

GCSE Physics

Worksheet: Pressure in a fluid ($p = F/A$)

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Pressure in a fluid ($p = F/A$)

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A crate of weight 890 N rests on a level floor. The area of its base in contact with the floor is 0.8 m².

0 1 . 1

Calculate the pressure that it exerts on the floor.

Use the equation:

pressure = force normal to a surface ÷ area of that surface

.....

.....

.....

.....

Pressure = Pa

[2 marks]

0 2

0 2 . 1

Which of these is the correct unit for pressure?

Tick (✓) **one** box.

N

☐

N/m

☐

Pa

☐

kg/m³

☐

[1 mark]

0 2 . 2

Which **two** of these would increase the pressure exerted by an object on a surface, for a fixed weight?

Tick (✓) **two** boxes.

Increasing the contact area

☐

Decreasing the contact area

☐

Standing the object on a wider base

☐

Standing the object on a narrower point

☐

[2 marks]

0 2 . 3

Write down the equation that links area of a surface (A), force normal to the surface (F) and pressure (p).

.....

.....

[1 mark]

0 3

A person of weight 620 N stands on one foot. The area of the sole of the foot in contact with the floor is 180 cm^2 .

0 3 . 1

Calculate the pressure exerted on the floor.
Give your answer in pascals.

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.....

Pressure = Pa

[3 marks]

0 4

A student seals the end of a syringe that contains air. The area of the plunger is 4.0 cm^2 .

0 4 . 1

Convert 4.0 cm^2 into m^2 .

.....

.....

.....

Area = m^2

[1 mark]

0 4 . 2

The pressure of the trapped air is 150 kPa.
Calculate the force that the trapped air exerts on the plunger.

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Force = N

[2 marks]

0 4 . 3

Explain, in terms of particles, how the trapped air exerts a force on the plunger.

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[2 marks]

0 4 . 4

The student pushes the plunger further in. The pressure of the trapped air increases to 200 kPa.
Calculate the new force of the trapped air on the plunger.

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.....

.....

Force = N

[1 mark]

.....

0 5

A person of weight 650 N stands still wearing trainers. The total area of the trainers in contact with the ground is 0.045 m^2 .

The same person then wears stiletto shoes. The area of the tip of one stiletto heel is $1.0 \times 10^{-4} \text{ m}^2$.

0 5 . 1

Calculate the pressure the person exerts on the ground while standing in trainers.

.....

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Pressure = Pa

[2 marks]

0 5 . 2

At one moment while the person is walking, all of their weight acts on the tip of one stiletto heel.

Calculate the pressure under the heel at this moment.

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.....

.....

Pressure = Pa

[2 marks]

0 5 . 3

An elephant's foot exerts a pressure of about 150 000 Pa on the ground.
Explain why the stiletto heel can exert a much bigger pressure than an elephant's foot, even though the person weighs far less than an elephant.

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.....

[2 marks]

0 6

The water in a large aquarium exerts a pressure on a glass viewing window. The area of the window is 0.60 m².

0 6 . 1

Write down the equation that links area (A), force normal to a surface (F) and pressure (p).

.....

.....

[1 mark]

0 6 . 2

The average pressure of the water on the window is 18 kPa.
Calculate the force of the water on the window.

.....

.....

.....

.....

.....

Force = N

[3 marks]

0 6 . 3

In which direction does the force of the water act on the window?

.....

.....

[1 mark]

0 6 . 4

The aquarium is filled to a greater depth.

Suggest what happens to the force of the water on the window. Give a reason for your answer.

.....

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.....

.....

[2 marks]

0 7

A drawing pin has a sharp point. The point has a very small area of $5.0 \times 10^{-7} \text{ m}^2$ (0.50 mm^2).

0 7 . 1

Explain, using ideas about pressure, why a drawing pin is designed with a sharp point rather than a flat end.

.....

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[2 marks]

0 7 . 2

A finger pushes on the head of the pin with a force of 20 N.
Calculate the pressure exerted by the point of the pin.

.....

.....

.....

.....

Pressure = Pa

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Pressure in a fluid ($p = F/A$) · 32 marks

Question 1 (2 marks)

01.1 [2 marks]

Answer: 1112.5 Pa

- $p = 890 \div 0.8$ (1)
 - 1112.5 (Pa) (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: Pa

02.2 [2 marks]

Correct: Decreasing the contact area; Standing the object on a narrower point

02.3 [1 mark]

Answer: $p = \frac{F}{A}$

- $p = F \div A$ (1)

Notes: Allow pressure = force $\div$ area, or any correct rearrangement.

Question 3 (3 marks)

03.1 [3 marks]

Answer: 34 400 Pa

- area = $180 \text{ cm}^2 = 0.018 \text{ (m}^2\text{)}$ (1)
- $p = 620 \div 0.018$ (1)
- 34 400 (Pa) (1)

Notes: An answer of 3.44 scores 2 marks (area not converted to m^2).

Question 4 (6 marks)

04.1 [1 mark]

Answer: $4.0 \times 10^{-4} \text{ m}^2$

- $4.0 \times 10^{-4} (\text{m}^2) / 0.00040 (\text{m}^2) (1)$
-

04.2 [2 marks]

Answer: 60 N

- $F = 150\,000 \times 4.0 \times 10^{-4} (1)$
- 60 (N) (1)

Notes: Allow ECF for an incorrect area from the previous part.

04.3 [2 marks]

Answer: Air particles collide with the plunger; each collision exerts a small force, and together they give a force at right angles to the plunger.

- the air particles collide with the plunger (1)
 - each collision exerts a (small) force on the plunger / the total force of all the collisions acts at right angles to the plunger (1)
-

04.4 [1 mark]

Answer: 80 N

- 80 (N) (1)
-

Question 5 (6 marks)

05.1 [2 marks]

Answer: 14 400 Pa (14 444 Pa)

- $p = 650 \div 0.045$ (1)
- 14 400 (Pa) (1)

Notes: Allow 14 444 (Pa).

05.2 [2 marks]

Answer: 6.5×10^6 Pa

- $p = 650 \div (1.0 \times 10^{-4})$ (1)
 - 6.5×10^6 (Pa) (1)
-

05.3 [2 marks]

Answer: Pressure = force $\div$ area; the heel tip's area is so much smaller than an elephant's foot that the pressure is bigger despite the much smaller force.

- pressure = force $\div$ area, so pressure depends on the area as well as the force (weight) (1)
 - the area of the heel tip is very much smaller than the area of an elephant's foot, so the pressure is much bigger even though the force is much smaller (1)
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Question 6 (7 marks)

06.1 [1 mark]

Answer: $p = \frac{F}{A}$

- $p = F \div A$ / pressure = force normal to a surface $\div$ area of that surface (1)

06.2 [3 marks]

Answer: 10 800 N

- 18 kPa = 18 000 Pa (1)
- $F = 18\,000 \times 0.60$ (1)
- 10 800 (N) (1)

Notes: An answer of 10.8 scores 2 marks.

06.3 [1 mark]

Answer: At right angles to the glass (outwards).

- at right angles to the window / normal to the glass (outwards) (1)

06.4 [2 marks]

Answer: It increases, because the pressure of the water on the window increases.

- the force increases (1)
- the (average) pressure (on the window) increases (because the water is deeper) (1)

Question 7 (4 marks)

07.1 [2 marks]

Answer: A small area gives a very large pressure for a given force ($p = F/A$), allowing the point to penetrate easily.

- a sharp point has a very small area (1)
- so for a given (pushing) force, the pressure (= force $\div$ area) at the point is very large, allowing it to penetrate a surface easily (1)

07.2 [2 marks]

Answer: 4.0×10^7 Pa

- $p = 20 \div (5.0 \times 10^{-7})$ (1)
 - 4.0×10^7 (Pa) (1)
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