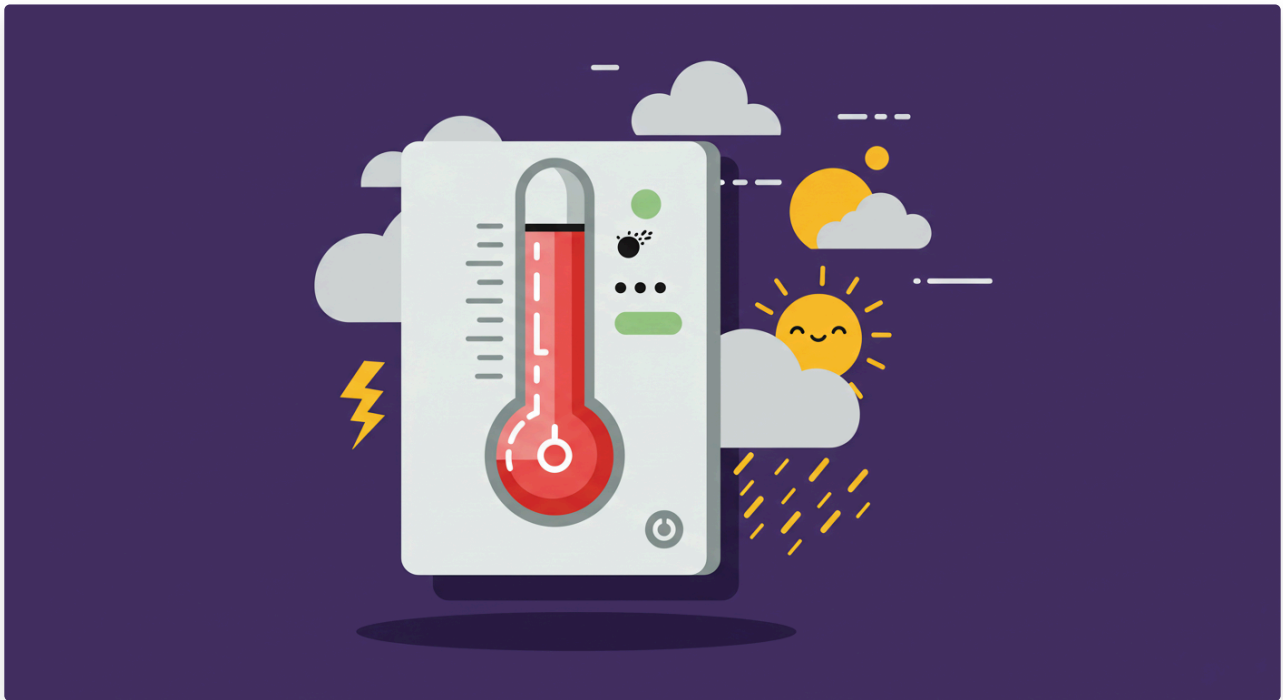


Temperature Conditionals

Textbook

Temperature Conditionals



Now let's program the micro:bit to respond to changes in temperature. As a review, we need to create a variable named `temp` and set it equal to the current temperature. This is done with the following code.

```
1 temp = input.temperature()
```

Now we want the micro:bit to display different things with different temperatures. We will do this with an if statement. If the temperature is cold, it will display the `SAD` icon. Else, it will display the `HAPPY` icon.

To do this, we will need to use a comparison statement. These comparison statements are called [conditionals](#). You've probably seen these before in math class, but we'll go over them again here:

- Greater than: `>`
- Greater than or equal to: `>=`
- Less than: `<`
- Less than or equal to: `<=`

Like in math, you can check to see if a number is greater than, less than, greater than or equal to, or less than or equal to another number. You do this with the same symbols as math. You can also check if two values are equal or not equal.

Conditionals with Temperature

Now let's check to see if the current temperature is less than 20. (20 degrees Celsius is a common room temperature.) If the current temperature is less than 20, we will display the `SAD` icon. If the current temperature is greater than `20`, we will display the `HAPPY` icon.

You can see how this is done below.

```
1 def on_forever():
2     temp = input.temperature()
3     if temp < 20:
4         basic.show_icon(IconNames.SAD)
5     else:
6         basic.show_icon(IconNames.HAPPY)
7 basic.forever(on_forever)
8
```

Notice how the variable named `temp` is used. If `temp < 20`, then the `SAD` icon is shown.

Play around with different temperatures! You might consider putting the micro:bit in the fridge or out in the sun to see the different temperature changes.

Check if Two Values are Equal

IMPORTANT!! If you want to check to see if a piece of data is equal to another piece of data, you can compare them by putting **two equal signs (==) between them**. A common mistake new programmers make is forgetting two equals signs and only using one when checking if two things are equal, so watch out!

```
1 def on_forever():
2     temp = input.temperature()
3     if temp == 20:
4         basic.show_icon(IconNames.SAD)
5     else:
6         basic.show_icon(IconNames.HAPPY)
7 basic.forever(on_forever)
8
```

Adopted from microbit.org platform

Math with Code

When working with numbers in your code, it's important to remember the [order of operations](#), which tells you the correct sequence for solving a math problem. This is the same rule you use in math class!

Here's the order to follow:

1. **Parentheses ()** - Do calculations inside parentheses first.
2. **Exponents (^)** - Next, do any exponentiation (like squaring a number).
3. **Multiplication and Division (* /)** - Then, do multiplication and division from left to right.

4. **Addition and Subtraction (+ -)** – Finally, do addition and subtraction from left to right.

For example, let's say you want to use math with temperature:

```
1 temp = input.temperature()
2 result = (temp + 5) * 2
3
```

In this code, the parentheses around `(temp + 5)` make sure that **addition** happens before the **multiplication**. So, the micro:bit first adds 5 to the temperature, then multiplies the result by 2.

Using the correct order helps make sure your program calculates things the right way every time!

Critical Thinking Questions

- Imagine you are programming a smart home system. How would you use conditional statements (like "if this, then that") to control a thermostat, so it automatically turns on the heat when it's too cold, or the air conditioning when it's too hot, based on specific temperature ranges?
- In mathematics, we follow an "order of operations" (like PEMDAS/BODMAS) to solve problems correctly. Why is it equally important for a computer program to follow a specific order when performing calculations involving multiple steps, and what could go wrong if it didn't?
- Consider a scenario where a drone needs to decide whether to land or keep flying based on its battery level and wind speed. How would you set up a series of comparison statements (e.g., greater than, less than, equal to) to guide the drone's decision-making process for a safe operation?

Questions (10)

1. What will show on screen when you run this code in a room that is 18 degrees Celsius?

MULTIPLE CHOICE

```
def on_forever(): temp = input.temperature() if temp < 20: basic.show_icon(IconNames.SAD) else:
basic.show_icon(IconNames.HAPPY) basic.forever(on_forever)
```

Choose the correct answer:

- A. SAD icon
- B. HAPPY icon
- C. Both icons
- D. No icon

2. What will happen when this code runs?

```
def on_forever(): temp = input.temperature() if temp = 22: basic.show_icon(IconNames.HEART) else:  
basic.show_icon(IconNames.SKULL) basic.forever(on_forever)
```

Choose the correct answer:

- A. Shows HEART when temperature is exactly 22
- B. Shows SKULL when temperature is not 22
- C. The code will have an error
- D. Shows both icons

3. You want to create a hot weather alert that shows "HOT" when temperature is 30 degrees or higher. Which comparison operator should you use?

MULTIPLE CHOICE

```
def on_forever(): temp = input.temperature() if temp _____ 30: basic.show_string("HOT") basic.forever(on_forever)
```

Choose the correct answer:

- A. temp > 30
- B. temp >= 30
- C. temp < 30
- D. temp == 30

4. What will this code calculate if the temperature is 25 degrees?

```
temp = input.temperature() result = (temp + 5) * 2
```

Choose the correct answer:

- A. 35
- B. 55
- C. 60
- D. 30

5. You want to show different icons for three temperature ranges: cold (below 15), comfortable (15-25), and hot (above 25). What code structure do you need?

MULTIPLE CHOICE

Choose the correct answer:

- A. One if statement
- B. if and else statements
- C. if, elif, and else statements
- D. Only elif statements

6. You want to check if the temperature is between 18 and 22 degrees (including both 18 and 22). How should you write this condition?

MULTIPLE CHOICE

Choose the correct answer:

- A. if temp > 18 and temp < 22:
- B. if temp >= 18 and temp <= 22:
- C. if temp == 18 or temp == 22:
- D. if temp > 18 or temp < 22:

7. What will happen when this code runs with the order of operations? If temp is 20, what will result be?

MULTIPLE CHOICE

temp = input.temperature() result = temp + 10 * 2

Choose the correct answer:

- A. 60
- B. 40
- C. 30
- D. 200

8. You want to create a freezing alert that shows "FREEZE" only when the temperature is exactly 0 degrees. Which comparison should you use?

MULTIPLE CHOICE

Choose the correct answer:

- A. if temp < 0:
- B. if temp <= 0:
- C. if temp == 0:
- D. if temp >= 0:

9. You want to convert Celsius to Fahrenheit using the formula $F = (C * 9/5) + 32$. How should you write this to ensure correct order of operations?

MULTIPLE CHOICE

temp_celsius = input.temperature() temp_fahrenheit = ?

Choose the correct answer:

- A. temp_celsius * 9 / 5 + 32
- B. (temp_celsius * 9) / 5 + 32
- C. temp_celsius * (9 / 5) + 32
- D. All of these work the same way

10. Debug the following code:

DEBUG CODE

Code to Debug:

```
1 on_forever():
2     temp = input.temperature()
3     if temp == 20:
4         basic.show_icon(IconNames.SAD)
5     else:
6         basic.show_icon(IconNames.HAPPY)
7 basic.forever(on_forever)
```

Robotics Challenges (5)

1. T Shirt or Umbrella

Challenge

Textbook

T Shirt or Umbrella

Create a program that will display the **TSHIRT** icon if the temperature is greater than 20. If not, it will show the **UMBRELLA** icon.

Requirements

- Create the forever function
- Inside the forever function, create a variable named temp.
- Create an if statement to check if the variable named temp is greater than 20
- If the variable named temp is greater than 20, display the icon named TSHIRT
- Else, show the icon named UMBRELLA

Step 1

Create the forever function

T Shirt or Umbrella Step 1 of 5

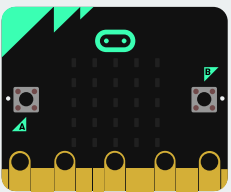
1

Next

Toolbox

Search

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



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2. Heat Warning and Cold Warning

Challenge

Textbook

Heat Warning and Cold Warning

Have you ever been using a phone or other device on a hot day? Have you ever gotten an alert saying that the device is too hot or too cold? Let's practice making that program on the micro:bit.

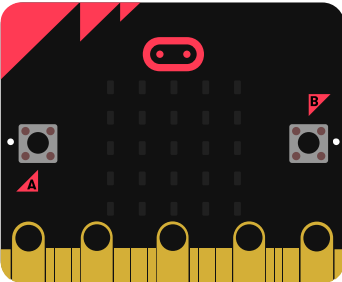
Create a program that displays the string **Heat Warning!** if the temperature is over 30.

It will display the string **Cold Warning!** if the temperature is under 10.

Else, it will display the **HAPPY** icon.

Requirements

- Create the forever function
- Inside the forever function, create a variable named temp.
- Create an if statement to check if the



Search

Basic

start

forever

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3. Fever Warning

Challenge

Textbook

Fever Warning

Have you ever been sick and had your temperature taken? Thermometers are used to see what your body temperature is. A normal body temperature is 37.8 degrees Celsius. If your body temperature measures higher than that, you have a fever.

Create a program that flashes the **NO** icon 4 times if the temperature is higher than 37.8 degrees Celsius.

Use the **for index in range()** code to repeat the following commands:

1. Display the **NO** icon.
2. Clear the screen
3. Pause for **500 ms**
4. Else, if the temperature is not higher than 37.8, display the icon named **SMALL_HEART**

Requirements

- Create the forever function

Step 1

Create the forever function

Fever Warning Step 1 of 8



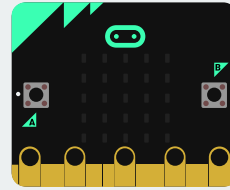
1

Next

Toolbox

Search

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



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4. Fire and Ice

Challenge

Textbook

Fire and Ice

Create a program that shows an animation that looks like fire if the temperature is above 35. Else if the temperature is below 5 it will show icicles growing.

The fire animation needs to be in for loop to repeat 5 times.

The icicles animation needs to be in a different for loop to repeat 5 times.

Reminder that second for loop in a program needs to be named for **index2 in range()**

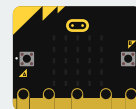
Else, it will show the **SMALL_SQUARE** icon.

Requirements

- Create the forever function
- Inside the forever function, create a variable named temp.
- Create an if statement to check if the

Search

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



Explorer

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5. Icon Thermometer

Challenge

Textbook

Icon Thermometer

Create a program that shows certain icons if the temperature is something specific.

If the temperature is equal to 50, it will show the **HEART** icon.

If the temperature is equal to 40, it will show the **FABULOUS** icon.

If the temperature is equal to 30, it will show the **TORTOISE** icon.

If the temperature is equal to 20, it will show the **BUTTERFLY** icon.

If the temperature is equal to 10, it will show the **GIRAFFE** icon.

Else, it will show the **HAPPY** icon.

Reminder! When checking if something is equal to another thing, you must use TWO EQUALS SIGNS. ==

One equals sign is used for creating variables in Python.

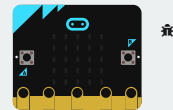
Requirements

Create the forever

Download

Q

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



Explorer

Answer Keys & Solutions

Questions

1. What will show on screen when you run this code in a room that is 18 degrees Celsius?

MULTIPLE CHOICE

Correct Answer:

- | | |
|---------------|-------------|
| A. SAD icon | ✓ Correct |
| B. HAPPY icon | ✗ Incorrect |
| C. Both icons | ✗ Incorrect |
| D. No icon | ✗ Incorrect |

Explanation:

Compare 18 with 20 using the less than symbol to see which condition is true.

2. What will happen when this code runs?

MULTIPLE CHOICE

Correct Answer:

- | | |
|---|-------------|
| A. Shows HEART when temperature is exactly 22 | ✗ Incorrect |
| B. Shows SKULL when temperature is not 22 | ✗ Incorrect |
| C. The code will have an error | ✓ Correct |
| D. Shows both icons | ✗ Incorrect |

Explanation:

Remember that checking if two values are equal requires two equal signs, not one.

3. You want to create a hot weather alert that shows "HOT" when temperature is 30 degrees or higher. Which comparison operator should you use?

MULTIPLE CHOICE

Correct Answer:

A. temp > 30

✗ Incorrect

B. temp >= 30

✓ Correct

C. temp < 30

✗ Incorrect

D. temp == 30

✗ Incorrect

Explanation:

"30 degrees or higher" means the temperature can be exactly 30 or greater than 30.

MULTIPLE CHOICE

4. What will this code calculate if the temperature is 25 degrees?

Correct Answer:

A. 35

✗ Incorrect

B. 55

✗ Incorrect

C. 60

✓ Correct

D. 30

✗ Incorrect

Explanation:

Follow the order of operations – parentheses first, then multiplication.

5. You want to show different icons for three temperature ranges: cold (below 15), comfortable (15-25), and hot (above 25). What code structure do you need?

MULTIPLE CHOICE

Correct Answer:

A. One if statement

✗ Incorrect

B. if and else statements

✗ Incorrect

C. if, elif, and else statements

✓ Correct

D. Only elif statements

✗ Incorrect

Explanation:

Three different conditions require if, elif, and else to cover all possibilities.

6. You want to check if the temperature is between 18 and 22 degrees (including both 18 and 22). How should you write this condition?

MULTIPLE CHOICE

Correct Answer:

A. if temp > 18 and temp < 22:

✗ Incorrect

B. if temp >= 18 and temp <= 22:

✓ Correct

C. if temp == 18 or temp == 22:

✗ Incorrect

D. if temp > 18 or temp < 22:

✗ Incorrect

Explanation:

"Including both 18 and 22" means you need greater than or equal to and less than or equal to.

7. What will happen when this code runs with the order of operations? If temp is 20, what will result be?

MULTIPLE CHOICE

Correct Answer:

A. 60

✗ Incorrect

B. 40

✓ Correct

C. 30

✗ Incorrect

D. 200

✗ Incorrect

Explanation:

Multiplication happens before addition, so calculate $10 * 2$ first, then add to temp.

8. You want to create a freezing alert that shows "FREEZE" only when the temperature is exactly 0 degrees. Which comparison should you use?

MULTIPLE CHOICE

Correct Answer:

- A. if temp < 0: ✗ Incorrect
- B. if temp <= 0: ✗ Incorrect
- C. if temp == 0: ✓ Correct
- D. if temp >= 0: ✗ Incorrect

9. You want to convert Celsius to Fahrenheit using the formula $F = (C * 9/5) + 32$. How should you write this to ensure correct order of operations?

MULTIPLE CHOICE

Correct Answer:

- A. temp_celsius * 9 / 5 + 32 ✗ Incorrect
- B. (temp_celsius * 9) / 5 + 32 ✗ Incorrect
- C. temp_celsius * (9 / 5) + 32 ✗ Incorrect
- D. All of these work the same way ✓ Correct

Explanation:

Multiplication and division have the same priority and are calculated left to right, so these expressions are equivalent.

10. Debug the following code:

DEBUG CODE

Incorrect Code:

```
1 on_forever():
2     temp = input.temperature()
3     if temp == 20:
4         basic.show_icon(IconNames.SAD)
5     else:
6         basic.show_icon(IconNames.HAPPY)
7 basic.forever(on_forever)
```

Correct Solution:

```
1 def on_forever():
2     temp = input.temperature()
3     if temp == 20:
4         basic.show_icon(IconNames.SAD)
5     else:
6         basic.show_icon(IconNames.HAPPY)
```

```
7 basic.forever(on_forever)
```

Explanation:

This code is missing def