Unit 7 · Physical Computing

WORKSHEET

Full marks 30

Name _____ Class _____ Roll no. ____ Date _____ Marks _____ / 30

1 Key words [4]

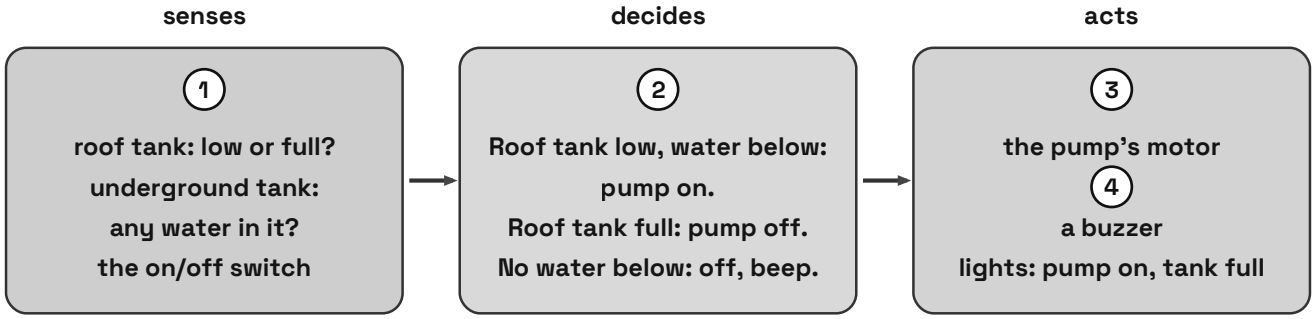
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

analog	breadboard	digital	microcontroller	octave	physical computing	polling	relay	sensor	threshold

Writing programs for computers that sense the world around them and act on it is called _____. A small computer on one chip, usually running one program over and over, is a _____. A _____ measures something by itself, such as how bright or how hot it is. A _____ is a switch worked by electricity, so that a small current can switch on the big current a pump needs. Checking an input again and again in a loop is called _____. An input that is either on or off, like a button, is _____; a quantity that can take any value in a range, like the temperature, is _____. The number a reading is compared with, to decide between two actions, is a _____.

2 Label the diagram [2]

The diagram shows a water level controller as inputs → program → outputs. Write what belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. In a smoke alarm, which is the output? [1]

a. the smoke sensor **b.** the program

c. the loud beeper **d.** the smoke

ii. Which line lights the bottom-right LED as brightly as it can? **[1]**

a. `display.set_pixel(5, 5, 9)` **b.** `display.set_pixel(4, 4, 9)`

c. `display.set_pixel(4, 4, 10)` **d.** `display.set_pixel(0, 4, 9)`

iii. What does `sleep(250)` do? **[1]**

a. waits 250 seconds **b.** waits a quarter of a second

c. switches the board off for 250 minutes **d.** lights 250 LEDs

iv. Which is an analog quantity? **[1]**

a. whether a door is open or shut **b.** how much water is in a tank

c. whether a button is pressed **d.** whether a light is on or off

v. Note A in octave 4 (`"a4"`) has a frequency of 440 Hz. What is the frequency of `"a5"`, one octave higher? **[1]**

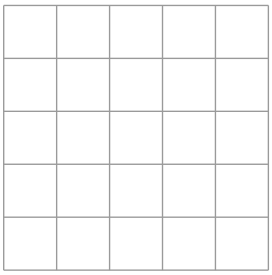
a. 445 Hz **b.** 540 Hz

c. 880 Hz **d.** 220 Hz

4 Draw the LEDs **[2]**

Shade the squares for the LEDs that the program lights. One square is one LED: x goes across from 0 to 4, y goes down from 0 to 4.

```
1  from microbit import *
2
3  display.show(Image("09090:09090:00000:90009:09990"))
```



What picture is it?

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5 What does it print? **[2]**

A board saved these light readings while a drawer was opened and closed. Write exactly what the program prints, in the box under it.

```
1  readings = [0, 150, 160, 0, 0, 200, 0]
2  opened = 0
3  was_open = False
4  for light in readings:
5      is_open = light > 30
6      if is_open and not was_open:
7          opened = opened + 1
8      was_open = is_open
9  print("Opened", opened, "times")
```

```
OUTPUT
```

6 Trace the program [4]

This program decides when a night light should be on, with two thresholds so that it doesn't flicker. Fill in the trace table: one row for each time round the loop.

```
on = False
for light in [55, 38, 45, 52, 61, 50]:
    if light < 40:
        on = True
    elif light > 60:
        on = False
    print(light, on)
```

light	on	Output

7 Find and fix the bug [3]

Read Sanjay's first program for his drawer alarm, then answer.

The drawer is dark when shut (light 0) and light when open. Sanjay opens it once, holds it open for a second, and shuts it. When he presses A, the board shows a number much bigger than 1.

```
from microbit import *
import music

opened = 0
while True:
    if display.read_light_level() > 30:
        opened = opened + 1
        music.pitch(880, 50)
    if button_a.was_pressed():
        display.scroll(opened)
    sleep(100)
```

i. Why is one opening counted many times?

ii. What must the program remember to count each opening once?

iii. Which lines would you change, and how?

8 Write a program [3]

Write the program on the lines. Any program that does the job gets the marks.

Write a program for the board that shows `Image.YES` while button A is held, `Image.NO` while button B is held, and nothing when neither is pressed.

9 Short answers [3]

Write short answers to the following questions.

What is the difference between `button_a.is_pressed()` and `button_a.was_pressed()`? Give a device for which each is the right choice.

10 Think [2]

Think, then answer.

Ram makes a night light with `if light < 50:`. At home it works well. He takes the same board to his grandmother's house, where it comes on in the middle of the afternoon. Why might this happen, and how should Ram choose the threshold there?

11 Activity: Inputs → program → outputs at home (not marked)

Find three devices at home or at school that sense something and act on it (a rice cooker, a traffic light, a water level controller…). Write each one's inputs, rules and outputs.

Device	Inputs	The rules (when … then …)	Outputs