Pneumatics and Air Types

Turn this handle and the bus door opens by hand.



National 5 Engineering Science

Daily Review

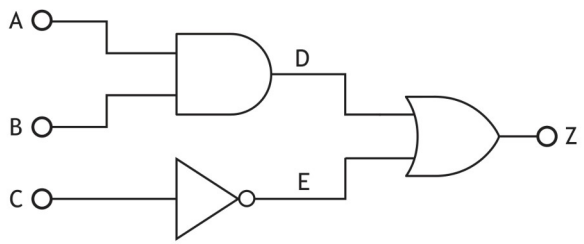


1	**AND** gate, A = 1 and B = 0. **State** Z.	0
2	**State** another name for a **NOT** gate.	Inverter
3	A **push button**. **State** analogue or digital.	Digital
4	**State** the **unit** of **force**.	Newton (N)
5	**State** the formula for **work done**.	$E_w = Fd$

Starter: Past Paper

14.

A different part of the food production process is controlled electronically. A logic diagram used in part of the control is shown.



(d) Complete the truth table, shown below, for this logic diagram. **3**

A	B	C	D	E	Z
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

Answer: Starter



<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>14.</td><td>(d)</td><td></td><td>
<table>
<tr><th>D</th><th>E</th><th>Z</th></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
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<tr><td>1</td><td>0</td><td>1</td></tr>
</table>
</td><td>3</td><td>1 mark for column D (A AND B).

1 mark for column E (NOT C).

1 mark for column Z (D OR E).
Apply FTE.</td></tr>
</table>

By the end of this lesson… (p.3)



1. I can **describe** what pneumatics is and **give** uses of it.
2. I can **name** the three air types: main air, pilot air and exhaust.
3. I can **describe** the function of main air and of pilot air.
4. I can **read** the pipes on a circuit: main air, pilot air, joined and crossing.
5. I can **follow** the safety rules for the pneumatics kit.

What has this handle done to the air in the door?

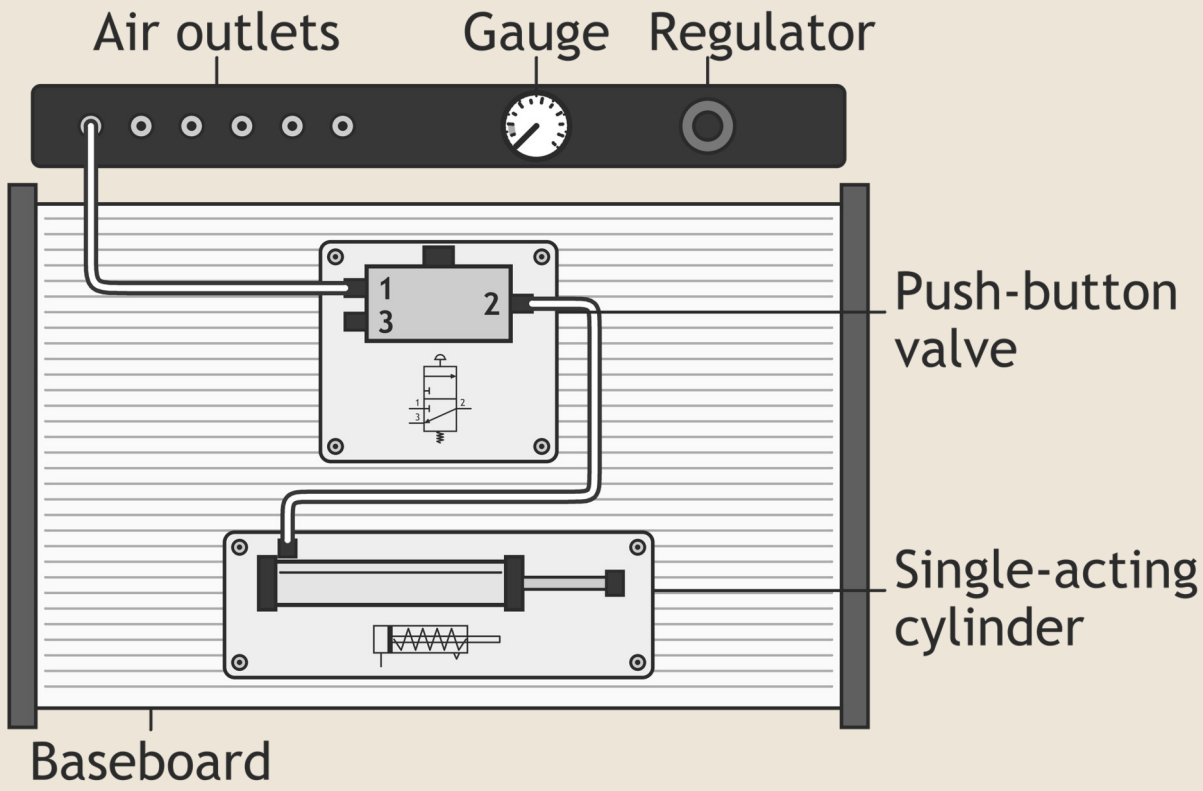


The Kit

The **regulator** sets the air **pressure**.
The **gauge** shows it.

The **valve** controls the air.

The **cylinder** moves.



Show Me: What Did You See?

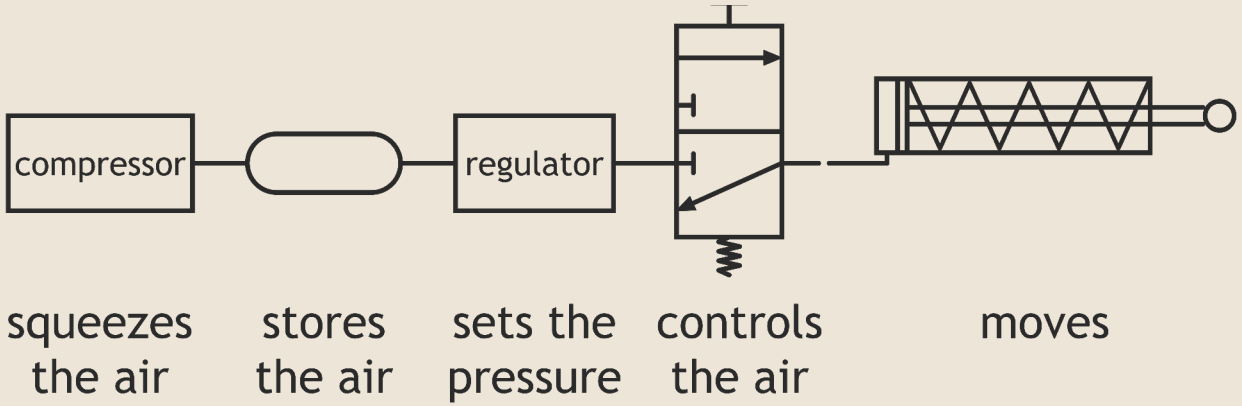
1. The button is **pressed**. **State** what the piston does.
2. The button is **released**. **State** what the piston does.
3. **State** what the **hiss** is.

Moves **out**

Moves back **in**

Used air **leaving**

What Is Pneumatics? (p.3)



Pneumatics uses **compressed** air to make things move.

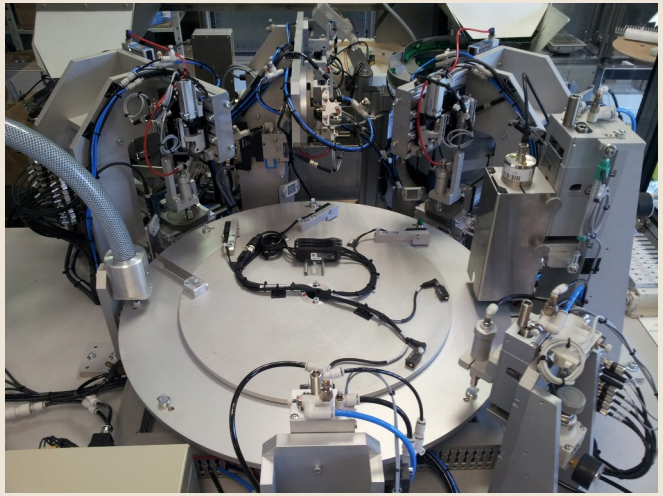
A **compressor** squeezes air and stores it in a **reservoir**.

A regulator sets the working **pressure** before the air reaches the circuit.

Where Pneumatics Is Used (p.3)

Pneumatics is used on **production** lines to push, clamp, lift and stamp products.

Bus and train doors and fairground rides also use **pneumatic** cylinders.

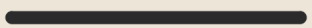




Air Types (p.3)

Symbol	Name	What it does
	**main air**	Main air operates a **cylinder**: it makes the piston outstroke or instroke.
	pilot air	Pilot air is a small air signal used to **actuate** a valve.
	**exhaust**	Exhaust is where used air leaves the circuit to the **atmosphere**.

Pipes on a Circuit (p.4)



main air pipe
A **solid** line carries main air.



pilot air pipe
A **dashed** line carries pilot air.



joined
A **dot** shows that the pipes are joined.



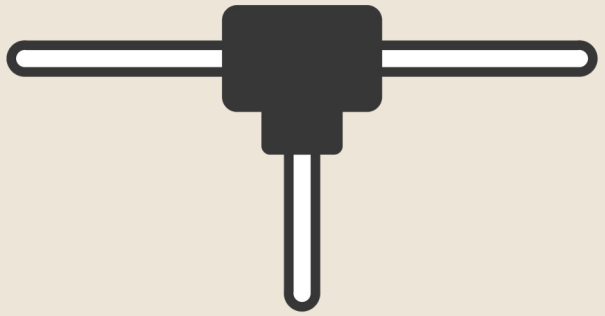
crossing
Pipes that cross without a dot are **separate** pipes.

Kit and Symbol

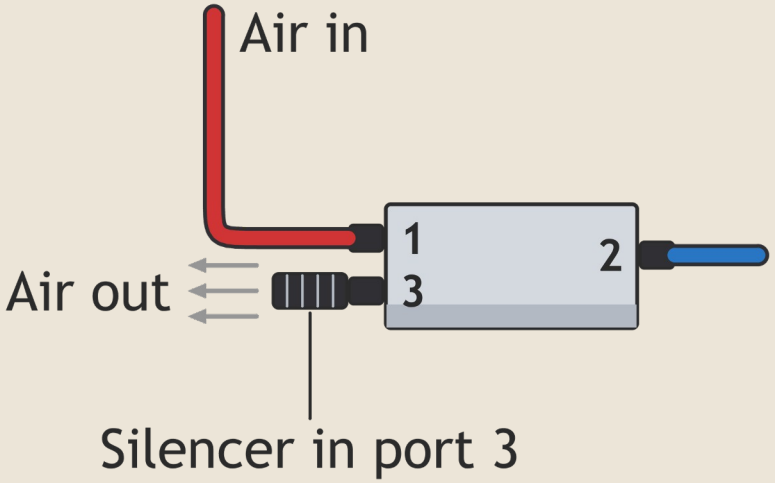
On the kit every pipe is a **blue tube**.

A **T-piece** joins pipes: a **dot** on paper.

The **silencer** in port 3 is the **exhaust**.









Show Me: Name the Symbol

1



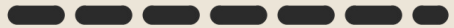
Main air

2



Exhaust

3



Pilot air pipe

4



Joined

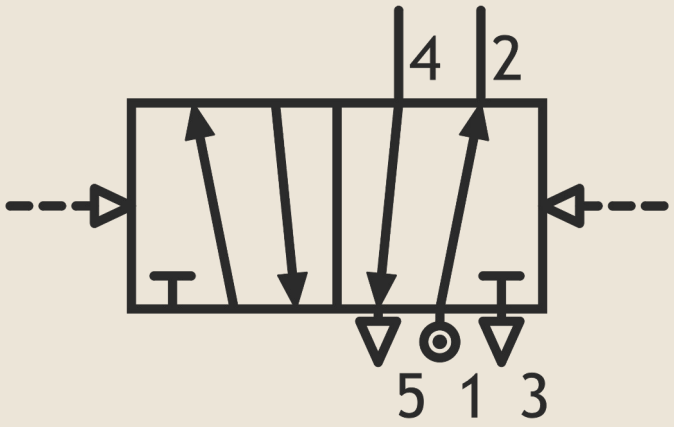
5



Crossing

Watch Out: Name Every Air Type

ON THE PAPER'S VALVE



2026: some candidates **did not name** these symbols.

THE CORRECT ANSWER



main air



exhaust



pilot air: dashed

Safety with the Kit (p.4)

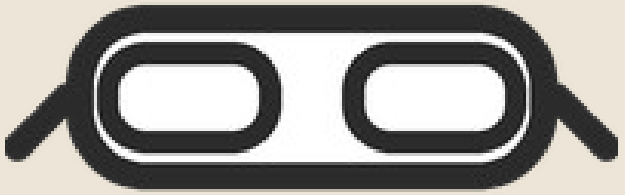
Wear **goggles** whenever the air is on.

Turn the air **off** before you connect or take apart any pipe.

Push each pipe fully **in** and pull gently to check it is held.

Never point a pipe or an exhaust at **anyone**.

Keep fingers clear of a **moving** piston.

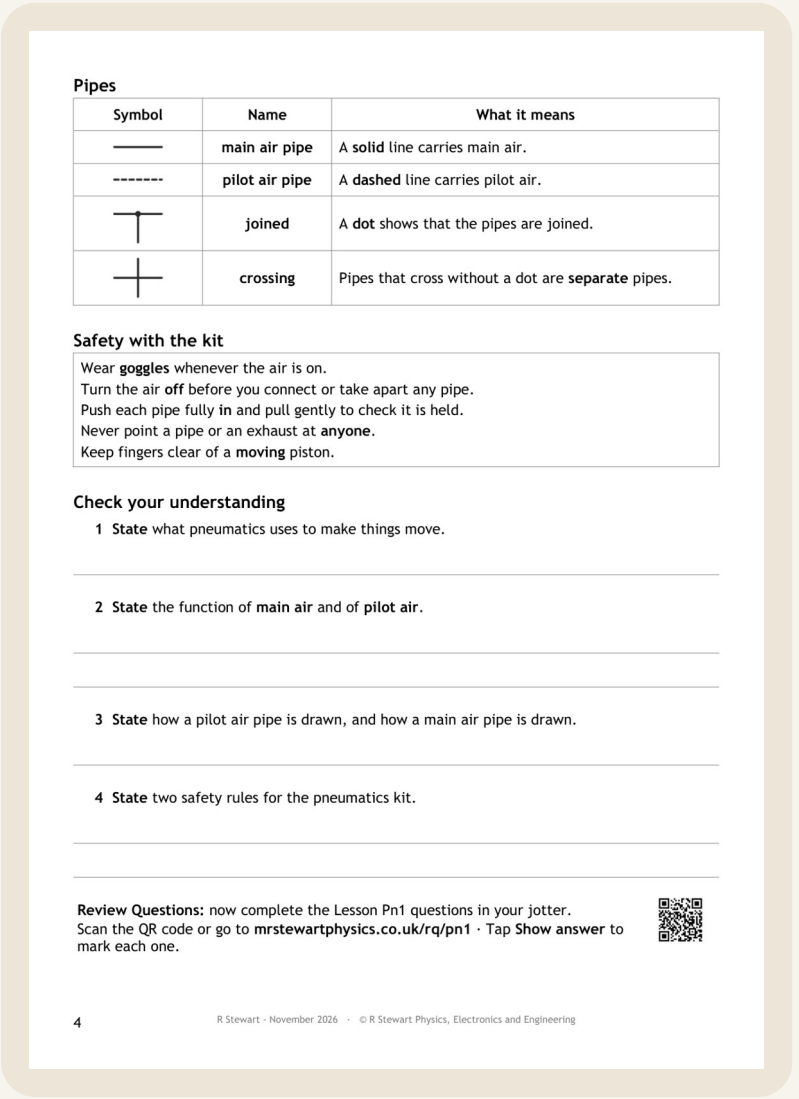


Check Your Understanding (pp 3-4)

In your booklet

Answer the **Quick check** on page **3**.

Answer Questions **1** to **4** on page **4**.



Pipes

Symbol	Name	What it means
———	**main air pipe**	A **solid** line carries main air.
- - - - - - -	**pilot air pipe**	A **dashed** line carries pilot air.
T	**joined**	A **dot** shows that the pipes are joined.
+	**crossing**	Pipes that cross without a dot are **separate** pipes.

Safety with the kit

Wear **goggles** whenever the air is on.
Turn the air **off** before you connect or take apart any pipe.
Push each pipe fully **in** and pull gently to check it is held.
Never point a pipe or an exhaust at **anyone**.
Keep fingers clear of a **moving** piston.

Check your understanding

1 **State** what pneumatics uses to make things move.

2 **State** the function of **main air** and of **pilot air**.

3 **State** how a pilot air pipe is drawn, and how a main air pipe is drawn.

4 **State** two safety rules for the pneumatics kit.

Review Questions: now complete the Lesson Pn1 questions in your jotter.
Scan the QR code or go to **mrstewartphysics.co.uk/rq/pn1** · Tap **Show answer** to mark each one.

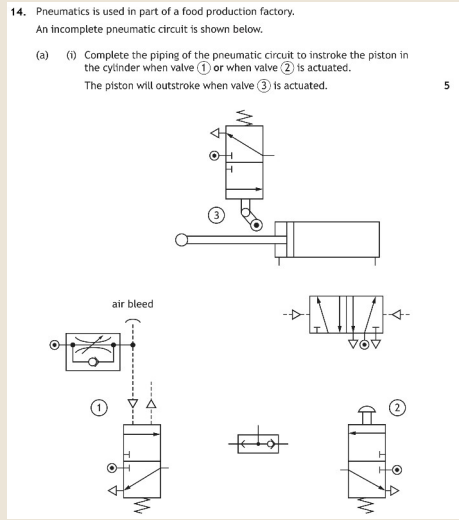
4 R Stewart · November 2026 · © R Stewart Physics, Electronics and Engineering

Answers: Check Your Understanding (pp 3-4)

Question	Answer
Quick check	Through the **exhaust**, to the **atmosphere**.
1	**Compressed** air.
2	Main: operates a **cylinder**. Pilot: **actuates** a valve.
3	Pilot: a **dashed** line. Main: a **solid** line.
4	Any **two** of the **safety** rules on page **4**.

Pneumatics in the Exam

Year	Questions	Marks
2026	S1 Q1, S2 Q14	11
2025	S2 Q8	10
2024	S1 Q3, S2 Q15	13
2023	S2 Q9	11
2022	S2 Q15	12

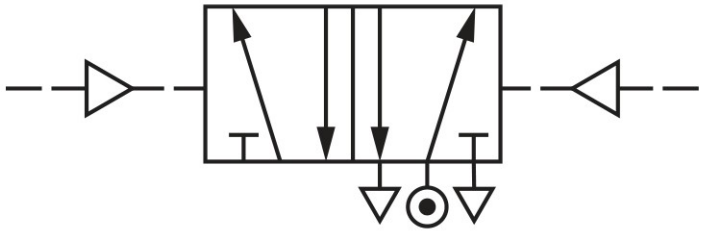

14. Pneumatics is used in part of a food production factory.
An incomplete pneumatic circuit is shown below.
(a) (i) Complete the piping of the pneumatic circuit to instroke the piston in the cylinder when valve ① or when valve ② is actuated.
The piston will outstroke when valve ③ is actuated. 5
air bleed

2026 Section 2 Q14

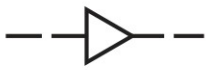
Scan the QR for every past paper by topic.

Exam: 2026 Section 1 Question 1

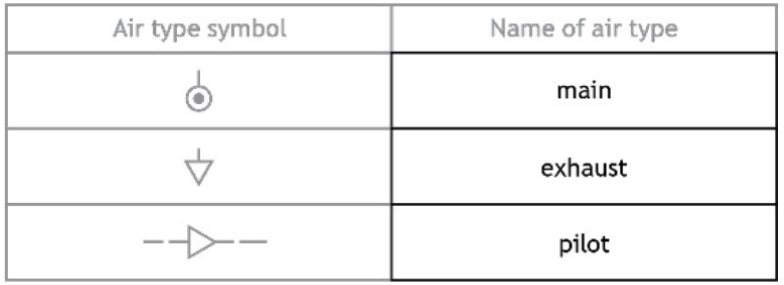
1. The symbol for a 5/2 valve is shown.



Complete the table below by naming the air type symbols shown on the valve. **3**

Air type symbol	Name of air type
	
	
	

Marking: 2026 Section 1 Question 1

Question			Expected response	Max mark	Additional guidance
1.				3	**1 mark** for main air. **1 mark** for exhaust. **1 mark** for pilot air. Accept air types clearly labelled on the valve.

Checkpoint

1. **Explain** why a pilot air pipe is drawn **dashed**.

   A **signal**, **so** drawn unlike main air

2. **State** what a **regulator** sets.

   The working **pressure**

3. **State** where **exhaust** air goes.

   To the **atmosphere**

Review Questions (p.4)

Lesson Pn1 (online)

Answer the Lesson **Pn1** questions in your **jotter**.
Scan the QR or go to **mrstewartphysics.co.uk/rq/pn1**.
Tap **Show answer** to **mark** each one.

Scan me

Look back — by the end of this lesson… (p.3)



1. I can **describe** what pneumatics is and **give** uses of it.
2. I can **name** the three air types: main air, pilot air and exhaust.
3. I can **describe** the function of main air and of pilot air.
4. I can **read** the pipes on a circuit: main air, pilot air, joined and crossing.
5. I can **follow** the safety rules for the pneumatics kit.

Extension

1. **Explain** why a pneumatic system needs a **regulator**.

2. **Explain** why port 3 of a kit valve has a **silencer**.

Course Specification — 1 of 1

Pneumatics

- symbols and operation of standard pneumatic components (restrictor, uni-directional restrictor, reservoir, 5/2 valve and actuators: diaphragm and solenoid)
- pneumatic time delay circuits
- calculating relationships between force, pressure and area in single-acting and double-acting cylinders
- controlling speed and force

Credits (1 of 2)

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Starter: Past Paper: © Qualifications Scotland (SQA). 2026 National 5 Engineering Science Section 2, Q14

Answer: Starter: © Qualifications Scotland (SQA). 2026 National 5 Engineering Science Section 2, Q14 marking instructions

The big question (a bus door release): Photo: ZidaneHartono, CC BY-SA 4.0, via Wikimedia Commons

Drawings: Pneumatic symbols and circuits drawn by R Stewart in the Qualifications Scotland paper style; CP2080 kit drawings by R Stewart.

Where Pneumatics Is Used (assembly machine): Photo: Wikimachinespeciale, CC BY-SA 3.0, via Wikimedia Commons

Where Pneumatics Is Used (air impact wrench): Fumikas Sagisavas, CC0, via Wikimedia Commons

Credits (2 of 2)

Watch Out (course report): © Qualifications Scotland (SQA). 2026 National 5 Engineering Science course report, Question 1

Pneumatics in the Exam: © Qualifications Scotland (SQA). 2026 National 5 Engineering Science Section 2, Q14

Exam: 2026 Section 1 Question 1: © Qualifications Scotland (SQA). 2026 National 5 Engineering Science Section 1, Q1

Marking: 2026 Section 1 Question 1: © Qualifications Scotland (SQA). 2026 National 5 Engineering Science Section 1, Q1 marking instructions

Screenshots and page figures: Booklet 6, Pneumatics (N5 Engineering Science, R Stewart, November 2026): page images.

Course specification: © Qualifications Scotland (SQA). N5 Engineering Science course specification v2.0, p.6

R Stewart - November 2026