothesis and formulate the conclusion for this investigation, based on the results. (5)

.....

.....

.....

.....

WORKSHEET 10 - TECH/NS: BUILD THE DEVICE/PROTOTYPE

INSTRUCTIONS:

- Use the identified materials to build the device / prototype/working model.
- The device must showcase a viable solution to the problem. It should be to scale, neat and show intelligent use of available materials.
- Use safe working practices to build the device/prototype/ working model.

[35]

Worksheet 11 - TECHNOLOGY / NS / MATHS [INFORMAL]

Give this worksheet to the panel when you present your idea for feedback.

ITEM	FEEDBACK (HOW WE CAN IMPROVE)	PERSON GIVING FEEDBACK
General circuit design	.....	.....
Design of housing/box	.....	.....
Output values calculations	.....	.....
Graphs to demonstrate outputs and calculations	.....	.....
Any other improvements?	.....	.....

Worksheet 12 - TECHNOLOGY / NS / MATHS

What changes have you decided to make after feedback? Write your decision to change or better your product below and give a good reason.

Worksheet 13 - TECHNOLOGY / NS / MATHS

It is always necessary to stand back and reflect on what you have done or experienced. Please answer the questions below:

1. What did you learn doing this project...

   1.1 About electronics?

   .....

   .....

   1.2 About your personal abilities?

   .....

   .....

   1.3 About the actual reason for subjects such as Tech, NS and Math?

   .....

   .....

2. What did you find difficult about the project?

   .....

   .....

   .....

3. What did you find easy about the project?

   .....

   .....

   .....

4. Will you be able to do this on your own (e.g. at home) some day?

   .....

5. Why? Why not?

   .....

   .....

   .....

6. If you could make any other electronic device, what would it be?

   .....

   .....

Assessment rubrics

GRADE 9 INTEGRATED PROJECT – NATURAL SCIENCES RUBRIC 30 MARKS

Worksheet marks	Learner's mark
WORKSHEET 4 (Step 1): Assess the investigative question developed by learner	/ 3
WORKSHEET 4 (Step 2): Assess the hypothesis formulated by learner	/ 2
WORKSHEET 5.4: Draw final circuit diagram (Assessed by TECH)	/ 5
Subtotal Steps 1 and 2	/ 10

Circuit construction and build (WORKSHEET 9: Steps 3 to 5 & WORKSHEET 10: Step 6)					
Item	**Excellent (5)**	**Good (4)**	**Adequate (3)**	**Poor (1-2)**	**Learner's mark**
Step 3: Identify the dependent, independent, and controlled variables.	Independent, dependent, and controlled variables are correctly identified.	Only the independent and dependent variables are correctly identified.	Any two of the three variables are correctly identified.	Only one of the variables is correctly identified	**/ 5**
Step 4: **Step 4.1:** Output-power vs input-voltage. **Step 4.2:** Graphical representation.	Neatly laid out. Axes clearly labelled. All points plotted correctly as well as linked.	Everything was neatly plotted according to calculations, with small errors for example not giving a heading, or could have been neater.	In general, neatly done but due to some calculation errors, the graph is not a true presentation.	Untidy work, wrong calculations, missing the relationship between input-voltage and output-power completely.	**/ 5**
Step 5: Drawing conclusion on the relationship of variables	Hypothesis evaluated and correct relationship between variables stated, including control variables.	Hypothesis evaluated and correct relationship between variables stated,	Correct relationship between variables stated, but hypothesis not evaluated	Meaningful relationship between variables stated but incorrect (2) No valid relationship stated but mentions one variable (1)	**/ 5**
Step 6: Model of circuit construction	Excellent understanding of circuit construction. Innovative use of found materials to create mock components.	Good understanding of circuit construction. Good use of found materials to create mock components.	Adequate understanding of circuit construction. Could be more creative in the use of found materials to create mock components.	Limited understanding of circuit construction. Unsuccessful use of found materials to create mock components.	**/ 5**
Subtotal Steps 3 to 6					/ 20
FINAL MARK					**/ 30**

No	Learner names (Group members)
1	
2	
3	
4	
5	

GRADE 9 INTEGRATED PROJECT – TECHNOLOGY RUBRIC 70 MARKS

WORKSHEET 5.5: RUBRIC TO ASSESS THE CIRCUIT DIAGRAM & FREEHAND SKETCH

Level	Criteria	Marks
1	Learner did not complete drawing. No or minimal labelling and or notes were provided. Learners need much help and motivation to draw properly. Incorrect selection of material for the labelling. No or little evidence of specifications being covered	0 - 1
2	Learners were able to complete the drawing with some labelling and guiding notes although it is not very clear. Drawing is not fully complete. Selection of material and specifications is well presented in the labelling.	2 - 3
3	The drawing is aesthetically pleasing and mostly covers the design specifications with correct labelling and guiding notes that are properly structured. Good selection of material is evident.	4 - 5
4	Drawing is aesthetically pleasing with relevant creativity and covers design specifications completely. The labelling and guiding notes are well explained and fully covers all specification. Well considered (spot - on) selection of material.	6 - 7

Worksheet 5.5: Subtotal	/ 7

Assessment rubrics

GRADE 9 INTEGRATED PROJECT – TECHNOLOGY RUBRIC 70 MARKS

WORKSHEET 10 **RUBRIC: MAKE**

Level	Criteria	Marks
1	● Learners could not complete the device / prototype / model. ● Little to no consideration for specifications and constraints. ● Learners and group needed a lot of help and motivation. ● The device / prototype / model does not work at all, and the components were not connected. ● The device / prototype / model was not made to scale. ● Safe working practices were not followed while learners attempt to make the device / prototype / working model.	**1 - 7**
2	● Learners were able to complete the device / prototype / model. ● Some specifications and constraints were adhered to. ● All learners in the group attempted to put in effort to complete the model. ● The device / prototype / model was partially made to scale. ● Evidence of some safe working practices were illustrated while learners attempted to make the device / prototype / working model. ● Model appears acceptable and the components, buzzer/ LED are functioning.	**8 - 17**
3	● Learners were able to build a functional device / prototype / model. ● All specifications and constraints were adhered to. ● The model was neat, the components, buzzer / LED are functioning. ● All learners in the group attempted to put in effort to complete the model. ● Evidence of good safe working practices were illustrated while learners attempted to make the device / prototype / working model.	**18 - 27**
4	● Learners were able to build a functional and creative device / prototype / model. ● All specifications and constraints were adhered to. ● The model was accurately built to scale, the components, buzzer / LED are functioning. ● All learners in the group contributed the necessary effort to complete the model. ● Evidence of excellent safety and working practices were illustrated while learners attempted to make the device / prototype / working model.	**28 - 35**

Worksheet 10: Subtotal	/ 35
FINAL MARK	**/ 70**

Assessment rubrics

GRADE 9 INTEGRATED PROJECT – MATHEMATICS RUBRIC 50 MARKS

	Concepts and skills	5 Marks	4 Marks	3 Marks	0 -2 Marks
Worksheet 8a	**Calculations with whole numbers and decimal fractions**	Learner shows great understanding of working with whole numbers and decimal fractions. Completing the table with 0 mistakes.	Learner shows good understanding, making a few (1-3) mistakes in the table.	Learner shows some understanding of the work. Fair number of answers correct (4 – 8) in the table.	Learner shows little or no understanding of the work. Many mistakes in the table.
	Solving problems in financial context such as: • **Discount and VAT** • **Simple Interest** • **Compound Interest** • **Rentals**	Activity 2 and 3 with no mistakes. Learners shows excellent financial maths skills and understanding.	Activity 2 and 3 have a few mistakes. Learner had a good understanding of financial maths, using the correct values and formulae where needed. Even if answers are wrong, the learner still carried it over to the new question as questions expected and understands the terminology used.	Activity 2 and 3 have a fair amount of mistakes. Learner shows some understanding of financial maths. Learner used some formulae correct, carried over values where needed and shows a good measure of understanding of the terminology.	Activity 2 and 3 with many mistakes. Learner struggles with financial maths. Using the incorrect formulae, shows little understanding of the terminology, does not carry over values or make up values and formulae.
Worksheet 8b	**Solve equations by using the inverse operation and substituting**			Learner shows great understanding of substitution and using the inverse operation in activity 1.	Learner struggles to substitute correctly and shows little understanding on the inverse operation in activity 1.
	Investigate and extend numeric patterns represented in tables. Describe general rules for patterns.	Learner shows great understanding of the work in activity 2 with zero mistakes.	Learners shows a good understanding of the work in activity 2 with 1 – 7 mistakes.	Learner shows a fair understanding, had to be guided through activity 2, couldn't do it on his/her own. Made 8 – 14 mistakes.	Learner shows little to no understanding for the work in activity 2. Learner made more than 14 mistakes.
	Justify equivalence represented by: • **Tables** • **Equations** • **Graphs on a Cartesian plane**	Learner shows great understating of using the values in a table and to plot on a graph. Learner used appropriate increments on the graph for x and y axis.	Learner shows a good understanding of the plo ng of the values on the graph from the table.	Learner struggle to plot values from a table onto a graph or made mistakes with the increments or drawing of the graph.	Learner shows little or no understanding of the correlation between the values in a table and the coordinates on a Cartesian plane.
	Direct and indirect proportion			Learner knows the difference between direct and indirect proportion.	Learner struggles to differentiate between direct and indirect proportion.

GRADE 9 INTEGRATED PROJECT – MATHEMATICS RUBRIC 50 MARKS

Worksheet 8c	**Measurements and dimensions**	Learners shows a great understanding of using measurements and dimensions in creating a packaging. Correct height, length and breadth was used. The circle is also on the correct place.	Learners shows a good understanding of using measurements and dimensions in creating a packaging. Only small mistakes were made when using the height, length and breadth. The circle is close to the correct place.	Learner shows adequate understanding of measurements and dimensions. Minor mistakes.	Learner shows little or no understanding of measurements and dimensions in 2D/3D shapes.
	Area of polygons and circles	Learner understands the concept of area and surface area. Correct formulae and substitution for different faces. Minor mistake.	Learner has a good concept of area and surface area of polygons and circles. Few mistakes in formulae of substitution.	Learner shows a fair understanding of the measure and dimensions concept in area and surface area in polygons and circles.	Learner shows little to no understanding of measurement and dimensions in area and surface area. Learners used incorrect formulae and substitution. Left out values or used wrong values.
	Conversions	Learner has an excellent understanding of conversions. Area conversions and conversions between area and volume done without mistakes.	Learner has a good understanding of conversions. Learner used correct methods with small mistakes in calculations.	Learner has a fair understanding of conversions. Used correct methods with incorrect conversion values. Couldn't convert ^{2} ^{2}.	Learner struggles with conversions and the concepts of area and volume.
	Drawing a 3D prism on scale.	Learner used scale without mistakes.	Learner made a minor mistake or 2.	Learner had a fair idea of what to do and how to use the scale, needed some help.	Learner struggle to use the scale, made no attempt to draw the prism on scale.
	Solve problems using the Theorem of Pythagoras		Learner has an excellent understanding of the Theorem of Pythagoras and how to use it in context.	Learner used the Theorem with some help.	Learner does not know the Theorem of Pythagoras or how to apply it in context.
	Total:	**8a: /10**	**8b: /16**	**8c: /24**	**/50**