

Atmospheric pressure

4.5.5.2 · Forces · revision notes

The atmosphere is a thin layer of air around the Earth, and air molecules colliding with surfaces create atmospheric pressure. You need to describe a simple model of the atmosphere and explain why atmospheric pressure decreases as height increases. This is in GCSE Physics only, not in Combined Science.

Key facts

- Atmosphere = thin layer of air around the Earth
- Air gets less dense with increasing altitude
- Atmospheric pressure is caused by air molecules colliding with surfaces
- Atmospheric pressure at sea level $\approx 100 \text{ kPa}$ (100 000 Pa)
- Higher altitude $\rightarrow$ less air above $\rightarrow$ smaller weight of air $\rightarrow$ lower pressure
- $F = p \times A$

Notes

A simple model of the atmosphere

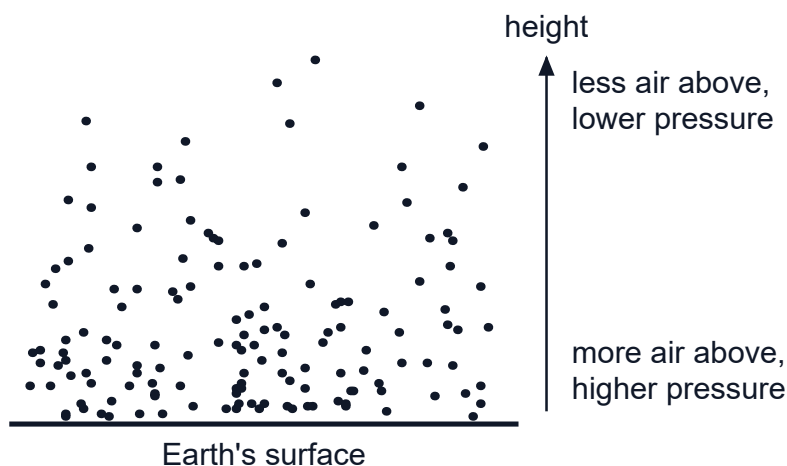
- The atmosphere is a thin layer of air around the Earth. It is thin compared with the size of the Earth.
- The atmosphere gets less dense with increasing altitude (height above sea level).
- Most of the air is close to the Earth's surface. The atmosphere has no sharp top edge: it gradually gets thinner.

What causes atmospheric pressure

- Air molecules move randomly and collide with surfaces. Each collision exerts a small force on the surface.
- Atmospheric pressure is the total force of these collisions on each square metre of the surface.
- It acts on every surface, at right angles to it, in all directions.
- At sea level, atmospheric pressure is about 100 000 Pa (100 kPa).

Why pressure decreases with height

- The number of air molecules, and so the weight of air, above a surface decreases as the height of the surface increases.
- So at any height there is less air above a surface than there is at a lower height.
- The air is also less dense, so fewer molecules collide with each square metre of a surface each second.
- So atmospheric pressure decreases as height increases.



The air gets less dense with height, and there is less air above, so the pressure falls.

How to answer each type of question

Describe a simple model of the atmosphere

2 marks

Grade 4

1. Say it is a thin layer of air around the Earth (thin compared with the Earth's size).
2. Say how its density changes with altitude.

Example. Describe the Earth's atmosphere.

Model answer. A thin layer of air around the Earth, thin compared with the size of the Earth (1).
It gets less dense as the altitude increases (1).

Don't lose marks

- ✗ Saying pressure decreases with height 'because there is less gravity'. The key reason is that there is less air (a smaller weight of air) above.
- ✗ Describing the atmosphere as thick. It is a thin layer compared with the size of the Earth.
- ✗ Saying atmospheric pressure only acts downwards. It acts on surfaces in all directions.
- ✗ Saying the molecules 'push' without mentioning collisions with the surface.

More tips

Memory tricks

- Less air on top = less pressure. Think of a pile of mattresses: the bottom one is squashed the most.
- Sea level ≈ 100 kPa: about 100 000 N pushing on every square metre.
- Pressure differences always push from high to low.

Exam technique

- Use the key phrases 'air molecules collide with the surface' and 'less air (a smaller weight of air) above'.
- For 3-mark explanations, give the cause of the pressure, then what changes with height, then the effect on the pressure.
- Convert kPa to Pa before using $F = p \times A$.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4

Describe a simple model of the atmosphere

The atmosphere is thin compared with the size of the Earth and gets less dense with increasing altitude.

Grade 5

Explain what causes atmospheric pressure

Air molecules collide with a surface, and each collision exerts a force on it.

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