ARVIND MAFATLAL GROUP | GET SET LEARN

TINKRBOT

TinkRworks®
PREMIUM LEARNING PARTNER

Contemporary Global Pedagogy:
Aligned with NEP 2020 and NCF 2023

GET SET LEARN

MAF Technologies Private Limited

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Module 1: Introduction to TinkRbot

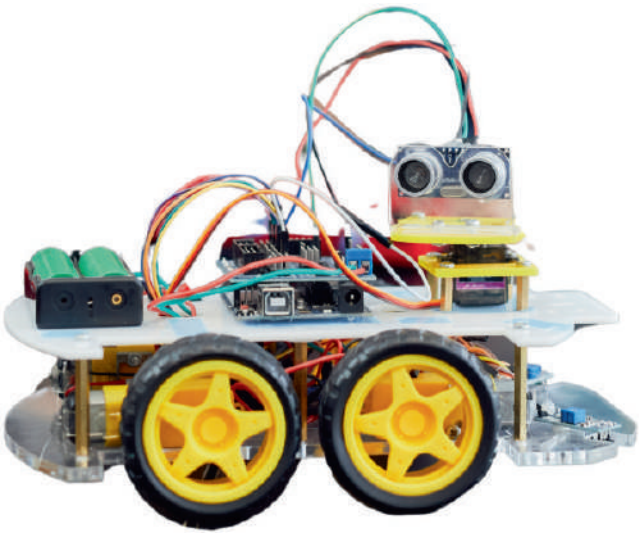
1.1 Introduction

TinkRbot is a robotic vehicle which is equipped with sensors to analyse the surrounding environment. It can act autonomously by analysing its surroundings. For example, autonomous cars.

Before we deep dive into the world of Tinkrbot, let's take a moment to understand the fundamental workings of robots and machines, as well as the key differences between them.

1.2 Robot

A robot is a programmable machine that can carry complex tasks automatically. Unlike simple machines (like levers or gears), robots can sense their environment and respond accordingly.



Here are some following characteristics to describe a robot

- It uses sensors to "see" its environment.
- It can move around.
- It has its energy source like a battery.

Robots can be pre-programmed for specific tasks or be adaptable to changing situations.

They can be complex humanoids or simple industrial arms, but all serve a purpose.

1.3 Machine

A machine is a mechanical or electrical device designed to perform specific tasks or functions, often with moving parts. Machines are typically created to simplify or automate tasks that would be difficult, time-consuming, or impossible for humans to do alone.

The following are some characteristics of a machine:

- Machines are built for a specific purpose, big or small. They can open a door or assemble a car, but they usually stick to their one speciality.
- They work using gears, levers, and motors, or they might need electricity to run.
- Machines are good at doing what they're made for, often faster and more accurately than humans.

- Some are simple, like hammers, while others are complex, like computers or robots.
- Machines are all about exerting or applying force in a controlled way. Think lifting, pushing, pulling, cutting, or shaping things.

1.4 Distinguishing between Robots and Machines

1.4.1 Robots

Robots are a type of machine, but they're special because they can do things on their own.

They use sensors to understand their environment, just as we use our eyes and ears to know what's happening around us.

Robots can move around. Some robots can walk or roll, while others can pick up things or press buttons.

They have their energy source, called a battery.

Robots can be programmed to do specific tasks, but they can also adapt to new situations. This means they can learn and change their behaviour based on what's happening around them.

Robots can be complex, like human-like robots, or simple, like industrial robot arms. But all robots are designed to do a job or serve a purpose.

1.4.2 Machines

Machines are built to do a specific job. They can be used for assembling a car or opening a door. But unlike robots, machines can usually do only one specific task at a time.

Machines work using gears, levers, and motors. They might also need electricity to run.

Machines are good at doing the job they were made for. They can often do these jobs faster and more accurately than humans.

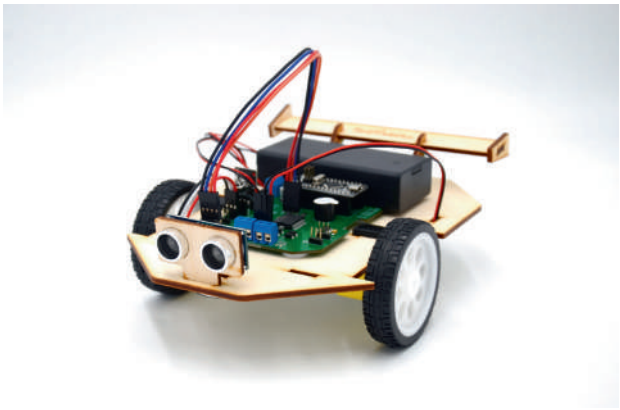
Some machines are simple, like hammers. Others are complex, like computers or robots.

Machines are all about using force in a controlled way. This could be lifting, pushing, pulling, cutting, or shaping things.

1.5 Features of the Tinkrbot

The following are the features of Tinkrbot:

- Drive forward, backwards, and turn- **Motor**.
- Lights that can change colour- **RGB pixel**.
- Create tones with varying pitch- **Buzzer**.
- Detects when an object is in front of it- **Ultrasonic Sensor**.
- Can be controlled by a remote- **IR Sensor**.



Exercise: 1

Q1. Multiple choice questions

1. What is the primary function of Tinkrbot?

a) Cooking meals
b) Mimicking the behaviour of an automatic car
c) Playing music
d) Cleaning floors

2. As mentioned in the introduction, Which of the following is NOT a characteristic of a robot?

a) Sensory perception
b) Energy autonomy
c) Emotional intelligence
d) Autonomous task execution

3. What type of sensor does TinkRbot use to detect obstacles in its path?
   a) Infrared sensor
   b) Ultrasonic sensor
   c) Magnetic sensor
   d) Thermal sensor

4. What feature of TinkRbot allows it to create tones with varying pitch?
   a) RGB pixel lights
   b) Motorized movement
   c) Buzzer
   d) Infrared sensor

5. How can TinkRbot be controlled?
   a) Using voice commands
   b) By telepathy
   c) Via a remote control
   d) Automatically without any external input

Q2. State whether the statements are true or false:

1. Robots have sensors to see their environment.
2. Robots cannot work autonomously.
3. Machines can do multiple tasks at a time

Q3. Answer the following

1. What are the characteristics of robots?
2. Write any two differences between a Robot and a Machine.

Module 2: Parts of Tinkrbot

2.1 Kit Dissection

Below are the parts used to build the Tinkrbot project.

Let us learn about the components of Tinkrbot.

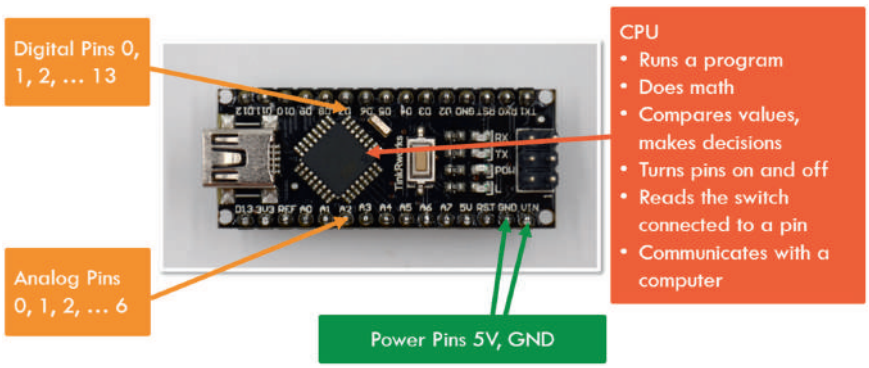
2.2 Arduino

The Arduino is a microcontroller or a small computer that can run simple programs.

It can be used to run motors, LEDs, etc.

It can understand signals sent by sensors and other electronics.

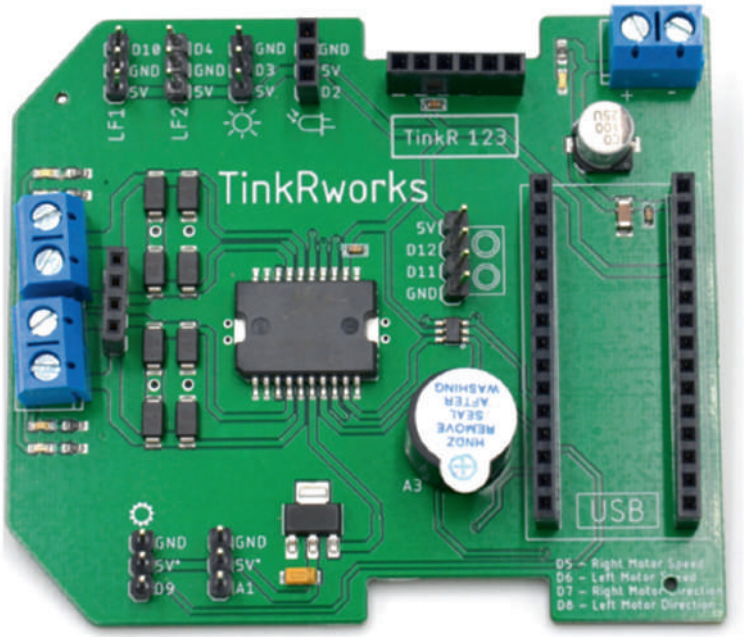
There are several different types of Arduinos; we will be using one called Arduino Nano.



2.3 PCB

A Printed Circuit Board (PCB) is a circuit board used to connect all electronic components, like motors, LEDs, sensors, etc. with a battery and Arduino.

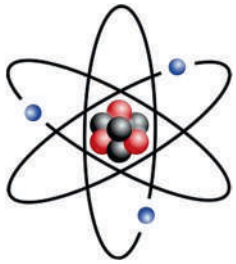
It uses metal paths instead of wires to connect components, which makes the connection easy.



Module 3: Electricity

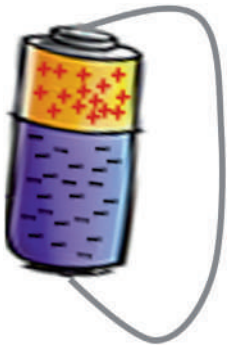
3.1 What is Electricity?

Electricity is the movement of electrons from one place to another.



3.2 Battery

A battery is a place to store electricity as chemical energy.



3.2.1 How does the battery work/ How does the battery generate electricity?

Electrons in the battery want to flow from the -ve side to the +ve side of the battery but can't because of the wall.

However, if a wire is attached to both sides, the electrons can flow from one side of the battery, through the wire to the other side of the battery. This is how it generates electricity by the flow of electrons.

We are using Lithium-Ion (Li-ion) batteries, which are rechargeable.

3.2.2 Why does a battery run out of energy?

Eventually, all the positive atoms no longer lack electrons and no more current will flow through the wire. Then the battery is out of energy or gets discharged.

3.2.3 How does the battery get recharged?

The charger uses electricity (usually from a wall socket) to force electrons to flow from +ve to -ve.

Exercise 3

Q1. Multiple choice questions

1. What is the primary purpose of the motor mount in the TinkrBot project?
   a) Generating electricity
   b) Holding sensors in place
   c) Securing the motors firmly
   d) Controlling the LED lights

2. Why is it essential to install the motor mount correctly?
   a) To adjust the volume of the buzzer
   b) To ensure proper alignment of the robot's wheels
   c) To change the colour of the RGB lights
   d) To prevent overheating of the microcontroller

3. Which component does the motor mount specifically secure in place?
   a) Ultrasonic sensor
   b) Motor
   c) Infrared sensor
   d) Buzzer

4. How can one access the video tutorial for installing the motor mount?
   a) By downloading an app
   b) By scanning a QR code
   c) By reading the instruction manual
   d) By visiting a website

5. What role does the motor mount play in the functionality of TinkrBot?

a) It provides power to the motors
b) It converts signals into Morse code
c) It holds the motors securely in place
d) It controls the movement of the robot's arms

6. What is the primary function of an Arduino in the project?

a) Storing chemical energy
b) Generating electricity
c) Running simple programs and controlling electronic components
d) Producing metal paths for circuit connections

7. What type of Arduino will be used in the project?

a) Arduino Uno
b) Arduino Mega
c) Arduino Nano
d) Arduino Pro Mini

8. What is the purpose of a printed circuit board (PCB) in the project?

a) To store electricity as chemical energy
b) To connect electronic components like motors, LEDs, and sensors with the battery and Arduino
c) To generate electricity through the flow of electrons
d) To create metal paths for wires

9. How is electricity defined?

a) Movement of protons
b) Movement of neutrons
c) Movement of electrons
d) Movement of atoms

10. How does a battery generate electricity?

a) By storing electrons in its reservoir

b) By converting light energy into electrical energy

c) By allowing electrons to flow from the negative side to the positive side through a wire

d) By creating magnetic fields within its structure

Q2. Fill in the Blanks

1. PCB stands for _____

2. Electricity is the movement of _____from one place to another place

3. _____microcontroller is used in our project.

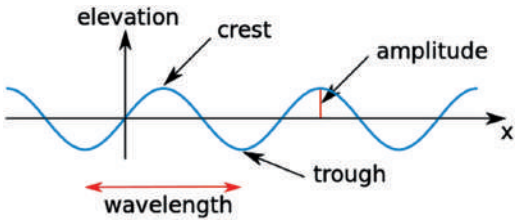
Module 4: Introduction to lights and RGB pixels

4.1 Light

Light is a form of energy that travels in a straight line in the form of waves.

4.1.1 Properties of light

Wavelength: The length between humps in the wave is called wavelength.
Amplitude: The height of the wave is called amplitude.



4.2 How do we see objects in the presence of light?

As light falls on an object, it bounces off to our eyes, and then we can see the object.

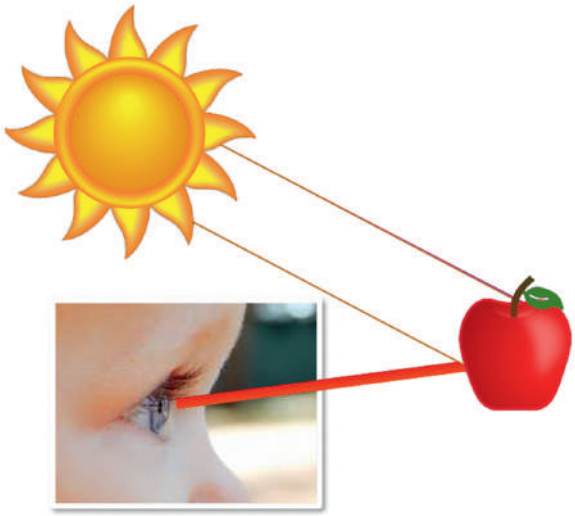
Did you know?

White light is made up of all seven colours- Violet, Indigo, Blue, Green, Yellow, Orange, and red.

Then, how do we see different coloured objects in white light?

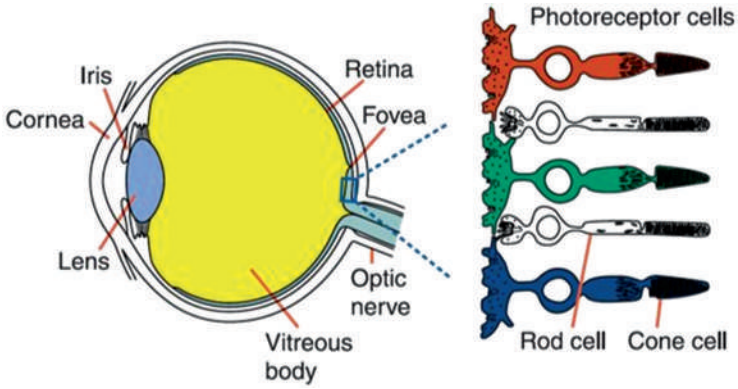
Let's understand with an example-

- Light exits the sun and hits the apple.
- The light from the sun has all the colours of the rainbow.
- The apple absorbs all the light except red.
- The red light bounces off and enters our eyes.
- What if the object were blue? Or purple?



So, wonder how our eyes sense the different colours.

- Light enters our eyes through a hole called a Pupil.
- The human eye has 4 photoreceptors that detect light- 3 cones, 1 rod.
- Three types of cells detect colour and are called cones.
- Cones need a medium or higher amount of light to detect colour.
- Rods detect low levels of light but do not detect colour.



We have understood how we see colours in real objects but what about digital screens? How do different colours appear on a digital screen?

4.3. Digital Screen and RGB colour codes

Digital screens are made up of thousands of tiny squares called pixels.

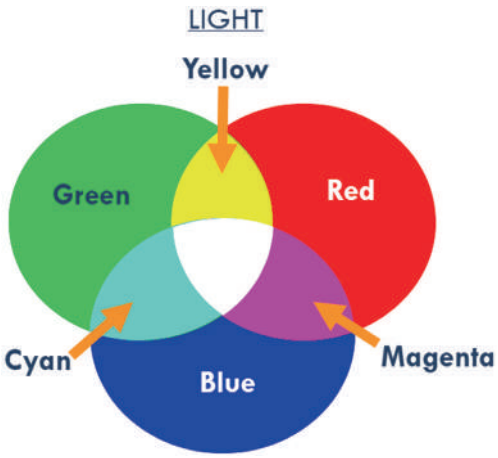
Each pixel contains a red, a green, and a blue light which are programmable lights.

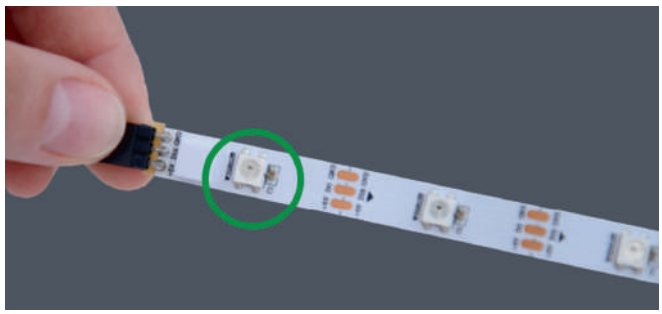
Red, Green, and Blue, known as RGB are the primary colours of light.

In computers, we can change the brightness of each primary colour (Red, Green, Blue) and make different colours.

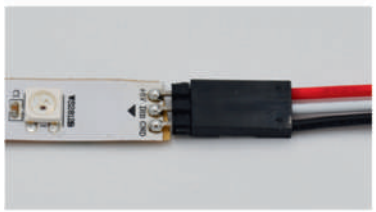
The values we can use to change colours are between 0 and 255.

We are also using the RGB pixel in our project to create different colours.





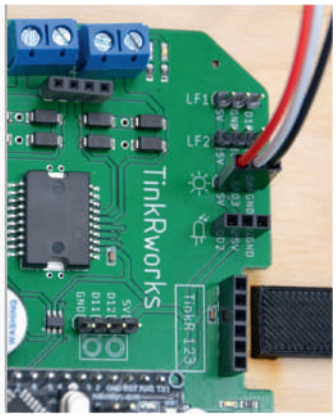
4.4 RGB Pixel connections



5V – 5V

DI – D3

GND –GND



The RGB pixel strip has 3 colour wires, each wire is connected to the pin on the PCB. As we see in the above picture – the red wire is connected to a 5V pin on the PCB, similarly white wire to D3 and black/brown wire to GND pins respectively.

Exercise 4

Q1. Multiple choice questions

1. What is the primary form of energy associated with light?

a) Mechanical energy
b) Electrical energy
c) Solar energy
d) Light energy

2. What property of light is defined as the length between humps in the wave?

a) Amplitude
b) Frequency
c) Wavelength
d) Intensity

3. How do we perceive different colours in objects under white light?

a) Objects emit their colours
b) Objects absorb certain colours and reflect others
c) Objects refract light to produce colours
d) Objects generate colours through chemical reactions

4. Which component of the human eye is responsible for detecting colour?

a) Pupil
b) Retina
c) Cornea
d) Optic nerve

5. How are different colours created on digital screens?

a) By mixing paint colours
b) By changing the shape of pixels
c) By altering the temperature of the screen
d) By adjusting the brightness of red, green, and blue lights

Q2. Fill in the Blanks:

1. Light travels in _____.
2. There are two types of photoreceptor cells in our eyes _____, & _____.
3. Digital screens are made up of _____.

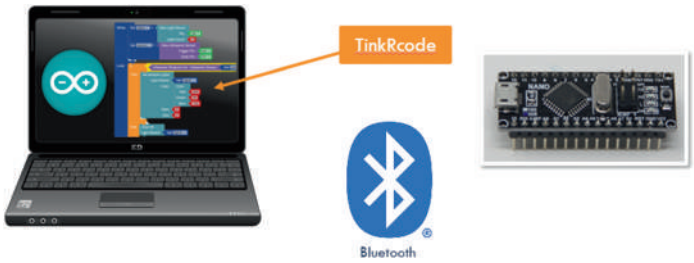
Q3. Answer the following:

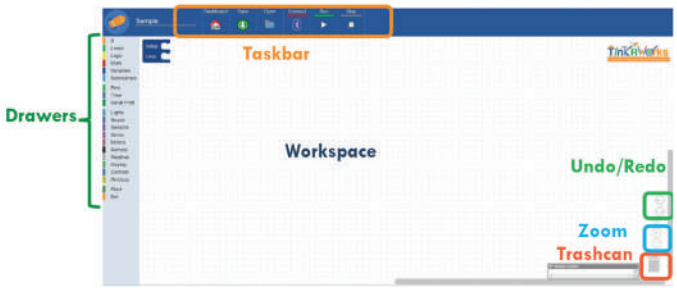
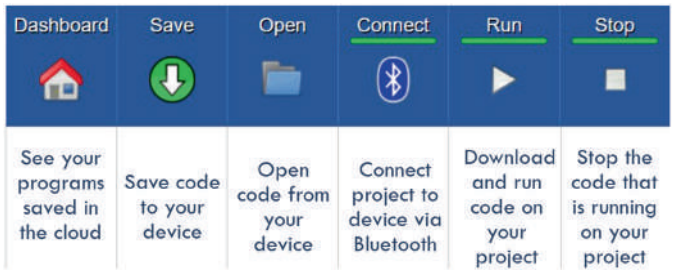
1. How do we see coloured objects?
2. How can we obtain different colours in LEDs?

Q4. Draw a neat, labelled diagram to show the wavelength, Amplitude, Crest and Trough of a wave.

Module 5: Programming Lights

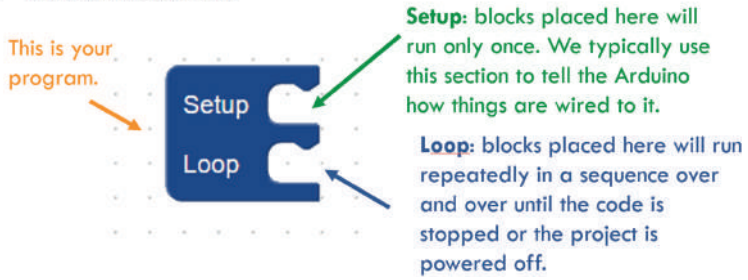
5.1 Introduction to TinkRcode

Steps to program the bot.	
Go to tinkrcode.com or open the TinkRcode app. Select "Sign In" Enter the organization, username, and password are correctly entered	
Make (Create) a New Program	

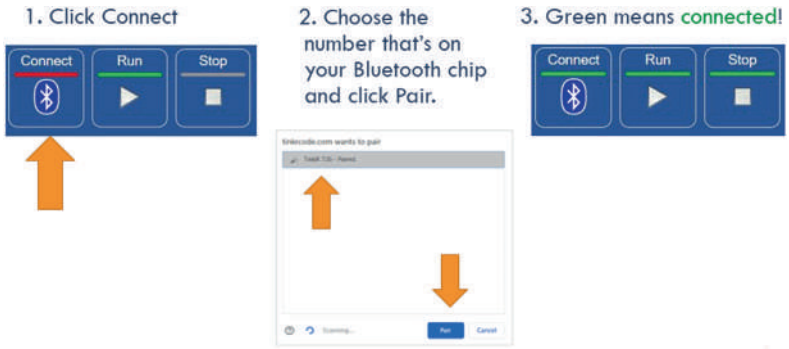
TinkRcode Anatomy	
RUN your program by clicking on the 'Run' tab	

5.2 What is "Setup" and "Loop"?

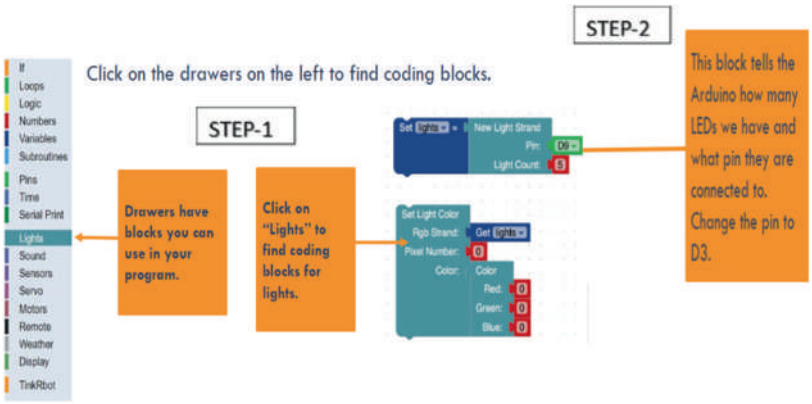
- TinkRcode uses drag-and-drop coding blocks.
- What's this block for?



5.3 How to connect to Bluetooth?



5.5 How to Program Light?

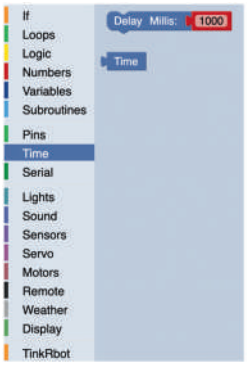


5.6 Blocks to use

5.6.1 Set Light block!

5.6.2 Set Multiple Light block!

5.6.3 Delay Millis block!



In order to make our RGB pixels do complex sequences we need to have control over time. Timing blocks can be found in the "Time" drawer.

The "delay milliseconds" block makes the Arduino wait for the specified time before moving onto the next command. There are 1000 milliseconds in a second.

5.6.4 Clear All Light Strands block!

Whenever we run any light program, the program gets stored in the computer chips inside the pixels and lit up even if we stop the program. So, to off that lights we use the "Clear All Light Strands" block.

5.7 Colour Chart

		RED	GREEN	BLUE
	WHITE	255	255	255
	RED	255	0	0
	GREEN	0	255	0
	BLUE	0	0	255
	YELLOW	255	255	0
	HOT PINK	255	0	150
	PURPLE	200	0	255
	TURQUOISE/TEAL	0	255	255
	ORANGE	255	100	0
	LIME	100	255	0

Exercise 5

Q1. Match the following:

Group A		Group B	
	Red		Pin Number 3
	White		GND
	Black		5 V

Q2. State whether the statements are true or false:

1. The red wire of the LED strip can be connected to GND.
2. Primary colours in the computers are Red, Blue and Yellow.

Q3. Convert the following:

1. One second= _____Milliseconds
2. One minute= _____Milliseconds

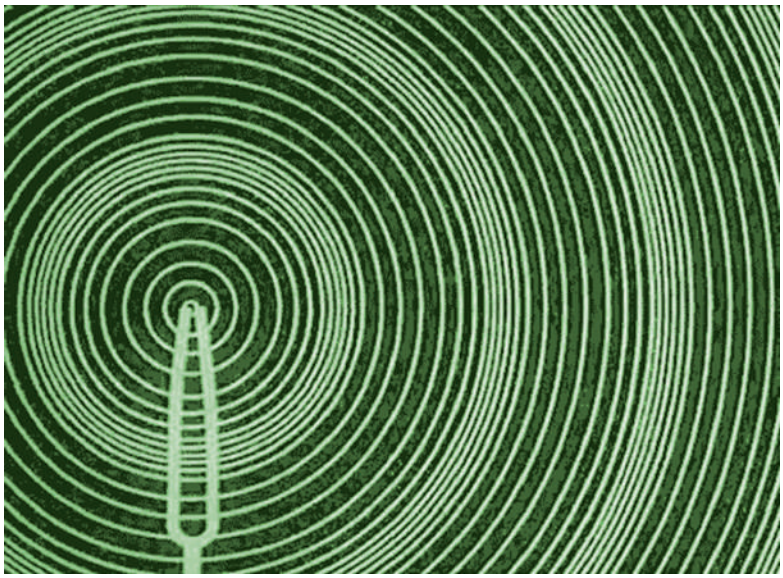
Module 6: Introduction to Sound

6.1 Sound

Sound is a form of energy that we can hear with our ears.

It's made when something vibrates, like when a drum is hit or someone speaks. These vibrations create waves that travel through the air and reach our ears, allowing us to perceive them as sound.

Sound is a vibration which travels in the form of waves in all directions from their source.



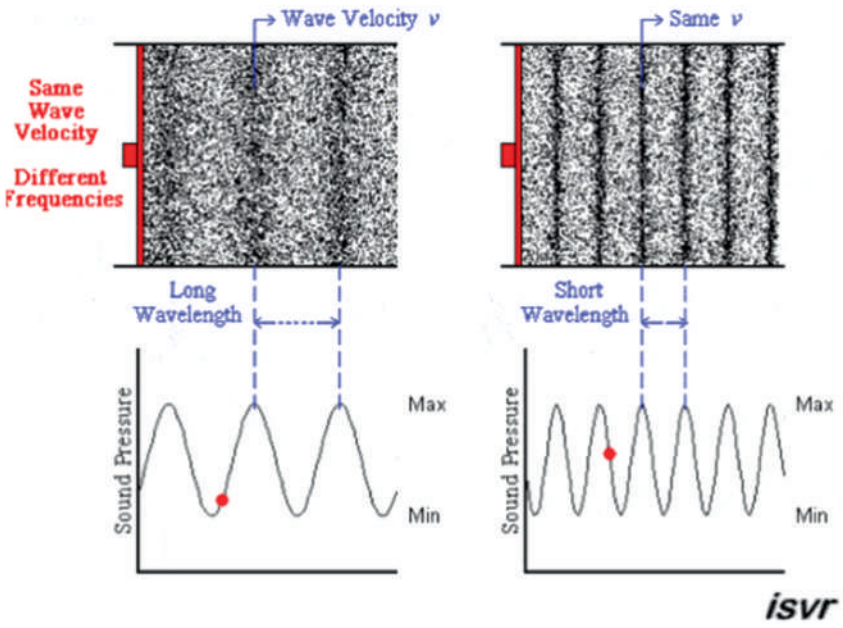
6.1 Properties of Sound Wave

6.1.1 Wavelength

Wavelength is the distance between two humps.

Low tones = Long wavelength

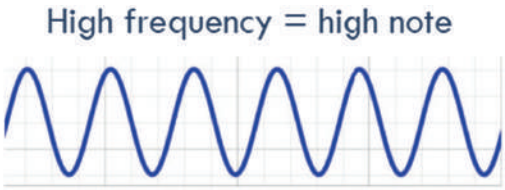
High tones = Short wavelength



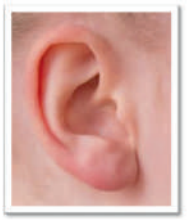
6.1.2 Frequency

Frequency is how many waves are there per second.

High Frequency = High pitch
Low Frequency = Low pitch



Did you know that different animals, including us, have different hearing ranges?
Animals' hearing range


20 to 20,000Hz


67 to 45,000 Hz


48 to 85,000 Hz


9,000 to 200,000 Hz

Exercise 6

Q1. Multiple Choice Question

1. What is the sound?

a) Light waves travelling from a source
b) A form of energy emitted by animals
c) Vibrations that travel in the form of waves
d) Mechanical movements of particles

2. How is wavelength defined in the context of sound waves?

a) The height of the wave
b) The distance between two humps of the wave
c) The number of waves per second
d) The speed at which the wave travels

3. What property of sound determines its pitch?

a) Wavelength
b) Frequency
c) Amplitude
d) Speed

4. How does frequency relate to pitch?
   a) Higher frequency results in lower pitch
   b) Lower frequency results in higher pitch
   c) Higher frequency results in higher pitch
   d) Frequency and pitch are unrelated

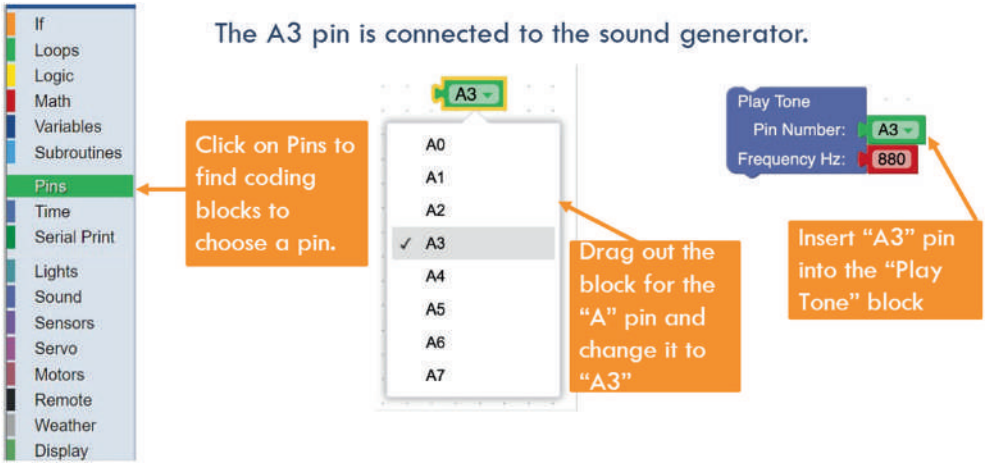
5. Why do different animals have different hearing ranges?
   a) Due to variations in the structure of their ears
   b) Because of differences in the frequency of sound they can detect
   c) Because of variations in the amplitude of sound waves they perceive
   d) Due to differences in the speed of sound propagation in their environment

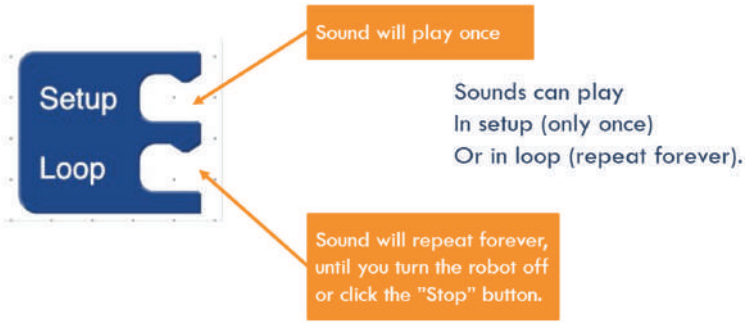
Q2. State whether the statements are true or false:

1. All animals have the same hearing range capacity.
2. Sound is a vibration which travels in the form of waves.
3. High frequency are the result of low tone.

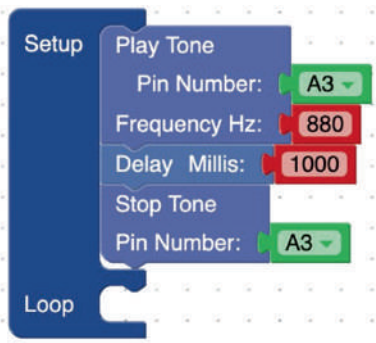
Module 7: Programming Sound

7.1 Let us learn to program sound.





7.2 Blocks to use



7.2.1 Play tone block!

After setting the PIN to A3, we use the "Play Tone" block to play different music tones by changing the frequency from 0 to 880.

7.2.2 Delay Millis block!

The delay tells the Arduino how long to play the tone. Here, the tone of 880 Hz will play for 1 second.

7.2.3 Stop Tone block!

The "Stop Tone" block will stop the tone from playing after the delay has finished.

Exercise 7

Q1. Multiple Choice Question

1. Which block is used to play different music tones by changing the frequency?
   a) Play Tone
   b) Delay Millis
   c) Stop Tone
   d) Pin Number
2. What does the Delay Millis block determine in sound programming?
   a) The duration of the delay before the sound starts
   b) The frequency of the sound being played
   c) The length of time the sound is played
   d) The interval between consecutive tones
3. What does the Stop Tone block do in sound programming?
   a) Increases the volume of the sound
   b) Changes the pitch of the sound
   c) Stops the tone from playing after a specified delay
   d) Adjusts the amplitude of the sound wave

4. How is the frequency adjusted in the Play Tone block?
   a) By changing the pin number
   b) By adjusting the amplitude
   c) By modifying the delay time
   d) By setting the frequency parameter from 0 to 880

5. What is the purpose of setting the pin number in sound programming?
   a) To control the duration of the sound
   b) To specify the type of sound being played
   c) To identify the output pin connected to the speaker
   d) To adjust the volume of the sound

Q2. Fill in the blanks

1. The maximum frequency of the buzzer in our project is _____.
2. The pin number for 'Play Tone Block' is _____.
3. The delay tells the _____ ___ how long to play the tone

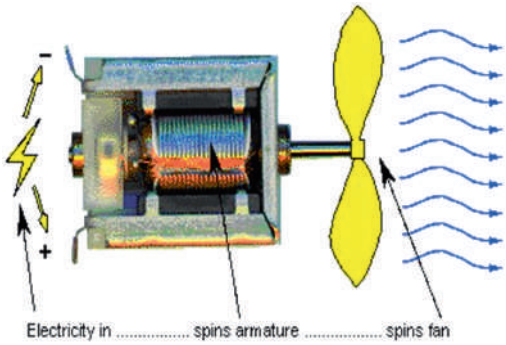
Module 8: Introduction to Motors

8.1 Motor

A motor is a rotary machine, driven by an electrical current. It converts electrical energy into mechanical energy.

There are two types of motors:

- AC (Alternating Current motors)
- DC (Direct Current motors)

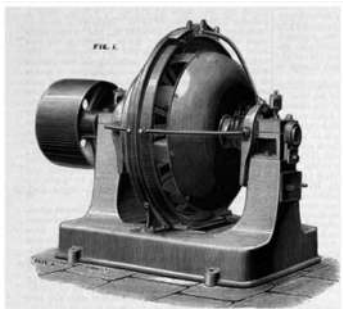


8.1.1 Where can we find motors?

We find motors in washing machines, refrigerators, aircraft, drills, etc.

8.2 Generator

A generator is a rotary machine, driven by motion. It converts mechanical energy into electrical energy.



8.2.2 Where can we find generators?

We find generators in windmills, hydropower plants, steam plants, nuclear power plants, etc.

Did you know that both motors and generators use electromagnets?

8.3 Electromagnet

An electromagnet is a device that turns into a magnet when electricity is passed through it.

We can make an electromagnet just by making a coil of wire and putting electricity through it.

To sustain the magnetic field we can also add a piece of metal inside of the coil.

Exercise 8

Q1. Multiple Choice Questions

1. Where are motors commonly found?

a) Windmills
b) Hydropower plants
c) Refrigerators
d) Nuclear power plants

2. What is the primary function of a generator?

a) To convert mechanical/motion energy into electrical energy
b) To rotate mechanical parts in machines
c) To produce heat for industrial processes
d) To control the flow of electricity in circuits

3. How does an electromagnet work?
   a) By converting electricity into heat energy
   b) By producing light when electricity is passed through it
   c) By creating a magnetic field when electricity flows through a coil of wire
   d) By generating sound waves through electrical pulses

4. What can be done to make an electromagnet?
   a) Add water to the coil of wire
   b) Increase the temperature of the coil
   c) Insert a piece of metal inside the coil
   d) Remove the electricity from the coil

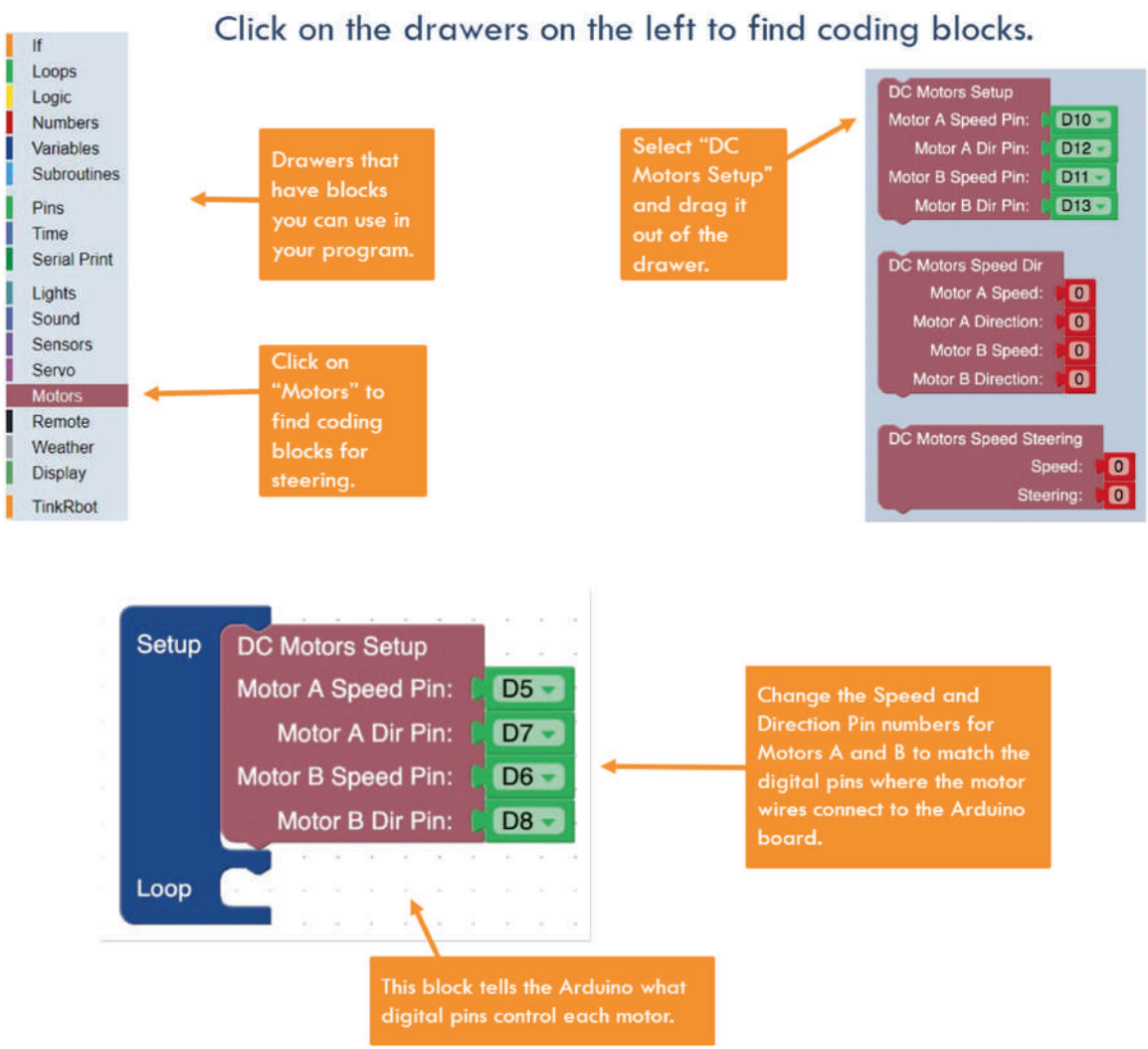
5. What is the similarity between motors and generators?
   a) Both convert mechanical energy into electrical energy
   b) Both are used in windmills
   c) Both use electromagnets
   d) Both are found in refrigerators

Q2. State whether the statements are true or false:

1. We can sustain the magnetic field by putting a piece of metal inside the coil.
2. The motor converts mechanical energy into electrical energy.
3. There are two types of motors AC and DC motors.

Module 9: Programming Motors

9.1 How to program motors?



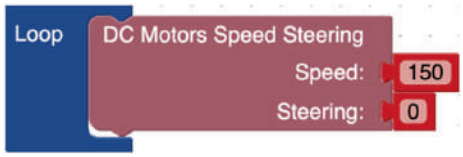
9.2 Blocks to use

DC Motors Speed Steering block!

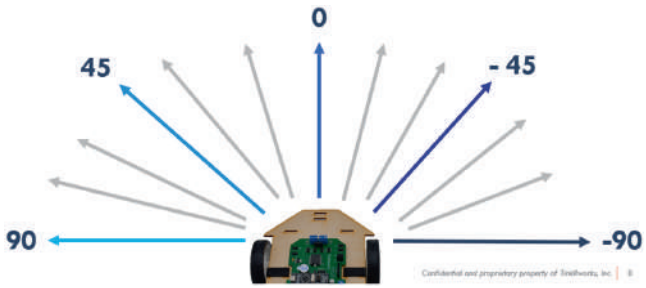
This block we use to run the motors just by giving speed and steering value.

These are the points to be noted while programming this block:

- Maximum speed is 255
- For forward movement speed should be in "+ve" and for backward movement it should be in "-ve"
- 0 steering will make it move straight.
- For left movement steering should be in "+ve" and for right movement steering should be in "-ve".



Refer to this for steering:



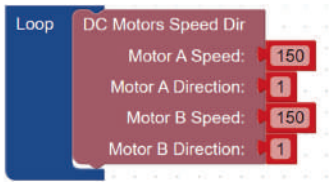
Independent Control for Motors A and B: Speed and Direction Settings

We can also use this block to program the motors. Here we need to set the speed and direction (instead of steering) for individual motors.

These are the points to be noted while programming this block:

- Maximum speed is 255
- For forward movement speed should be in "+ve" and for backward movement it should be in "-ve"
- The direction could be only either 0 or 1. where 1 is for forward and 0 is for backward (these 0 and 1 work oppositely by changing the alignment of motors)

We can create left or right movements by making the difference in speed of both the motors accordingly.



Did your bot go straight when you put direction 0 (in case of first motor block) or same speed for both the motors (in case of second motor block)? If not, it could be due to manufacturer mismatch between the motors.

To fix this problem we need to make some adjustments in the programming by matching the speed of motors. This process is called **Calibration**

Exercise 8

Q1. Multiple Choice Questions

1. Which block is used to program motors by giving speed and steering value?

a) DC Motors Speed Steering block

b) DC Motors direction block

c) DC Motors Speed Control block

d) DC Motors Rotation block

2. What is the maximum speed value that can be set using the DC Motors Speed Steering block?

a) 128

b) 180

c) 255

d) 300

3. What should be the steering value for the motors to move straight?

a) +ve value

b) -ve value

c) 0

d) 1

4. Which block is used to program motors by setting the speed and direction for individual motors?

a) DC Motors Speed Steering block

b) DC Motors direction block

c) DC Motors Speed direction block

d) DC Motors Rotation block

5. What should be the direction value for forward movement using the DC Motors direction block?

a) 0

b) 1

c) +ve value

d) -ve value

Q2. Fill in the blanks:

1. To fix this problem we need to make some adjustments in the programming by matching the speed of motors. This process is called _____.
2. Negative steering value turns bot in _____direction.

Module 10: Introduction to Sensors and Ultrasonic Sensor

10.1 Sensor

A device which measures or detects a physical property and records indicates, or otherwise responds to it is called a sensor. For Example: Touch Sensor, Light Sensor, Motion Sensor, Ultrasonic Sensor, IR Sensor etc.

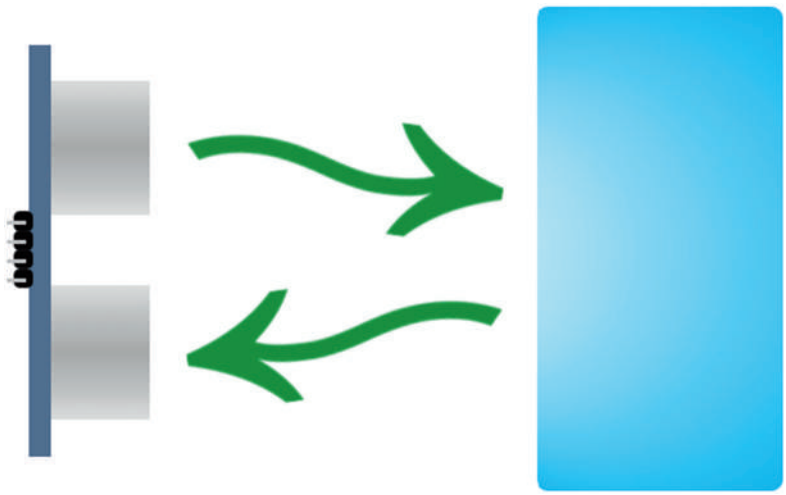
We are using "Ultrasonic Sensor" and "IR Sensor '' in our TinkRbot.

10.1.1 Ultrasonic Sensor

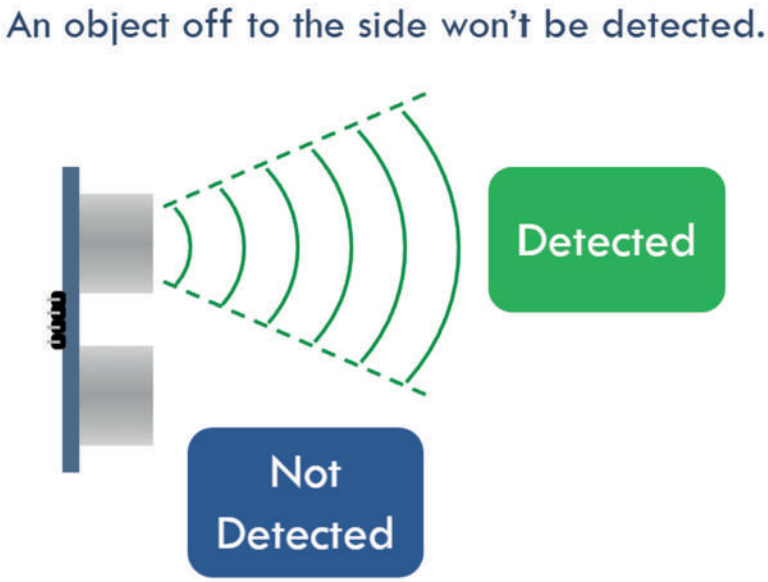
The ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal.

10.1.2 How does it work?

The sound wave goes out of the ultrasonic sensor, bounces off an object in front of it and comes back. This is how it detects the obstacle in front of it and sends the signal to Arduino.



The ultrasonic sensor has 4 pins, Positive terminal, negative terminal, Trigger pin (which sends the sound wave) and Receiver pin (which receives the sound wave), so the object in front of the Trigger pin will only be detected.



Our ultrasonic sensor works on the principle of Echolocation.

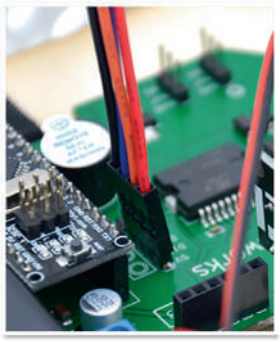
10.2 Echolocation

Echolocation is the use of sound waves to determine the location of objects. Many animals have this ability, including bats, whales, dolphins, shrews, and some birds.

10.3 Let us check the connections of the bot

Trace your wires!

Sensor	Wire	PCB
Vcc	Red	5V
Trig	Orange	D12
Echo	Blue	D11
Gnd	Black	GND



Exercise 10

1. What is a sensor?

a) A device that emits light waves

b) A device that detects or measures physical properties and responds to them

c) A device that generates electricity

d) A device that controls motion

2. Which sensors are used in the TinkRbot project?

a) Touch Sensor and Motion Sensor

b) Light Sensor and IR Sensor

c) Ultrasonic Sensor and IR Sensor

d) Touch Sensor and Light Sensor

3. How does the Ultrasonic Sensor detect obstacles?

a) By emitting infrared light

b) By emitting sound waves and detecting their reflection

c) By measuring changes in temperature

d) By analyzing changes in air pressure

4. What are the two pins of the Ultrasonic Sensor and their functions?

a) Power pin and Ground pin
b) Signal pin and Ground pin
c) Trigger pin (sends sound wave) and Receiver pin (receives sound wave)
d) Input pin and Output pin

5. What principle does the Ultrasonic Sensor work on?

a) Infrared radiation
b) Electromagnetic induction
c) Echolocation
d) Refraction

Q2. Answer the following questions:

1. What is an Ultrasonic sensor and how does it work in our project?

2. What is Echolocation?

Module 11: Programming Ultrasonic Sensor

11.1 Introduction

We want our robot to avoid hitting objects that are in front of it.

For example:

If there is an object less than 25cm in front of the bot.

Then turn right (or left or reverse, etc.)

For this, we need to program an ultrasonic sensor using a conditional statement.

11.2 Conditional Statement

A conditional statement is a sentence that contains an "if" and a "then" part. It tells us that if something happens (the condition), then something else will happen (the result).

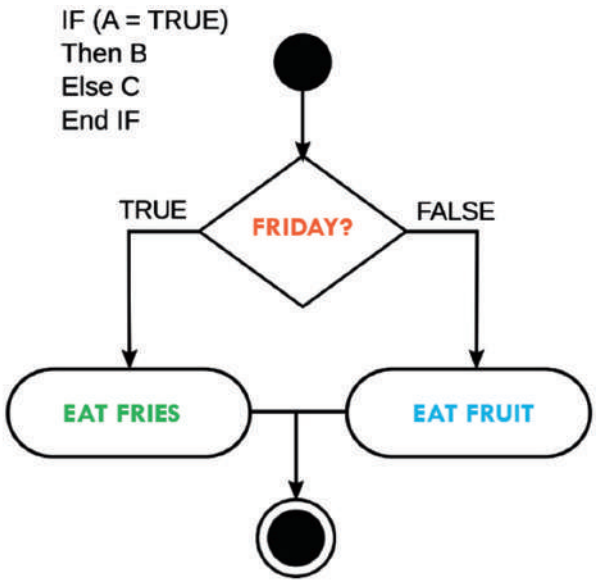
Conditional Statement Example:

IF it is FRIDAY

- Then EAT FRIES

Else

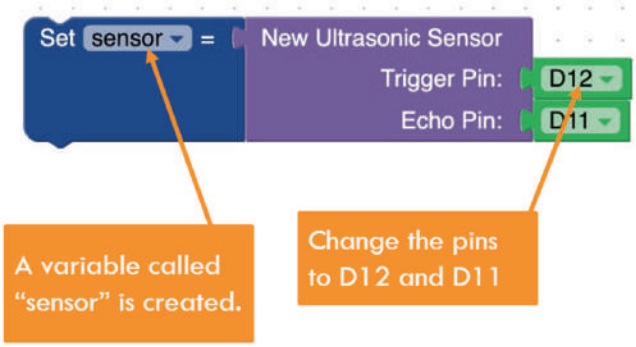
- (Then) EAT FRUIT



11.3 Blocks to use

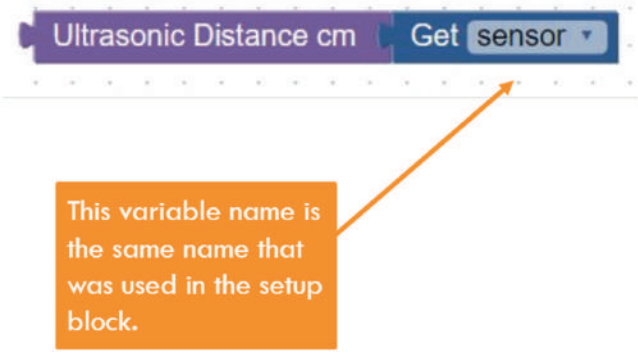
11.3.1 Set Sensor block!

This block tells the Arduino which pins to use to talk to the ultrasonic sensor.



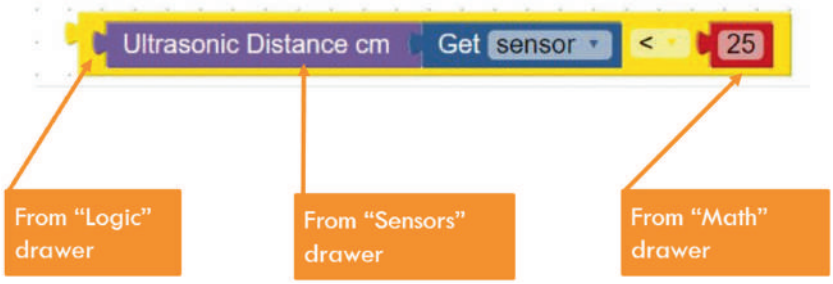
11.3.2 Ultrasonic Distance cm block!

This block returns a value in centimeters – how far away the nearest sensed object is.



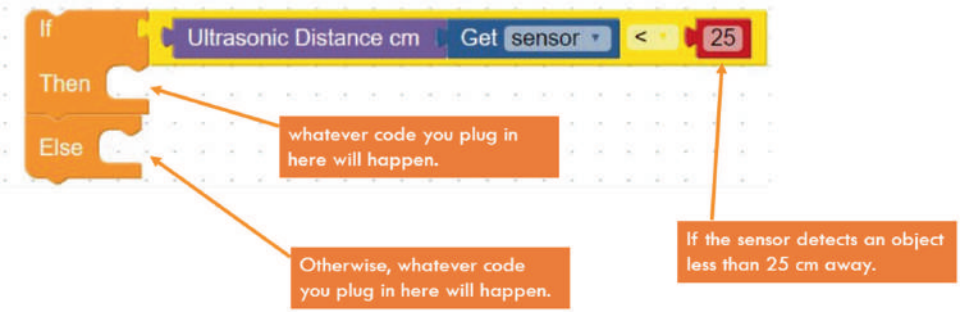
11.3.3 Logic block!

The yellow block will be either True or False that the ultrasonic sensor "sees" something that is less than 25 cm away.



If_Else_then block!

This if_then_else block we will get inside the if drawer and this is the block that we will use to apply condition in our sensor program.



Exercise 11

1. What is the purpose of programming the ultrasonic sensor in the robot?

a) To measure the temperature of the surroundings

b) To avoid hitting objects in front of the robot

c) To play music when objects are detected

d) To change the colour of the robot based on the surroundings

2. What is a conditional statement?

a) A statement that contains "if" and "then" parts and predicts the weather

b) A statement that contains "if" and "then" parts and specifies a condition and a result

c) A statement that contains "if" and "then" parts and describes a scientific experiment

d) A statement that contains "if" and "then" parts and explains historical events

3. Which block tells the Arduino which pins to use to talk to the ultrasonic sensor?

a) Ultrasonic Distance cm block

b) Logic block

c) If_Else_then block

d) Set Sensor block

4. What does the Ultrasonic Distance cm block return?
   a) Temperature in Celsius
   b) Distance in inches
   c) Distance in centimeters
   d) Voltage readings

5. What does the logic block indicate?
   a) Whether the robot is moving forward or backward
   b) Whether the ultrasonic sensor detects an object less than 25 cm away
   c) Whether the robot needs to turn left or right
   d) Whether the battery level is low or high

Q2. Fill in the blanks

1. _____block tells the Arduino which pins to use to talk to the ultrasonic sensor.
2. _____statement is a sentence that contains an "if" and a "then" statements.

Module 12: Programming with Subroutine

12.1 Subroutine

A subroutine is a set of instructions that perform a specific task, which can be given a name and called (executed) from different parts of a program.

For Example:

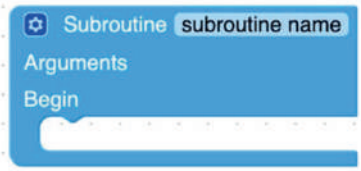
- Clean yourself:
- Take shower
- Dry yourself off
- Brush your teeth
- Comb your hair, etc.

If there are too many blocks in our workspace and it looks messy then it helps to make our workspace clean.

12.2 Blocks to use

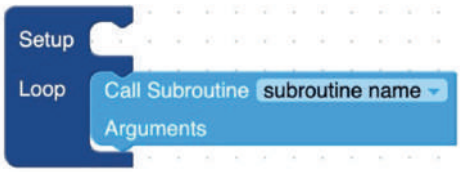
12.2.1 Subroutine block!

This is the Definition Block that contains all the steps of code for one Subroutine.



12.2.2 Call Subroutine block!

The Call Subroutine Block triggers the Arduino to run what is in the Definition block.



Exercise 12

Q1. Multiple choice questions

1. What is a subroutine?

a) A type of sensor used in robotics
b) A set of steps needed in one part of a routine
c) A type of motor used for precise movements
d) A type of battery used to power electronic devices

2. How does a subroutine help in organizing the workspace?

a) By adding more blocks to the workspace
b) By reducing the number of blocks in the workspace
c) By changing the colour of the blocks in the workspace
d) By rearranging the blocks randomly in the workspace

3. What does the Subroutine block contain?

a) The steps needed to clean yourself
b) The definition block that contains all the steps of code for one subroutine
c) The call subroutine block that triggers the Arduino to run code
d) The logic blocks used for decision-making

4. What does the Call Subroutine block do?

a) Triggers the Arduino to run the steps in the subroutine
b) Adds more steps to the subroutine
c) Deletes the definition block from the subroutine
d) Changes the subroutine to a different type

5. How does the Call Subroutine block contribute to the execution of code?

a) It defines the steps of the subroutine
b) It triggers the Arduino to run the steps in the subroutine
c) It determines the colour of the subroutine block
d) It changes the subroutine's position in the workspace

Q2. State whether the statements are true or false:

1. A subroutine is a set of instructions that perform a specific task

2. The call subroutine block triggers the battery.

Module 13: Programming Remote Control

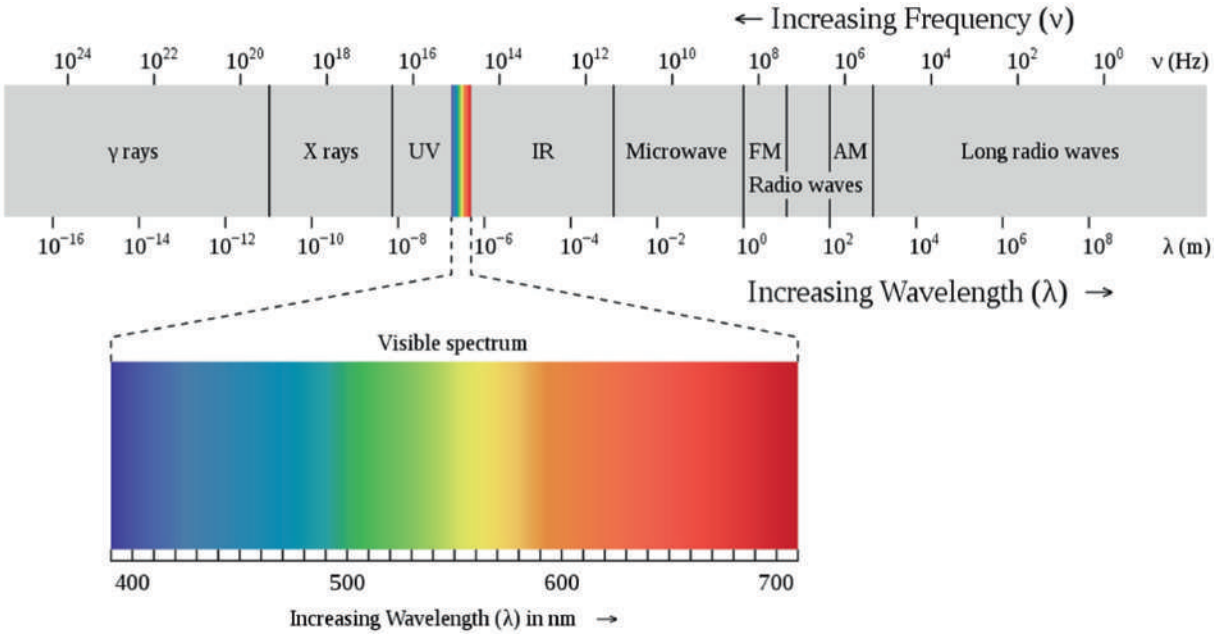
What devices that you have seen are controlled by Remote? How does that exactly work?

13.1 Introduction

Remote controls like TV utilize IR sensors to receive signals, allowing users to wirelessly interact with electronic devices.

13.2 IR

IR stands for "Infrared." It is a type of electromagnetic radiation that is invisible to the human eye but can be detected as heat and by the **IR Sensor**. Infrared radiation has longer wavelengths than visible light and is commonly used in various technologies, such as night vision, remote control devices, and thermal imaging cameras.



We use IR every day! Have you ever seen the light on a remote control?

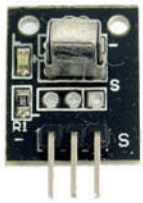
When you press a button on the remote, Infrared light shines towards the IR sensor on the TV.

Let's learn how it works!

The remote control sends information to the IR sensor as the flashes of IR light.

The sensor detects the flashes and then sends a series of 1s and 0s to the Arduino.

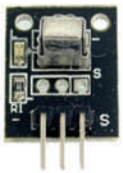
Remote Control



IR Sensor

Arduino

Check the connections on the PCB.

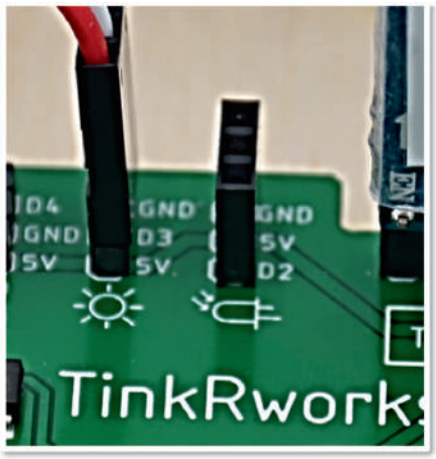


Sensor Pins: PCB Sockets:

- → GND

+ → 5V

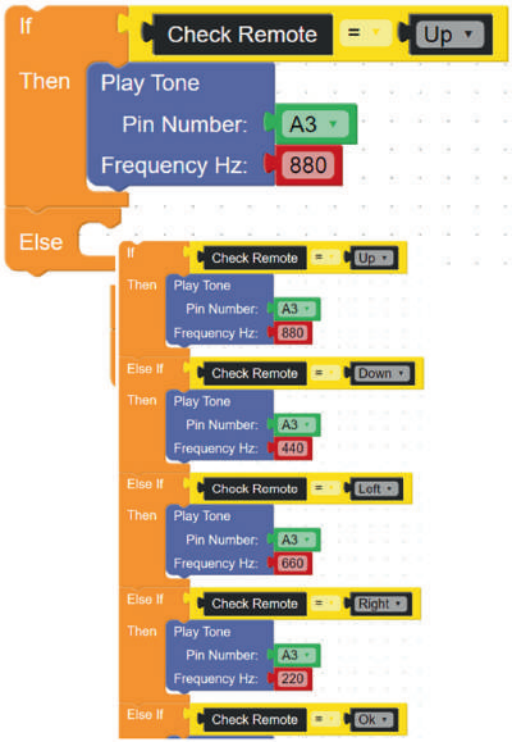
S → D2



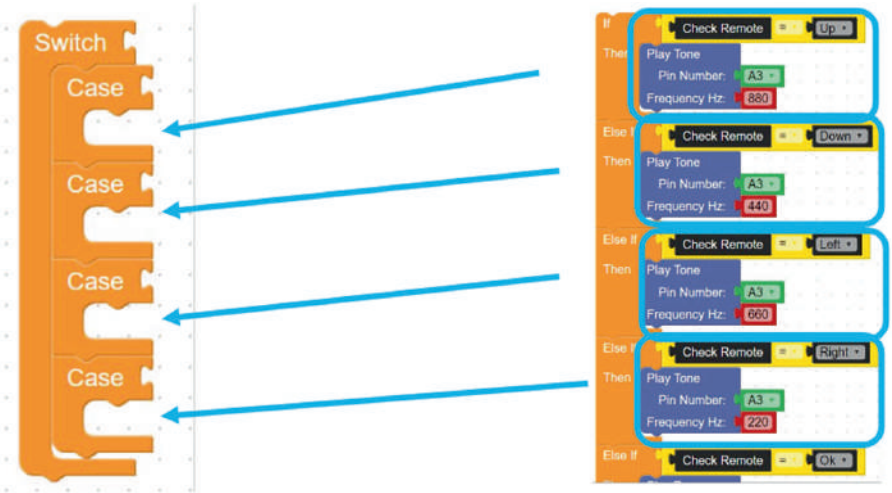
13.3 Programming IR Remote

We want the bot to do an action when a certain button is pressed. So here also we need to apply conditional blocks.

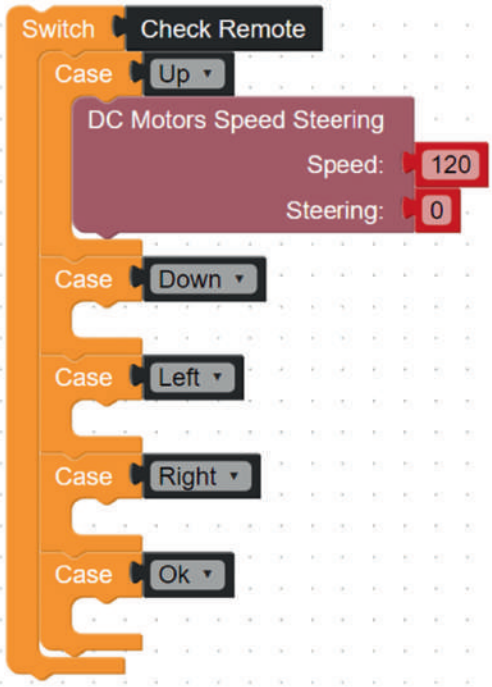
So here we can use If/Then/Else blocks but then we would have to add all the buttons like this-



Therefore, instead of If/Then/Else, we will use Switch/Case block



Now this Switch/Case block works as the setup, and we can program different buttons like this.



Exercise 13

Q1. Multiple choice questions

1. What type of electromagnetic radiation is utilized by remote controls, such as TV remotes?
   a) Ultraviolet (UV) radiation
   b) Infrared (IR) radiation
   c) Visible light radiation
   d) X-ray radiation

2. What does "IR" stand for in the context of remote controls?
   a) Infrared
   b) Intensity Receiver
   c) Infrared Remote
   d) Integrated Receiver

3. How does a remote control interact with electronic devices wirelessly?

a) By emitting radio waves
b) By emitting infrared light pulses
c) By emitting ultraviolet radiation
d) By emitting visible light pulses

4. What does the IR sensor on a TV detect when it receives signals from a remote control?

a) Visible light pulses
b) Ultraviolet radiation
c) Infrared light pulses
d) Radio waves

5. What programming block is used to handle different button presses on a remote control?

a) If/Then/Else blocks
b) For/While loops
c) Switch/Case blocks
d) Function blocks

Q2. Match the following

	PCB Socket		Sensor Pins
1.	GND	a.	+ve pin
2.	D2	b.	-ve pin
3.	5V	c.	S pin

Answer key

Exercise 1

Q1. Multiple choice question

1. b) Mimicking the behaviour of an automatic car
2. c) Emotional intelligence
3. b) Ultrasonic sensor
4. c) Buzzer
5. c) Via a remote control

Q2. State whether the statements are true or false:

1. True
2. False
3. False

Q3. Answer the following

Q.1)

a) It uses sensors to "see" its environment.

b) It can move around.

c) It has an energy source like a battery.

d) Robots can be pre-programmed for specific tasks or be adaptable to changing situations.

e) They can be complex humanoids or simple industrial arms, but all serve a purpose.

Q.2)

4. Robots can work autonomously. machines cannot work autonomously.
5. Robots can do multiple tasks at a time. machines can do only a single specific task.
6. Robots have their energy source like batteries. while machines need power to perform the task

Exercise 2

Q1. Multiple Choice Question

1. c) Securing the motors firmly
2. b) To ensure proper alignment of the robot's wheels
3. b) Motor
4. b) By scanning a QR code
5. c) It holds the motors securely in place
6. c) Running simple programs and controlling electronic components
7. c) Arduino Nano
8. b) To connect electronic components like motors, LEDs, and sensors with the battery and Arduino
9. c) Movement of electrons
10. c) By allowing electrons to flow from the negative side to the positive side through a wire

Q2. Fill in the blanks

1. Printed circuit Board
2. Electrons
3. Arduino nano

Exercise 3

Q1. Multiple choice question

1. d) light energy
2. c) wavelength
3. a) object emits its colour
4. b) retina
5. d) By adjusting the brightness of Red, green and blue lights

Q2. Fill in the Blanks

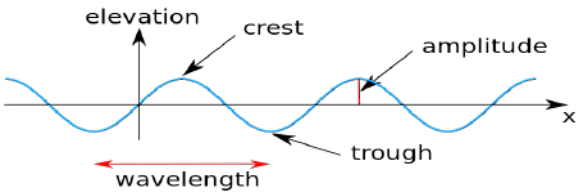
1. wave
2. cone and Rod
3. pixels

Q3. Answer the following

We see coloured objects because they absorb and reflect light. The reflected light enters our eyes, where cones in the retina detect different wavelengths, creating the perception of colour in our brains.

LEDs have different colours because they use special materials which can change the movement of electrons inside them. By adding different elements to these materials, we can control the flow of electrons and make LEDs give off different light colours, like red, green, or blue.

Q4. Draw a neat, labelled diagram to show the wavelength and Amplitude of a wave.



Exercise 4

Q1. Match the following:

Group A	
1	c.
2	a.
3	b.

Q2. State whether the statements are true or false:

1. False
2. False

Q3. Convert

1. 60000 ms
2. 1000ms

Exercise 5

Q1. Multiple Choice Questions

1. c) Vibrations that travel in the form of waves
2. b) Distance between two humps
3. b) Frequency
4. c) high-frequency results in high pitch
5. b) Because of differences in the frequency of sound they can detect.

Q2. State True or False

1. False
2. True
3. False

Exercise 6

Q1. Multiple Choice Questions

1. a) Play tone
2. c) the length of the sound being played
3. c) Stops the tone from playing after a specific delay
4. d) By setting the frequency parameter from 0 to 880

Q2. Fill in the blanks

1. 880Hz
2. A3
3. Arduino

Exercise 7

Q1. Multiple Choice Question

1. c) Refrigerators
2. a) converts mechanical/motion energy to electrical energy
3. c)By creating a magnetic field when electricity flows through a coil of wire
4. c) Insert a piece of metal inside the coil
5. c) Both use electromagnets

Q2. True or False

1. True
2. False
3. True

Exercise 8

Q1. Multiple choice questions

1. a) DC Motor Speed Steering block
2. c) 255
3. c) 0
4. c) DC Motor speed direction Block
5. b) 1

Q2. Fill in the Blanks

1. Calibration
2. Right

Exercise 9

Q1. Multiple Choice Question

1. b) A device that detects or measures physical properties and responds to them
2. c) Ultrasonic Sensor and IR Sensor
3. b) By emitting sound waves and detecting their reflection
4. c) Trigger pin (sends sound wave) and Receiver pin (receives sound wave)
5. c) Echolocation

Q2. Answer the following Questions.

1. An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal. The sound wave goes out of the ultrasonic sensor, bounces off an object in front of it and comes back. This is how it detects the obstacle before it and sends the signal to Arduino.
2. Echolocation is using sound waves to determine the location of objects. Many animals have this ability, including bats, whales, dolphins, shrews, and some bird

Exercise 10

Q1. Multiple choice questions

1. b) To avoid hitting objects in front of the robot
2. b) A statement that contains "if" and "then" parts and specifies a condition and a result
3. d) Set Sensor block
4. b) Whether the Ultrasonic sensor detects an object less than 25 cm away

Q2. Fill in the blanks

1. Set sensor
2. Conditional

Exercise 11

Q1. Multiple Choice Questions

1. b) A set of steps needed in one part of a routine.
2. b) By reducing the number of blocks in the workspace
3. b) The definition block that contains all the steps of code for one subroutine
4. a) Triggers the Arduino to run the steps in the subroutine
5. b) It triggers the Arduino to run the steps in the subroutine

Q2. State whether the statements are true or false:

1. True
2. False

Exercise 12

Q1. Multiple choice questions

1. b) Infrared (IR) radiation
2. a) Infrared
3. b) By emitting infrared light pulses
4. c) Infrared light pulses
5. c) Switch/Case blocks

Q2. Match the following

1.	b
2.	c
3.	a

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