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GRADE 9 TECHNOLOGY

PRACTICAL ASSESSMENT TASK: TERM 3

(REVISED ATP 2023/4)

Name: _____ **Grade 9:**		**Possible mark**		**Learners' mark**
Investigate (15 Marks)	Investigation A: • Situations where electronic circuits control electric circuits. A circuit with an input sensor, control knob, transistor, and output device.	8/2 = 4	15	
	Investigation B: The fire alarm circuit	11		
Design (20)	Design brief and specifications	8	20	
	Initial idea: Isometric sketch	12		
Make (35 Marks)	Orthographic drawing	15	35	
	Exploded view drawing of the housing	12		
	Making and presentation	16/2 = 8		
TOTAAL		**70**		

Scenario

A fire detection company, Pro-Fire services has had a request for portable fire alarms. There have been many veldfires around campsites in the Western Cape. These campsites need early warning systems to ensure that campers can move out of harm's way in time. Portable fire alarms will be used at these campsites.

Pro-Fire Services have asked you to design the **housing** of a portable fire alarm. The fire alarm must make use of batteries and must be loud enough to alert campers in case of a fire. The housing must be strong and light weight. It must be easy to set up and switch on. It must also be easy to replace the batteries of the device. The device will be used outside and will therefore have to be water-resistant.

Definition: Housing

"Housing" is used to indicate the outer protective covering for equipment.

The "housing" protects the electronic circuit from human interference or often from unfavourable conditions. These conditions may be weather, for outside installations, or poisonous fumes, dust, heat, etc. It protects the electronic circuit on the inside.

INVESTIGATION A **[8/2 = 4]**

Situations where electronic circuits control electric circuits

There are many household appliances that use electronic circuits to control electric circuits with bigger currents. The following two devices are used inside the electric switchboard (or distribution board) of every building that is connected with electricity in a safe way.

Ordinary circuit breakers:
Shuts off a circuit (for example, the circuit supplying all the lights in a house) when the current becomes too big (if the current is too big for the thickness of wire used, the wire will overheat).

Residual-current circuit breakers:
Switches off the main power supply if it detects a leakage of power, such as when a person accidentally touches a "live" electrical wire or contact and the electricity is then conducted through his or her body. This device has to cut the current very quickly, otherwise the person can die due to electric shock. Therefore, it switches off the power even when it detects only a small amount of leakage of electrical current.

An electrical distribution board with circuit breakers

*An **electronic circuit** is different from an **electric circuit** because it only uses a very small current, and because it uses electronic control devices such as thermistors, LDRs, diodes and transistors.*

The following household appliances use electronic circuits to control them:

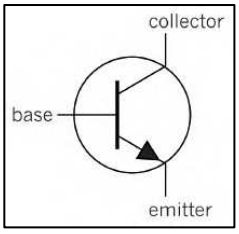
- ovens: to control the temperature,
- radios and other music appliances: to control the volume of the speakers,
- some energy-saving lights: to switch off automatically when there is enough natural light,
- and kettles: to switch off when the water boils.

Circuits with input sensors, transistors, variable resistors, and output devices

- A **sensor** is a control device that can have a **variable effect.** A sensor is an input component

- Components such as **thermistors** and **LDRs (Light dependent resistors)** can have different resistances, depending on the temperature or amount of light. They are resistors that can be used as sensors.

- A **switch** is an on/off device that is either open (infinitely large resistance) or closed (zero resistance), so a switch is not a sensor.
- A **transistor** works as a type of switch to turn current on and off. It can also amplify a current. A **transistor** is a semiconductor device that consists of three layers. Each layer has its own connection point with a specific name: collector, base and emitter.
- A **variable resistor** is also a control device, but it is not a sensor, because it is a device for which the user can set the resistance.
- **Output devices** could be something like a LED, a light bulb, an alarm or a buzzer.



*The control knob of a stove plate is connected to a **variable resistor.***

This controls the current through the heating element (output).

The bigger the current, the hotter the plate will be.

The circuit for a **fire alarm** is an example of where a small input current from an **input sensor** must switch on a circuit with a larger current for an **output device.** This type of circuit is called a control circuit since one circuit controls another circuit. We will look at it more closely in the next investigation.

Answer the questions below

1. Name TWO input components. (2)

   .....

   .....

2. Name TWO output devices. (2)

   .....

   .....

3. What does a thermistor do? (1)

   .....

   .....

4. Name a device that uses a variable resistor to set the level of something. Explain your answer. (1)

   .....

   .....

   .....

5. Name TWO examples of applications or devices where **electronic** circuits and **electric** circuits are used together. (2)

   .....

   .....

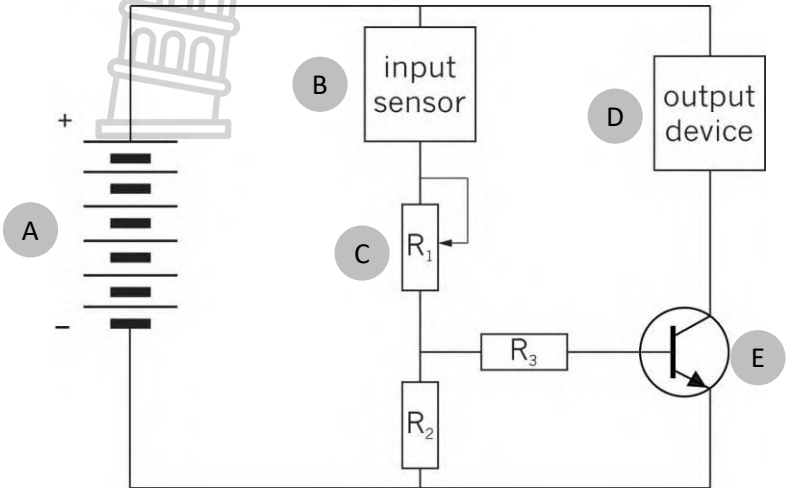
   .....

   .....

INVESTIGATION B: THE FIRE ALARM CIRCUIT [11]

Let's look at the electronic circuit you will be using for the fire alarm.

This type of circuit is used to switch an ***output device*** on and off without using a switch. Instead of a switch controlled by hand, this type of circuit uses an ***input sensor*** in combination with a **transistor** to switch the output device on or off *automatically*, depending on the measurement of something by the input sensor.



The circuit for the fire alarm contains the following components:

A. a battery consisting of 6 cells in series,
B. an input sensor to measure the temperature of the environment
C. a variable resistor to set the temperature at which the alarm should go off,
D. an output device to make noise when it gets too hot, and
E. a transistor to switch the output device on when it gets too hot.

1. What type of electronic component will you use as the input sensor? (1)

   .....

2. What type of device will you use as the output device? (1)

   .....

3. What voltage does the battery supply to the circuit? (2)

   .....

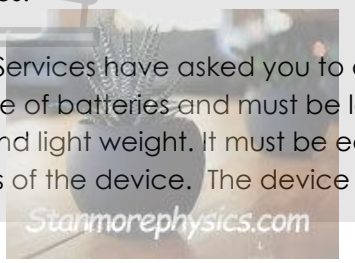
4. Redraw a circuit diagram for a fire alarm:
   - Show the correct symbols for the components (B and D) that you will use as the input and the output sensors. (2)
   - Show the emitter (e), base (b) and collector (c) of the transistor. (3)
   - The circuit diagram must be drawn neatly with a pencil and ruler. (2)

DESIGN BRIEF, SPECIFICATIONS, AND CONSTRAINTS [8]

1. Read through the scenario again and think about the questions below to help you write the design brief. (4)

Scenario

A fire detection company, Pro-Fire services has had a request for portable fire alarms. There have been many veldfires around campsites in the Western Cape. These campsites need early warning systems to ensure that campers can move out of harm's way in time. Portable fire alarms will be used at these campsites.



Pro-Fire Services have asked you to design the **housing** for the portable fire alarm. The fire alarm must make use of batteries and must be loud enough to alert campers in case of a fire. The housing must be strong and light weight. It must be easy to set up and switch on. It must also be easy to replace the batteries of the device. The device will be used outside and will therefore have to be water-resistant.

- What is it? (what is needed?)
- Who it is for?
- What it is for?
- Where will it be used?

I'm going to design ……

……

……

……

……

2. Identify the specifications and constraints and list them below. (4)

- ……
- ……
- ……
- ……
- ……
- ……
- Constrain ……

Design: Initial idea

Make a **3D sketch** of the fire alarm housing. **[Use the link 3D sketch]**

- Draw it in **isometric**, using the grid below.
- Make notes and labels next to the drawing to show your thoughts on the following:
  - Indicate and explain where and how the input and output components will fit into the housing.
  - Indicate and explain how it will be opened to replace the batteries.

Marking rubric: Initial idea	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
Freehand sketch is drawn neatly in isometric, using the provided grid. Lines are consistent and meet neatly at corners.					
Appropriate notes and labels were made					
Indicated how it will be opened to replace the batteries and where the input and output components will be positioned.					
Total	**/ 12**				

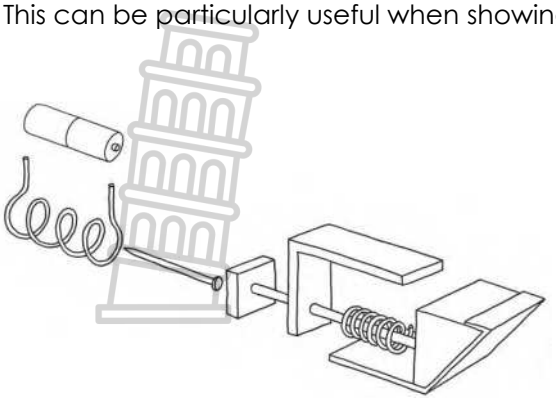
Use the link Make a 2D working drawing of your design (only the housing) in first- angle orthographic projection.

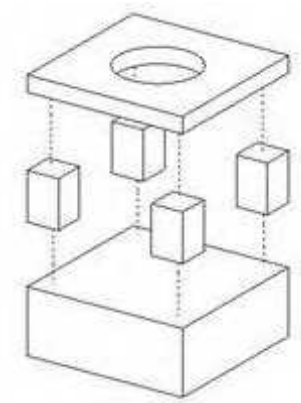
- Your drawing must show the top-, front- and side view.
- It should be drawn to scale and show as much detail as possible.
- Indicate at least 2 different dimensions
- Indicate the scale, heading and label the 3 different views
- Lines must be consistent and meet neatly at corners.

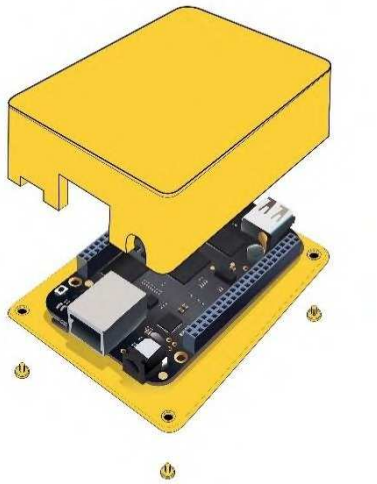
MARKING RUBRIC	POSSIBLE MARK	LEARNERS' MARK
Heading and labeled the 3 different views	2	
Drawn to scale and scale indicated	2	
At least 2 dimensions indicated neatly and correctly.	2	
Top view: Neat, correct, and complete.	3	
Front view: Neat, correct, and complete	3	
Side view: Neat, correct, and complete	3	
TOTAL	**15**	

EXPLODED VIEW DRAWINGS

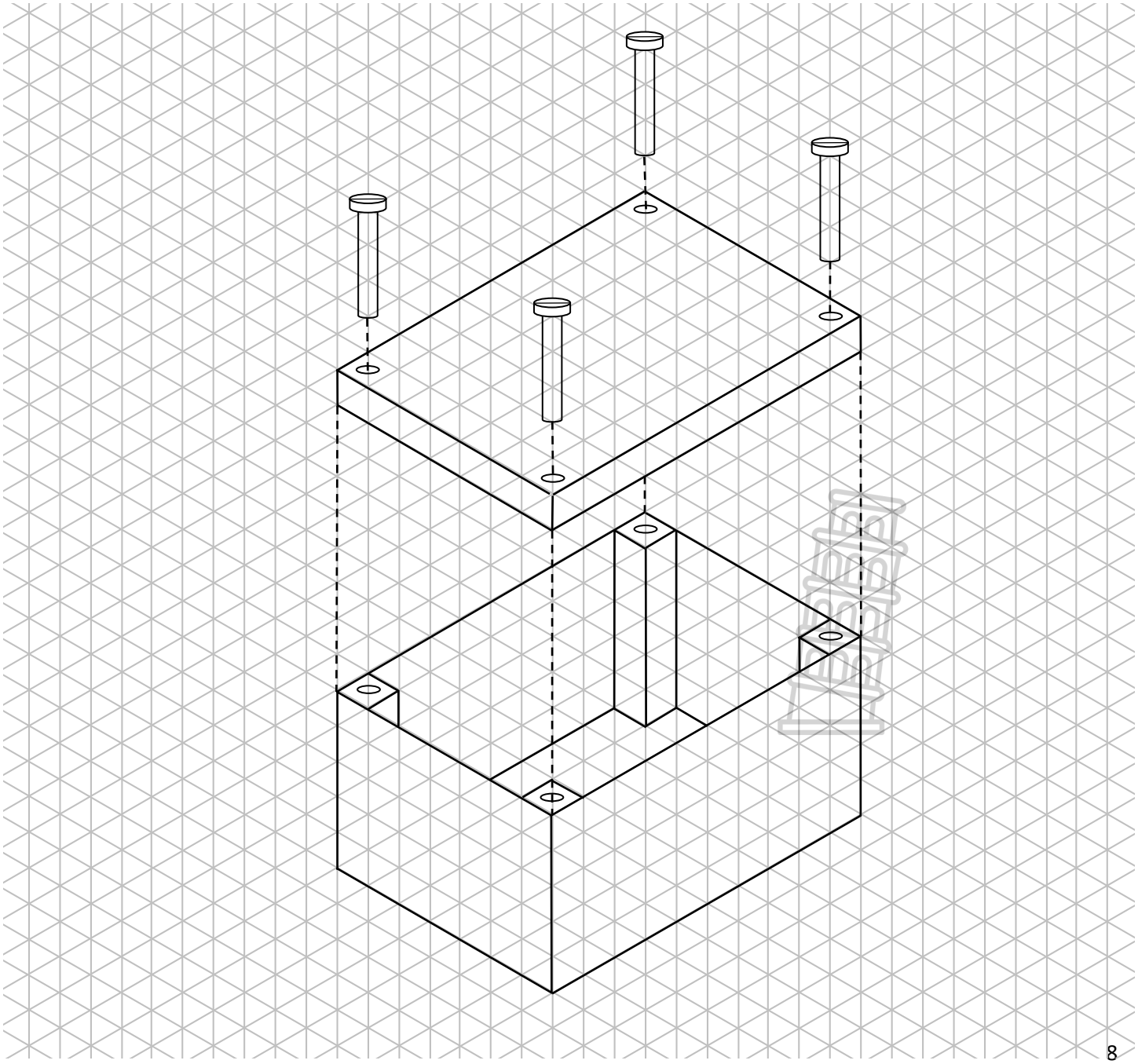
Exploded views or assembly drawings show objects blown apart to see how they fit together.
This can be particularly useful when showing how to put something together.







How to draw an exploded view of a housing in isometric.



Draw a 3D isometric exploded view of your design. [Use the heading link to do the drawing]

- Look at the example on the previous page to help you. You may not copy the drawing; you must draw your own design.
- Draw it in isometric using the isometric grid below.
- Do not draw the circuit and components. Only draw the housing.
- Use a ruler and pencil.

Marking rubric: Exploded view [An exact copy of the example on page 8 is not allowed. If it was copied, the maximum mark should be 5 /12]	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
Drawn in isometric, using the gridlines as a guideline.					
All parts of the housing are visible and correctly separated. Parts are aligned.					
Drawing is done neatly using a pencil and ruler. Lines are consistent and meet neatly at corners.					
Total	**/ 12**				

Make the prototype/working model [8]

Work safely in groups and demonstrate intelligent application of materials to build the model.

Marking rubric: Working model [An exact copy of the example on page 8 is not allowed. If it was copied, the maximum mark should be 5 /12]	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
The housing is strong water-resistant and light weight.					
It is easy to set up and to switch on					
It is easy to replace the batteries of the device.					
All members in the group have a definite role and function during the manufacturing of the model and were able to present their role to the rest of the class					
Total	**16/2 = 8**				

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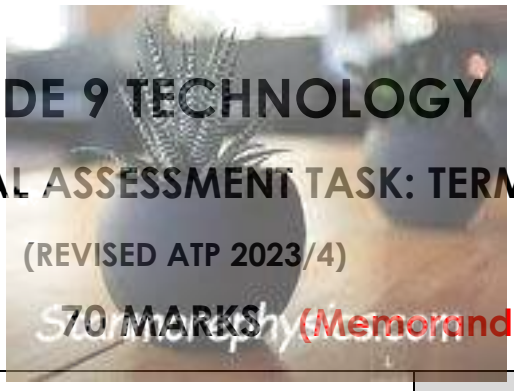

GRADE 9 TECHNOLOGY

PRACTICAL ASSESSMENT TASK: TERM 3

(REVISED ATP 2023/4)

70 MARKS (Memorandum)

Name: _____ Grade 9: __		Possible mark		Learners' mark
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	Initial idea: Isometric sketch	12		
Make (35 Marks)	Orthographic drawing	15	35	
	Exploded view drawing of the housing	12		
	Making and presentation	16/2 = 8		
TOTAL		**70**		

Scenario

A fire detection company, Pro-Fire services has had a request for portable fire alarms. There have been many veldfires around campsites in the Western Cape. These campsites need early warning systems to ensure that campers can move out of harm's way in time. Portable fire alarms will be used at these campsites.

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"Housing" is used to indicate the outer protective covering for equipment.

The "housing" protects the electronic circuit from human interference or often from unfavourable conditions. These conditions may be weather, for outside installations, or poisonous fumes, dust, heat, etc. It protects the electronic circuit on the inside.

INVESTIGATION A **[8/2 = 4]**

Situations where electronic circuits control electric circuits

There are many household appliances that use electronic circuits to control electric circuits with bigger currents. The following two devices are used inside the electric switchboard (or distribution board) of every building that is connected with electricity in a safe way.

Ordinary circuit breakers:

- Shuts off a circuit (for example, the circuit supplying all the lights in a house) when the current becomes too big (if the current is too big for the thickness of wire used, the wire will overheat).

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- Switches off the main power supply if it detects a leakage of power, such as when a person accidentally touches a "live" electrical wire or contact and the electricity is then conducted through his or her body. This device has to cut the current very quickly, otherwise the person can die due to electric shock. Therefore, it switches off the power even when it detects only a small amount of leakage of electrical current.

An electrical distribution board with circuit breakers

*An **electronic circuit** is different from an **electric circuit** because it only uses a very small current, and because it uses electronic control devices such as thermistors, LDRs, diodes and transistors.*

The following household appliances use electronic circuits to control them:

- ovens: to control the temperature,
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- and kettles: to switch off when the water boils.

Circuits with input sensors, transistors, variable resistors, and output devices

- A **sensor** is a control device that can have a **variable effect.** A sensor is an input component

- Components such as **thermistors** and **LDRs (Light dependent resistors)** can have different resistances, depending on the temperature or amount of light. They are resistors that can be used as sensors

- A **switch** is an input device that can be either open (infinitely large resistance) or closed (zero resistance), so a switch is not a sensor.
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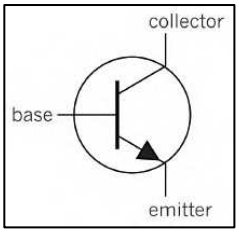


*The control knob of a stove plate is connected to a **variable resistor.***

This controls the current through the heating element (output).

The bigger the current, the hotter the plate will be.

The circuit for a **fire alarm** is an example of where a small input current from an **input sensor** must switch on a circuit with a larger current for an **output device.** This type of circuit is called a control circuit since one circuit controls another circuit. We will look at it more closely in the next investigation.

Answer the questions below

1. Name TWO input components. (2)

   A switch, a thermistor, LDR, a variable resistor… etc. (any TWO ✓✓)

2. Name TWO output devices. (2)

   A buzzer, a LED, an electric motor, a bulb, a speaker….etc. (any TWO ✓✓)

3. What is a thermistor? (1)

   A thermistor is a temperature sensitive resistor. The resistance of it depends on the temperature it is exposed to. ✓

4. Name a device that uses a variable resistor to set the level of something. Explain your answer. (1)

   Radio's volume control knob, to set the volume.

   Stove plate has a control knob to set the heat of the stove

   A fan's control knob to set the speed of the fan

   Or any similar answer ✓

5. Name TWO examples of applications or devices where **electronic** circuits and **electric** circuits are used together. (2)

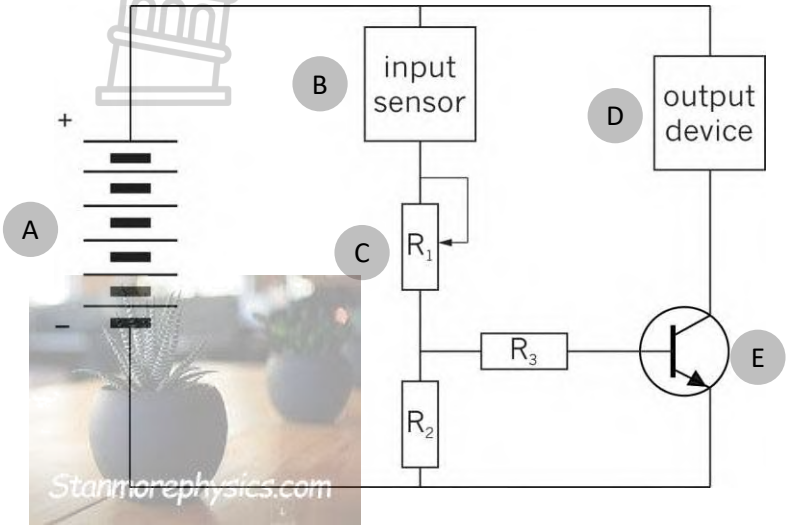
   - ovens: to control the temperature,
   - radios and other music appliances: to control the volume of the speakers,
   - some energy-saving lights: to switch off automatically when there is enough natural light,
   - kettle: to switch off when the water boils
   - automatic car gate

(any TWO suitable answers ✓✓)

INVESTIGATION 3: THE FIRE ALARM CIRCUIT [11]

Let's look at the electronic circuit you will be using for the fire alarm.

This type of circuit is used to switch an ***output device*** on and off without using a switch. Instead of a switch controlled by hand, this type of circuit uses an ***input sensor*** in combination with a **transistor** to switch the output device on or off *automatically*, depending on the measurement of something by the input sensor.



The circuit for the fire alarm contains the following components:

A. a battery consisting of 6 cells in series,
B. an input sensor to measure the temperature of the environment
C. a variable resistor to set the temperature at which the alarm should go off,
D. an output device to make noise when it gets too hot, and
E. a transistor to switch the output device on when it gets too hot.

1. What type of electronic component will you use as the input sensor? (1)

   Thermistor ✓

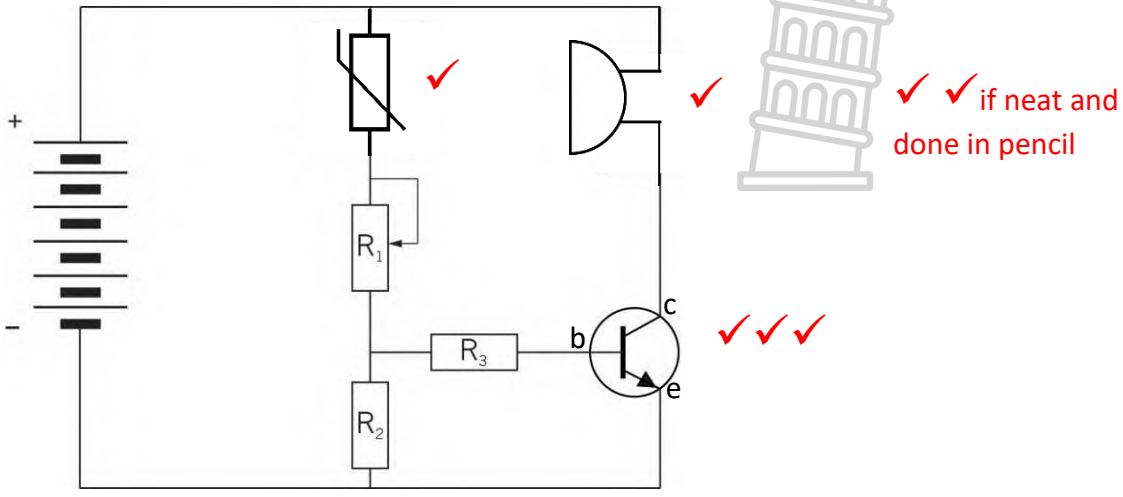
2. What type of device will you use as the output device? (1)

   Buzzer ✓

3. What voltage does the battery supply to the circuit? (2)

   9 ✓ Volt ✓

4. Redraw a circuit diagram for a fire alarm:
   - Show the correct symbols for the components (B and D) that you will use as the input and the output sensors. (2)
   - Show the emitter (e), base (b) and collector (c) of the transistor. (3)
   - The circuit diagram must be drawn neatly with a pencil and ruler (2)



DESIGN BRIEF, SPECIFICATIONS, AND CONSTRAINTS [8]

1. Read through the scenario again and think about the questions below to help you write the design brief. (4)

Scenario

A fire detection company, Pro-Fire services has had a request for portable fire alarms. There have been many veldfires around campsites in the Western Cape. These campsites need early warning systems to ensure that campers can move out of harm's way in time. Portable fire alarms will be used at these campsites.

Pro-Fire Services have asked you to design the **housing** for the portable fire alarm. The fire alarm must make use of batteries and must be loud enough to alert campers in case of a fire. The housing must be strong and light weight. It must be easy to set up and switch on. It must also be easy to replace the batteries of the device. The device will be used outside and will therefore have to be water-resistant.

- What is it? (what is needed?)
- Who it is for?
- What it is for?
- Where will it be used?

I'm going to design a housing for a portable fire alarm ✓ for Pro-fire services, ✓ that will be used as an early warning system for veldfires ✓ at campsites . ✓

2. Identify the specifications and constraints and list them below. (4)

- Must make use of batteries ✓
- Must be loud enough ✓
- Must be strong ✓
- Must light-weight ✓
- Must be easy to set up and switch on ✓
- Must be easy to replace the batteries ✓
- Must be water resistant ✓
- Constrain
- Should be completed in class ✓
- The device must be affordable to the average person ✓

(Any 4 of the above)

Design: Initial idea

Make a **3D sketch** of the fire alarm housing.

- Draw it in **isometric**, using the grid below.
- Make notes and labels next to the drawing to show your thoughts on the following:
  - Indicate and explain where and how the input and output components will fit into the housing.
  - Indicate and explain how it will be opened to replace the batteries.

Marking rubric: Initial idea	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
Freehand sketch is drawn neatly in isometric, using the provided grid. Lines are consistent and meet neatly at corners.					
Appropriate notes and labels were made					
Indicated how it will be opened to replace the batteries and where the input and output components will be positioned.					
Total	**/ 12**				

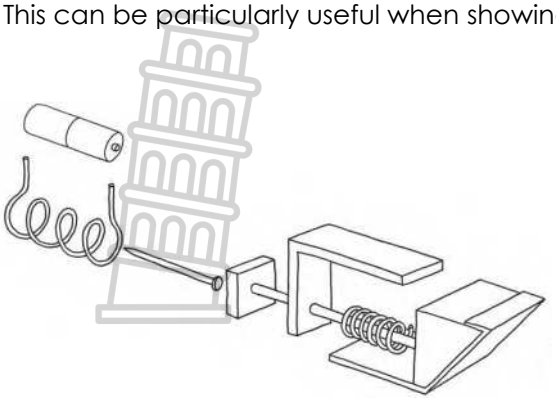
Make a 2D working drawing of your design (only the housing) in first- angle orthographic projection.

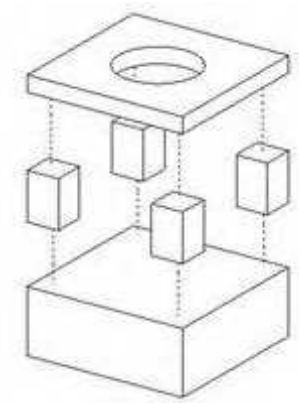
- Your drawing must show the top-, front- and side view.
- It should be drawn to scale and show as much detail as possible.
- Indicate at least 2 different dimensions
- Indicate the scale, heading and label the 3 different views
- Lines must be consistent and meet neatly at corners.

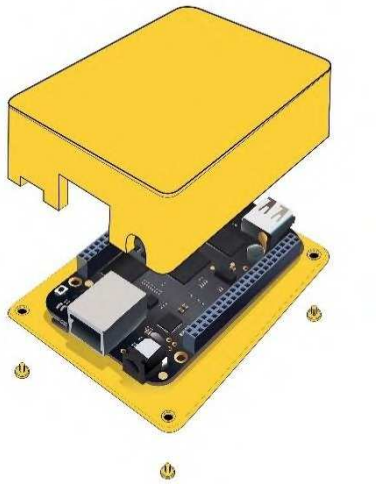
MARKING RUBRIC	POSSIBLE MARK	LEARNERS' MARK
Heading, labeled the 3 different views	2	
Drawn to scale and scale indicated	2	
At least 3 dimensions indicated neatly and correctly.	2	
Top view: Neat correct and complete.	3	
Front view: Neat correct and complete	3	
Side view: Neat correct and complete	3	
TOTAL	**15**	

EXPLODED VIEW DRAWINGS

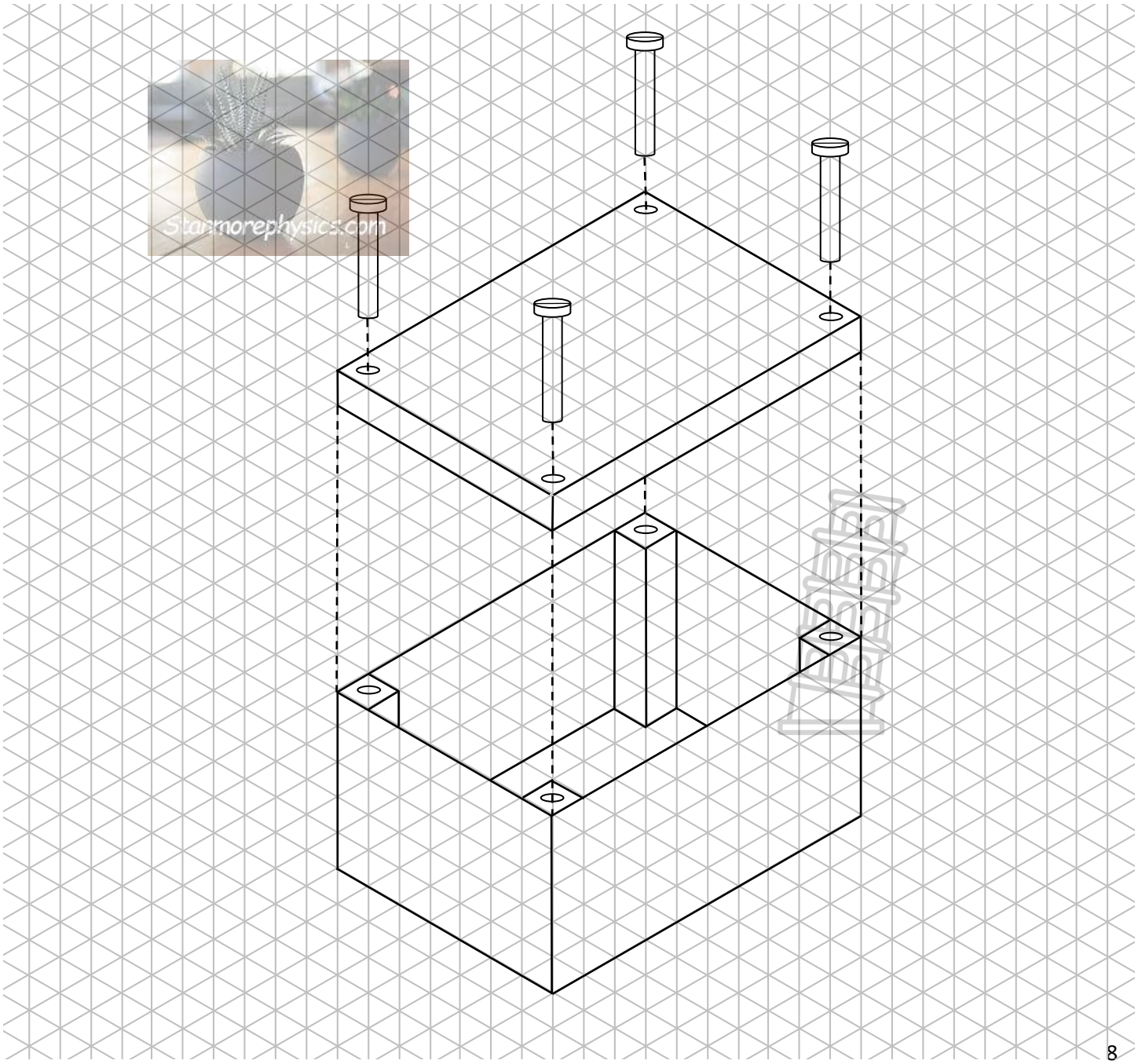
Exploded views or assembly drawings show objects blown apart to see how they fit together.
This can be particularly useful when showing how to put something together.







How to draw an exploded view of a plastic housing in Isometric.



Draw a 3D exploded view of your design

- Look at the example on the previous page to help you. You may not copy the drawing; you must draw your own design.
- Draw it in isometric using the isometric grid below.
- Do not draw the circuit and components. Only draw the housing.
- Use a ruler and pencil.

Marking rubric: Exploded view [An exact copy of the example on page 8 is not allowed. If it was copied, the maximum mark should be 5 out of 12]	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
Drawn in isometric using the gridlines as a guideline					
All parts of the housing are visible and correctly separated. Parts are aligned.					
Drawing is done neatly using a pencil and ruler. Lines are consistent and meet neatly at corners .					
Total	**/ 12**				

Make the prototype/working model **[8]**

Work safely in groups and demonstrate intelligent application of materials to build the model.

Marking rubric: Working model [An exact copy of the example on page 8 is not allowed. If it was copied, the maximum mark should be 5 /12]	**Good** All aspects are correctly done	**Adequate** Most of the aspects are correctly done	**Elementary** Half of the criteria is met	**Poor** Less than half of the criteria is met	**Not done**
	4	**3**	**2**	**1**	**0**
The housing is strong water-resistant and light weight.					
It is easy to set up and to switch on					
It is easy to replace the batteries of the device.					
All members in the group have a definite role and function during the manufacturing of the model and were able to present their role to the rest of the class					
Total	**16/2 = 8**				