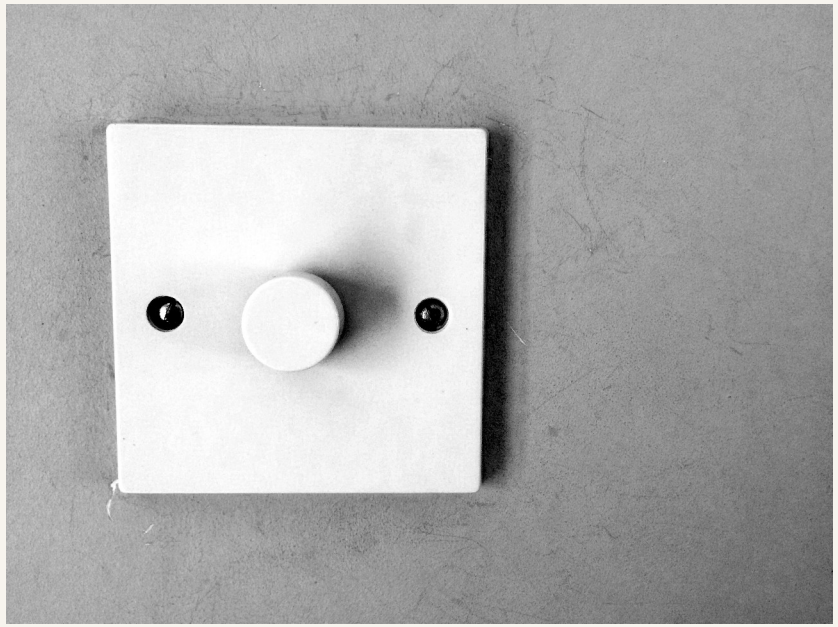
Digital Signals and Logic States

A pin on your Uno is 5 V or 0 V.
Nothing in between.



National 5 Engineering Science

Daily Review



1. **State** what **pause 500** does.
2. **State** the flowchart **symbol** for a **decision**.
3. **State** one **microcontroller** advantage.
4. Dark: **state** what an **LDR**'s resistance does.
5. **State** the **unit** of **power**.

By the end of this lesson...



1. I can **describe** the difference between **analogue** and **digital** signals
2. I can **identify logic 1** (high) and **logic 0** (low)
3. I can **give examples** of **digital input** and **output** devices

A dimmer and a light switch both control a lamp. What is different?

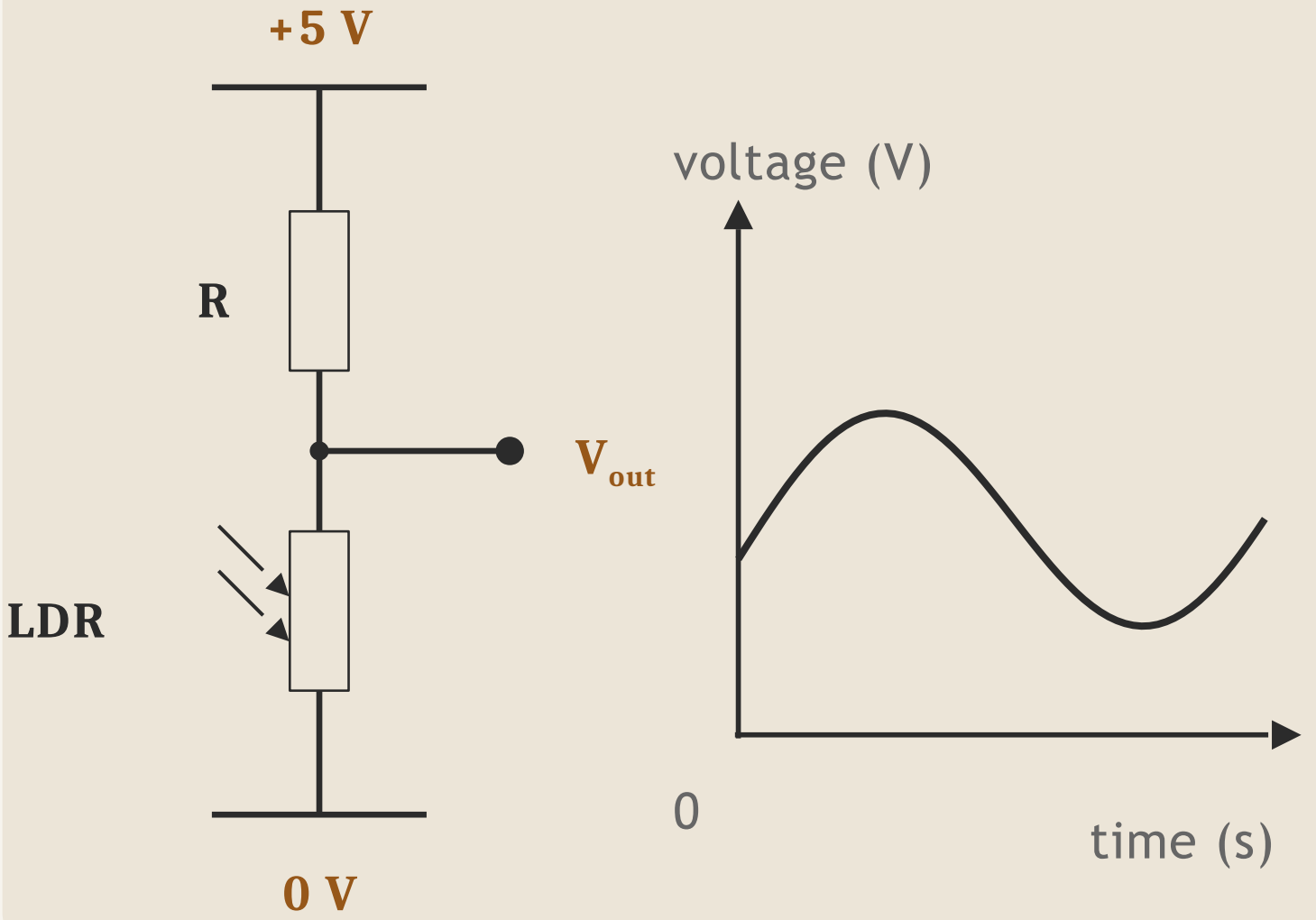
PHOTO:
a dimmer (awaiting approval)

Analogue Signals

Can take **any value** in a range.

Changes **smoothly**.

LDR divider: V_{out} **rises** as it gets **darker**.

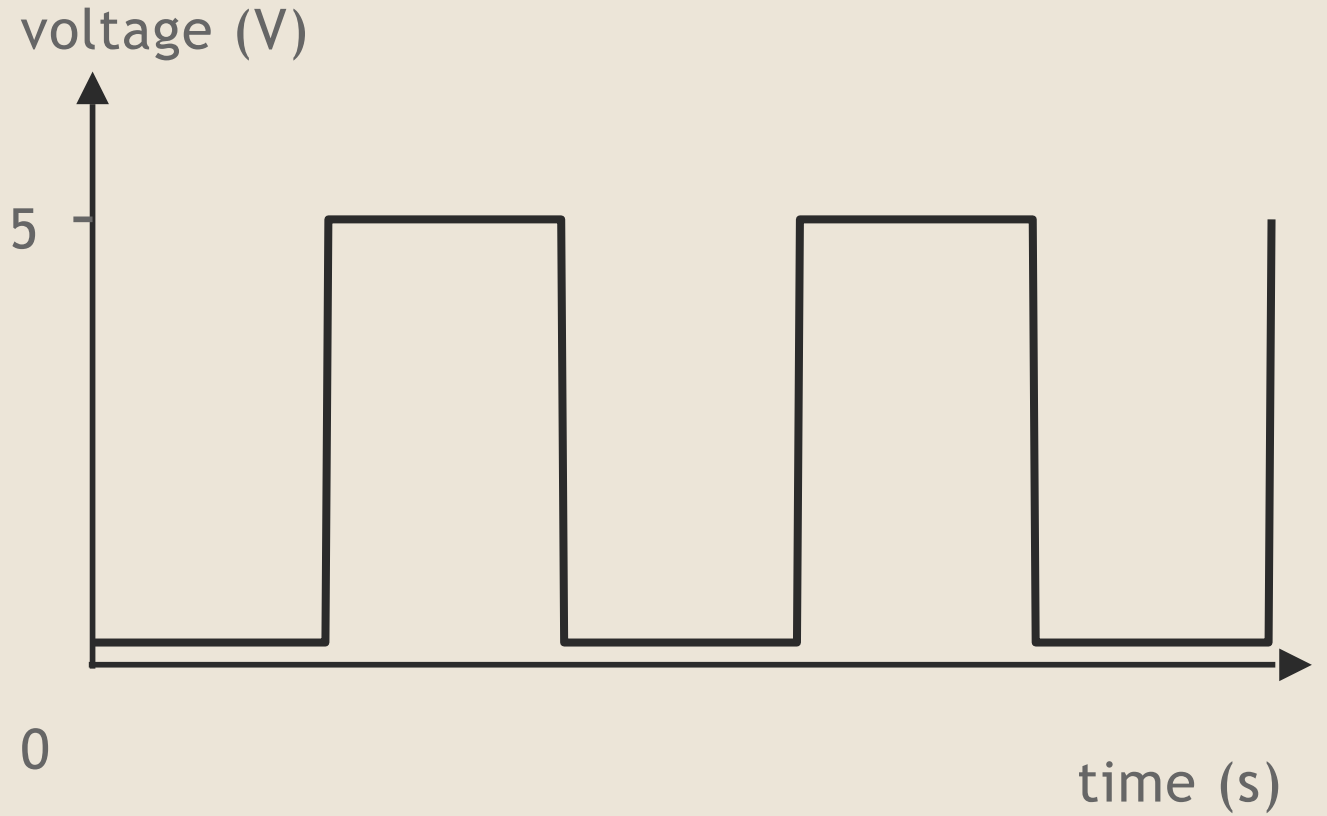


Digital Signals

Only **two values**.

ON or **OFF**, **HIGH** or **LOW**, **1** or **0**.

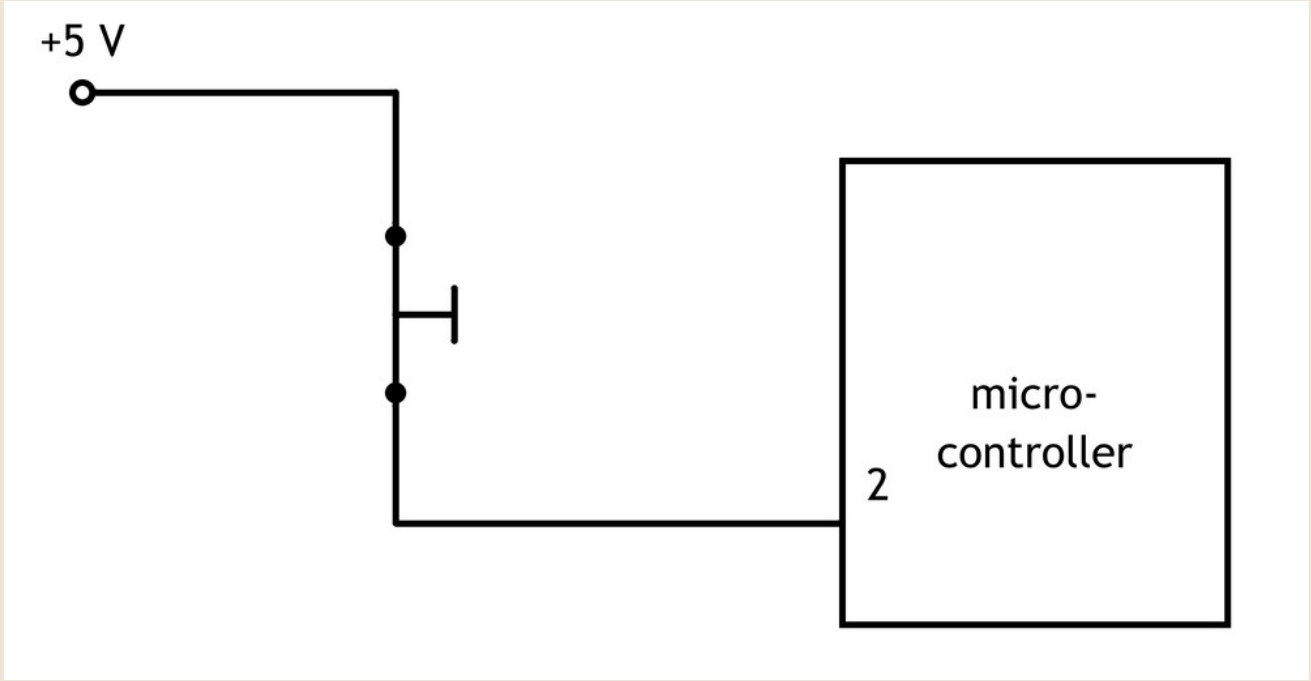
A **push switch**: pressed or not.



Logic 1 and Logic 0

Released: pin 2 near **0 V**: **logic 0** (low, off, false).

Pressed: pin 2 near **5 V**: **logic 1** (high, on, true).



Show Me: Analogue or Digital?

1. A **thermistor** voltage divider output. **State** which.
2. A **push button**. **State** which.
3. A **microphone** signal. **State** which.
4. A **limit switch**. **State** which.
5. A **volume** knob. **State** which.

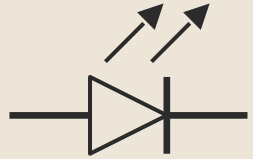
Digital Inputs and Outputs

Inputs give **1** or **0**: push button, limit switch, guard switch, infrared sensor.

Outputs are **on** or **off**: LED, buzzer, motor, relay.



switch



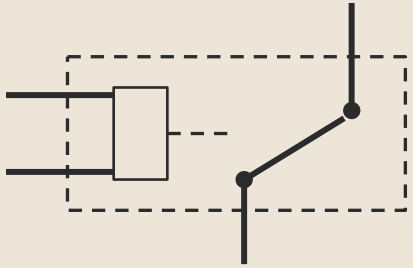
LED



buzzer



motor



relay



lamp

Show Me: State the Logic State

1. A **limit switch** is **touched**. **State** the logic state.
2. A **lamp** is **off**. **State** the logic state.
3. An **infrared** sensor **detects** a person. **State** the logic state.
4. A **pin** reads **0 V**. **State** the logic state.
5. A **relay** coil is **switched on**. **State** the logic state.

Task 1 (B4a-L1-p4)

Task 1

Complete the **Logic state** column.
Write **1** or **0** for each situation.

1. Digital Signals and Logic States

Analogue and Digital Signals

You met analogue signals in Booklet 3. An analogue signal can take any value within a range. A digital signal can only take one of two values: ON or OFF, HIGH or LOW, 1 or 0.

	Analogue	Digital
Number of values	many – changes smoothly	two – logic 1 or logic 0
Example	voltage from an LDR sensor	pushed/not pushed switch

Logic States

Logic state	Other names	Voltage
Logic 1	high, on, true	near supply voltage (e.g. 5 V)
Logic 0	low, off, false	near 0 V

TASK 1 – Logic States

Situation	Logic state (1/0)
A switch is being pressed.	
A switch is not being pressed.	
A guard sensor detects that the guard is in place.	
A buzzer is silent.	
A motor is running.	

Digital Inputs and Outputs

Type	Examples
Digital inputs	push button, limit switch, guard switch, infrared sensor (detected/not detected)
Digital outputs	lamp/LED on or off, buzzer on or off, motor on or off, relay on or off

Answers: Task 1

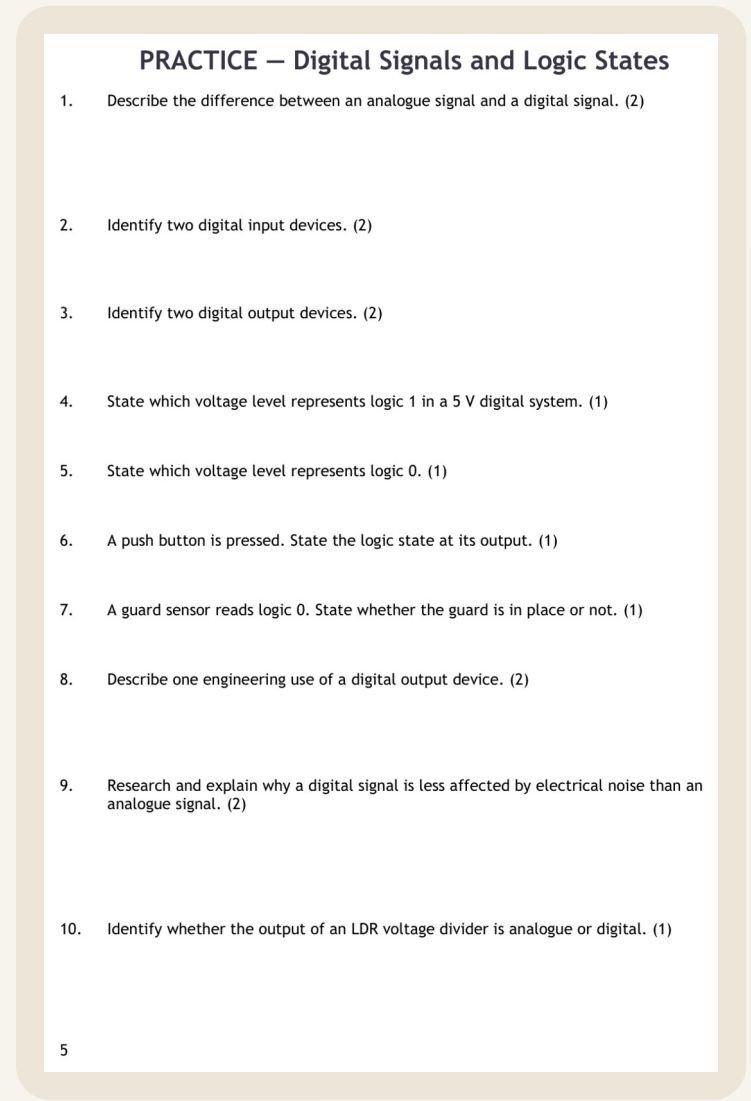


Situation	Logic state
A switch is being pressed.	1
A switch is not being pressed.	0
A guard sensor detects the guard is in place.	1
A buzzer is silent.	0
A motor is running.	1

Review Questions (Booklet page 5)

Review Questions

Answer Questions **1** to **10** on your own.
Question 9: explain it in your own words.



PRACTICE — Digital Signals and Logic States

1. Describe the difference between an analogue signal and a digital signal. (2)

2. Identify two digital input devices. (2)

3. Identify two digital output devices. (2)

4. State which voltage level represents logic 1 in a 5 V digital system. (1)

5. State which voltage level represents logic 0. (1)

6. A push button is pressed. State the logic state at its output. (1)

7. A guard sensor reads logic 0. State whether the guard is in place or not. (1)

8. Describe one engineering use of a digital output device. (2)

9. Research and explain why a digital signal is less affected by electrical noise than an analogue signal. (2)

10. Identify whether the output of an LDR voltage divider is analogue or digital. (1)

5

Answers: Review Questions (1 of 2)



Q	Mark 1	Mark 2
1	Analogue: **any value**	Digital: **two values**
2	Push button	Limit switch
3	LED or lamp	Buzzer
4	Near **5 V**	—
5	Near **0 V**	—

Answers: Review Questions (2 of 2)



Q	Mark 1	Mark 2
6	Logic **1**	–
7	Guard **not** in place	–
8	A **buzzer** sounds	to **warn** the user
9	Only **two** levels	so noise **can't flip** it
10	**Analogue**	–

Checkpoint

1. A pin reads **4.7 V** in a **5 V** system.
   State the **logic state**.

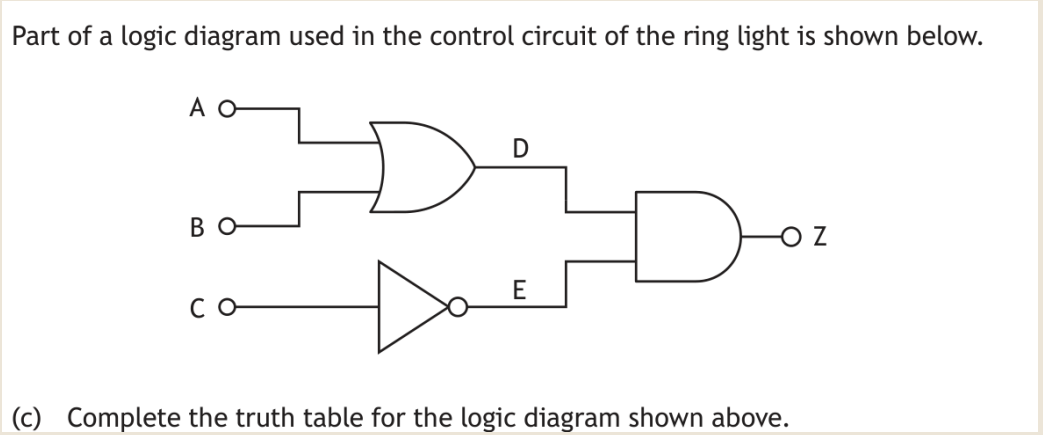
2. **State** another name for **logic 0**.

3. A motor is **off**. **State** its **logic state**.

Logic in the Exam

Year	Questions	Marks
2026	Q5, Q14(d)	6
2025	Q11(c), (d)	6
2024	Q1, Q12(c), Q14(c)	9
2023	Q3, Q12(f), (g)	8
2022	Q12(a), (b)	6

Scan the QR for every past paper by topic.



2025 Q11(c)

Look back — by the end of this lesson…



1. I can **describe** the difference between **analogue** and **digital** signals
2. I can **identify logic 1** (high) and **logic 0** (low)
3. I can **give examples** of **digital input** and **output** devices

Extension



1. A **3.3 V** microcontroller. **State** the voltage for **logic 1**.

2. **Explain** why one digital pin **cannot** work a **dimmer**.

Course Specification — 1 of 1

Digital electronic control systems

- AND, OR and NOT gates and combinations with up to three inputs, using truth tables, logic diagrams and Boolean expressions

Credits

Title: Photo: Paolomarco, CC BY-SA 4.0, Wikimedia Commons

Drawings: Gate symbols, logic diagrams and circuits drawn by R Stewart; booklet pages from Booklet 4a, Logic and Digital Control.

Logic in the Exam: © Qualifications Scotland (SQA). National 5 Engineering Science 2021-2026 question papers; figure 2025 Section 2, Q11

Course specification: © Qualifications Scotland (SQA). N5 Engineering Science course specification v2.0, p.5

R Stewart - November 2026