

Movement

Textbook

Movement



The micro:bit can respond to movement. Movements such as shaking or tilting the micro:bit can be an input. These movements can signal the micro:bit to run certain chunks of code.

This is possible because the micro:bit has an [accelerometer](#). An accelerometer measures motion. Accelerometers are used all the time in real-life, like when you turn your phone to switch the picture from portrait to landscape, or when a step counter senses your movement to count your steps. Accelerometers are used in several technologies!

The accelerometer in the micro:bit measures when the micro:bit itself moves. For instance, like when the micro:bit is shaken, tilted, or flipped upside down. Watch this video to learn more:



Program with the Accelerometer

Let's program the micro:bit to show a silly face when it is shaken.

We want this code to be inside a forever function, since we want it to respond whenever the movement happens. A reminder of what the forever function looks like.

```
1 def on_forever():  
2  
3 basic.forever(on_forever)
```

Add the code for the accelerometer. To do this, use the gesture code.

```
if input.is_gesture(Gesture.SHAKE):
```

You can see it inside the forever loop below.

```
1 def on_forever():  
2     if input.is_gesture(Gesture.SHAKE):  
3         basic.show_icon(IconNames.SILLY)  
4 basic.forever(on_forever)  
5
```

Note: Make sure to match indentation, spelling, and capitalization exactly.

This code tells the micro:bit to start your code when you shake it, triggering the accelerometer.

NOTICE Indentation with your If Statement!

Other Gestures

The micro:bit has several gestures it will respond to! Replace the word SHAKE in the code with the following commands.

Code	What it Does
<code>SHAKE</code>	This will trigger code if the micro:bit shakes.
<code>TILT_LEFT</code>	This will trigger code if the micro:bit is tilted to the left.
<code>TILT_RIGHT</code>	This will trigger code if the micro:bit is tilted to the right.

Some gestures don't work well with the simulated micro:bit, but work well with the physical robot. The following commands are best experienced if you download your code to the physical robot and practice the motions.

See what you can build with the following code commands!

Code	What it Does
<code>LOGO_UP</code>	This will trigger code if the micro:bit logo is at the top. Like normal.
<code>LOGO_DOWN</code>	This will trigger code if the micro:bit logo is at the bottom. Upside down.
<code>SCREEN_UP</code>	This will trigger code if the LED lights are facing up, as if it were laying face up on a desk.
<code>SCREEN_DOWN</code>	This will trigger code if the LED lights are facing up, as if it were laying face down on a desk.
<code>FREE_FALL</code>	This will trigger code if the micro:bit is falling down. <i>(BE CAREFUL! Do not let the micro:bit drop to the ground, it could break. Use padding.)</i>

Adopted from microbit.org platform

Critical Thinking Questions

- Many modern devices, from smartphones to gaming controllers, respond when you move them. Besides changing a screen or counting steps, what's another real-world gadget or system where sensing a shake or a tilt could be a really helpful way for a person to control it? Why would that motion make it easier to use?
- Imagine you're designing a safety alert for someone working in a dangerous place. How could a small device that senses sudden movement or falling be programmed to automatically send an alarm or alert if something goes wrong?
- Why is it important for devices that react to your actions, like a virtual reality headset or a fitness tracker, to be constantly checking for movement? What would happen if they only checked once in a while instead of all the time?

Questions (10)

MULTIPLE CHOICE

1. What will happen when you shake the micro:bit while running this code?

```
def on_forever(): if input.is_gesture(Gesture.SHAKE): basic.show_icon(IconNames.SILLY) basic.forever(on_forever)
```

Choose the correct answer:

- A. Nothing happens
- B. SILLY icon shows once
- C. SILLY icon shows while shaking
- D. Error occurs

2. You want to create a digital dice that shows a random number when you shake the micro:bit. What should you replace in this code?

MULTIPLE CHOICE

```
def on_forever(): if input.is_gesture(Gesture.SHAKE): basic.show_icon(IconNames.SILLY) basic.forever(on_forever)
```

Choose the correct answer:

- A. Replace Gesture.SHAKE with a different gesture
- B. Replace basic.show_icon(IconNames.SILLY) with a random number command
- C. Replace the forever function
- D. Replace the if statement with a for loop

3. A student wants their micro:bit to beep when tilted left and show a heart when tilted right. What code structure do they need?

MULTIPLE CHOICE

Choose the correct answer:

- A. One if statement with TILT_LEFT
- B. Two separate forever functions
- C. One forever function with if and elif statements
- D. A for loop with gesture commands

4. What is wrong with this code?

```
def on_forever(): if input.is_gesture(Gesture.SHAKE): basic.show_string("Shaken!") basic.forever(on_forever)
```

Choose the correct answer:

- A. Wrong gesture command
- B. Missing indentation for the if statement and its contents
- C. Should use elif instead of if
- D. Missing quotation marks

5. You want to create a magic 8-ball that shows different messages based on how you move it. Which gestures would work best for different responses?

MULTIPLE CHOICE

Choose the correct answer:

- A. Only use SHAKE for all responses
- B. Use SHAKE, TILT_LEFT, and TILT_RIGHT for different messages
- C. Use only LOGO_UP and LOGO_DOWN
- D. Use only SCREEN_UP and SCREEN_DOWN

6. Why does the accelerometer need to be inside a forever function?

```
def on_forever(): if input.is_gesture(Gesture.SHAKE): basic.show_icon(IconNames.HAPPY) basic.forever(on_forever)
```

Choose the correct answer:

- A. To make the icon show forever
- B. To continuously check for movement gestures
- C. To make the micro:bit shake
- D. To prevent errors

7. You want to create a step counter that shows a number each time you shake the micro:bit. What programming concept do you need besides gestures?

MULTIPLE CHOICE

def on_forever(): if input.is_gesture(Gesture.SHAKE): # What concept goes here? basic.forever(on_forever)

Choose the correct answer:

- A. A for loop
- B. A variable to count steps
- C. Multiple if statements
- D. A temperature sensor

8. Which gesture would be most appropriate for creating a "level" tool that shows when a surface is flat?

MULTIPLE CHOICE

Choose the correct answer:

- A. SHAKE
- B. FREE_FALL
- C. TILT_LEFT and TILT_RIGHT
- D. LOGO_UP

9. What safety concern does the passage mention about the FREE_FALL gesture?

MULTIPLE CHOICE

Choose the correct answer:

- A. It might not work in the simulator
- B. It uses too much battery
- C. The micro:bit could break if dropped
- D. It interferes with other gestures

10. You want to create an orientation display that shows different arrows based on how the micro:bit is positioned. Which combination of gestures would work best?

MULTIPLE CHOICE

Choose the correct answer:

- A. SHAKE and FREE_FALL
- B. LOGO_UP, LOGO_DOWN, SCREEN_UP, SCREEN_DOWN
- C. Only TILT_LEFT and TILT_RIGHT
- D. Only SHAKE

Robotics Challenges (5)

1. Is it Shaking?

Challenge

Textbook

Is it Shaking?

Create a program that will let the user know if it's shaking or not. If it is shaking, display the **YES** icon. If it's not shaking, display the **NO** icon.

Requirements

- ☐ Create the forever function
- ☐ Create an if statement to see if the gesture is SHAKE.
- ☐ If the gesture is SHAKE, display the icon named YES.
- ☐ Else (if the gesture is not SHAKE), show the icon named NO.

Answer Key

Step 1

Create the forever function

Is it Shaking? Step 1 of 4



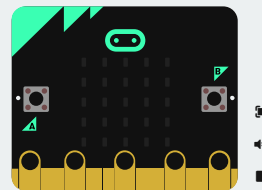
1

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```
1 def on_forever():
2     pass
3     basic.forever(on_forever)
4
```



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2. Richter Scale

Challenge

Textbook

Richter Scale

The Richter scale is used to measure how big earthquakes are.

Earthquakes that measure a 1 or 2 are mild and often go unnoticed.

Earthquakes that measure a 3 or 4 are felt with some slight shaking of buildings.

Earthquakes that measure a 5 or 6 are strong and can cause some damage to buildings.

Earthquakes that measure a 7 or above are major and cause great destruction.

Create a program that will display a number based on the kind of movement it registers.

If the gesture is **SCREEN_UP**, it will display the number **2**.

If the gesture is **TILT_LEFT**, it will display the number **4**.

If the gesture is **SHAKE**, it will display the number **6**.

If the gesture is **FREE_FALL**, it will display the number **8**. (Note: this motion cannot be seen on the

Basic

start

forever

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3. Screen Wake Up

Challenge

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Screen Wake Up

Have you ever seen a phone or device light up when it's turned over or moved? Create a program with the micro:bit that is similar.

If the micro:bit gesture is **LOGO_DOWN**, it will clear the screen.

Else, it will turn on all of its LED lights.

Step 1

Create the forever function

Screen Wake Up Step 1 of 3

1

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```
1 def on_forever():
2     pass
3     basic.forever(on_forever)
4
```

Requirements

Create the forever function

If the gesture is **LOGO_DOWN**, clear the screen

Else, show all the LED lights on.

Answer Key

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4. Tilt Animation

Challenge

Textbook

Tilt Animation

Create an animation that responds when the micro:bit is tilted to the left or right.

For example, you could show a ball that moves to the left and flattens against the side of the screen when the micro:bit tilts to the left. It would do the same on the right side when the micro:bit tilts to the right.

Requirements:

Have at least 3 images show for an animation on each side.

Requirements

- ☐ Create the forever function
- ☐ If the gesture is TILT_LEFT, show at least 3 images
- ☐ elif the gesture is TILT_RIGHT, show at least 3 images

Step 1

Create the forever function

Tilt Animation Step 1 of 4



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```
1 def on_forever():
2     pass
3     basic.forever(on_forever)
4
```

5. Frying Pan

Challenge

Textbook

Frying Pan

Create a program that looks like an egg in a frying pan. Start with just a single light showing in the center of the micro:bit. This light will be the egg. The egg will start small and spread out bigger when the micro:bit shakes.

If the gesture is SHAKE, the light will spread out to be a wider circle. Add a total of 2 images showing a spreading circle if the gesture is SHAKE.

Pause the widest circle for 2000 ms.

Else, the light in the center will show.

Requirements

- ☐ Create the forever function
- ☐ If the gesture is SHAKE, show at least 2 images
- ☐ After the two images, pause for 2000 ms

Step 1

Create the forever function

Frying Pan Step 1 of 4



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```
1 def on_forever():
2     pass
3     basic.forever(on_forever)
4
```

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Answer Keys & Solutions

Questions

1. What will happen when you shake the micro:bit while running this code?

MULTIPLE CHOICE

Correct Answer:

- | | |
|-----------------------------------|-------------|
| A. Nothing happens | ✗ Incorrect |
| B. SILLY icon shows once | ✗ Incorrect |
| C. SILLY icon shows while shaking | ✓ Correct |
| D. Error occurs | ✗ Incorrect |

Explanation:

The forever loop keeps checking for the shake gesture, so the icon displays during the shaking motion.

2. You want to create a digital dice that shows a random number when you shake the micro:bit. What should you replace in this code?

MULTIPLE CHOICE

Correct Answer:

- | | |
|--|-------------|
| A. Replace Gesture.SHAKE with a different gesture | ✗ Incorrect |
| B. Replace basic.show_icon(IconNames.SILLY) with a random number command | ✓ Correct |
| C. Replace the forever function | ✗ Incorrect |
| D. Replace the if statement with a for loop | ✗ Incorrect |

Explanation:

Keep the shake gesture but change what happens when you shake it.

3. A student wants their micro:bit to beep when tilted left and show a heart when tilted right. What code structure do they need?

MULTIPLE CHOICE

Correct Answer:

- A. One if statement with TILT_LEFT ✗ Incorrect
- B. Two separate forever functions ✗ Incorrect
- C. One forever function with if and elif statements ✓ Correct
- D. A for loop with gesture commands ✗ Incorrect

Explanation:

Multiple different gestures need different conditions within the same forever loop.

4. What is wrong with this code?

MULTIPLE CHOICE

Correct Answer:

- A. Wrong gesture command ✗ Incorrect
- B. Missing indentation for the if statement and its contents ✓ Correct
- C. Should use elif instead of if ✗ Incorrect
- D. Missing quotation marks ✗ Incorrect

Explanation:

Both the if statement and the code inside it need proper indentation inside the forever function.

5. You want to create a magic 8-ball that shows different messages based on how you move it. Which gestures would work best for different responses?

MULTIPLE CHOICE

Correct Answer:

- A. Only use SHAKE for all responses ✗ Incorrect
- B. Use SHAKE, TILT_LEFT, and TILT_RIGHT for different messages ✓ Correct
- C. Use only LOGO_UP and LOGO_DOWN ✗ Incorrect
- D. Use only SCREEN_UP and SCREEN_DOWN ✗ Incorrect

Explanation:

Different gestures can trigger different responses, making the magic 8-ball more interactive.

6. Why does the accelerometer need to be inside a forever function?

MULTIPLE CHOICE

Correct Answer:

- A. To make the icon show forever ✗ Incorrect
- B. To continuously check for movement gestures ✓ Correct
- C. To make the micro:bit shake ✗ Incorrect
- D. To prevent errors ✗ Incorrect

Explanation:

The micro:bit needs to keep watching for gestures, not just check once.

7. You want to create a step counter that shows a number each time you shake the micro:bit. What programming concept do you need besides gestures?

MULTIPLE CHOICE

Correct Answer:

- A. A for loop ✗ Incorrect
- B. A variable to count steps ✓ Correct
- C. Multiple if statements ✗ Incorrect
- D. A temperature sensor ✗ Incorrect

Explanation:

You need to store and update a count each time the shake gesture is detected.

8. Which gesture would be most appropriate for creating a "level" tool that shows when a surface is flat?

MULTIPLE CHOICE

Correct Answer:

A. SHAKE

✗ Incorrect

B. FREE_FALL

✗ Incorrect

C. TILT_LEFT and TILT_RIGHT

✓ Correct

D. LOGO_UP

✗ Incorrect

Explanation:

A level tool needs to detect when something is tilting away from being perfectly flat.

9. What safety concern does the passage mention about the FREE_FALL gesture?

MULTIPLE CHOICE

Correct Answer:

A. It might not work in the simulator

✗ Incorrect

B. It uses too much battery

✗ Incorrect

C. The micro:bit could break if dropped

✓ Correct

D. It interferes with other gestures

✗ Incorrect

Explanation:

The passage specifically warns about being careful and using padding when testing FREE_FALL.

10. You want to create an orientation display that shows different arrows based on how the micro:bit is positioned. Which combination of gestures would work best?

MULTIPLE CHOICE

Correct Answer:

A. SHAKE and FREE_FALL

✗ Incorrect

B. LOGO_UP, LOGO_DOWN, SCREEN_UP, SCREEN_DOWN

✓ Correct

C. Only TILT_LEFT and TILT_RIGHT

✗ Incorrect

D. Only SHAKE

✗ Incorrect

Explanation:

Orientation means position or direction, so you need gestures that detect different ways the micro:bit is facing.