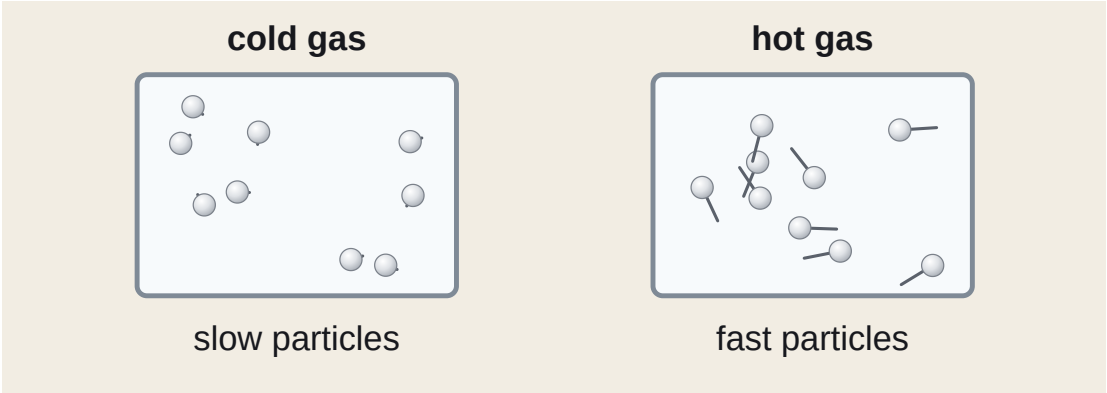
B2 · Temperature, kelvin and absolute zero; STP and SATP · Completed notes

Goals: Explain temperature as how fast particles move. Change a temperature between degrees Celsius and kelvin. State the conditions called STP and SATP.

These are the completed notes. The blanks are filled in and each question is worked.

Slide 1 of 6 · Temperature and moving particles

Lesson B1 named four things we measure about a gas. One of them was temperature. Today you learn what it measures.



Key ideas

Temperature tells you how fast the particles move.

In a hot gas the particles move **fast**.

In a cold gas the particles move **slowly**.

Heating a sealed gas raises its **pressure**.

Example

A sealed can of gas is heated. What happens to its pressure, and why?

1. The particles move faster.
2. They hit the walls harder and more often.
3. So the pressure goes up.

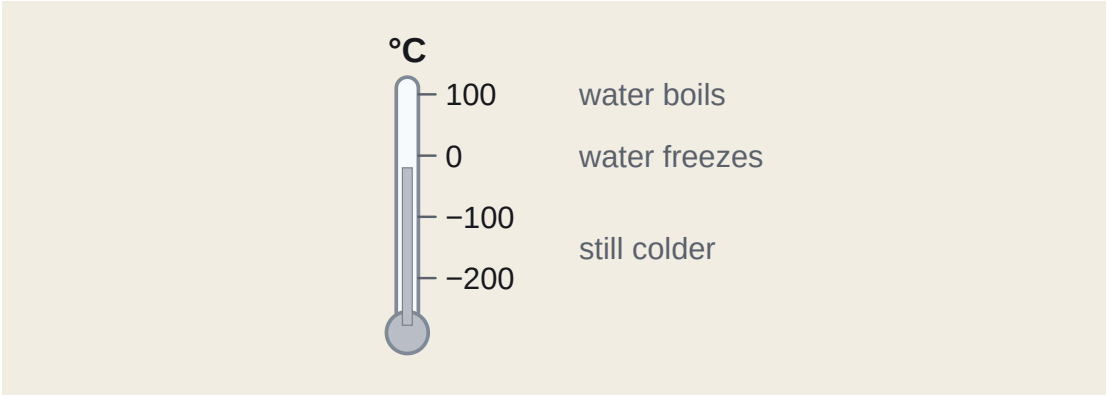
Try it

A gas is cooled. What happens to its particles?

1. Temperature tells you how fast the particles move.
2. In the colder gas the particles move more slowly.

Slide 2 of 6 · Why the Celsius scale does not work for gases

The last slide said temperature measures how fast particles move. The Celsius scale has a problem with that.



Key ideas

On the Celsius scale, water **freezes** at 0 °C.

Water **boils** at 100 °C.

At 0 °C the particles are **still moving**.

Gas questions need a scale where **zero** means the particles have stopped.

Example

Is 0 °C the lowest temperature there is? How do you know?

1. No. A winter day can be −30 °C.
2. So temperatures below 0 °C exist.

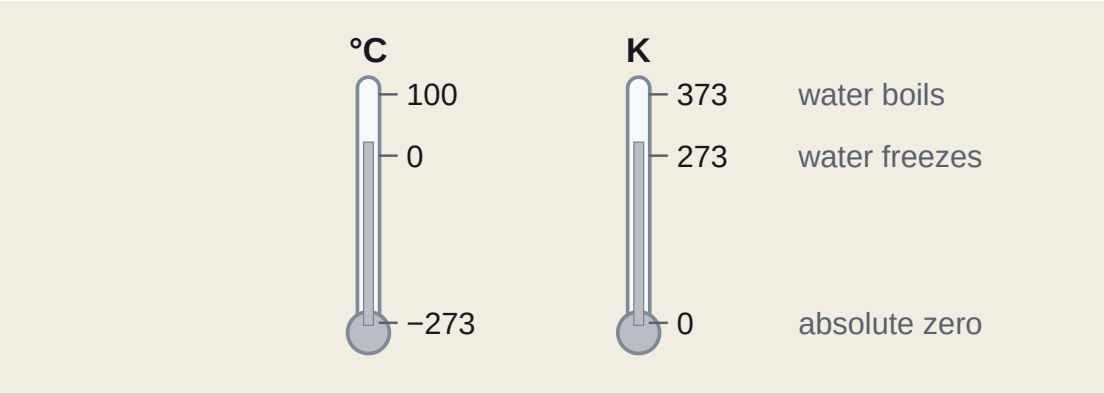
Try it

What should zero mean on a temperature scale used for gases?

1. Zero should mean the particles have stopped.
2. Nothing can be colder than that.

Slide 3 of 6 · The Kelvin scale and absolute zero

The last slide asked for a scale where zero means the particles have stopped. This slide gives it.



Key ideas

The unit of the Kelvin scale is the **kelvin**, K.

Zero kelvin is called **absolute zero**.

On the Celsius scale, absolute zero is **−273** °C.

A kelvin temperature is never **negative**.

Example

What is absolute zero, in kelvin and in degrees Celsius?

1. Absolute zero is 0 K.
2. On the Celsius scale it is −273 °C.
3. It is the lowest temperature there is.

Try it

Why can a temperature in kelvin never be negative?

1. Zero kelvin is the lowest temperature there is.
2. Nothing is colder, so nothing is below zero.

Slide 4 of 6 · Changing between degrees Celsius and kelvin

The last slide showed that the two scales are always 273 apart. That makes changing between them one step.

A room is at 35 °C.

T = 35 + 273

Kelvin is always the bigger number, so add.

T = 308 K

Key ideas

To go from degrees Celsius to kelvin, **add** 273.

To go from kelvin to degrees Celsius, **subtract** 273.

The **kelvin** value is always the bigger one.

Example

Use T (K) = t (°C) + 273. Convert 18 °C to kelvin. What is the temperature in K?

1. Kelvin is the bigger number, so add.
2. 18 + 273 = 291 K.

Try it

Use T (K) = t (°C) + 273. Convert 200 K to degrees Celsius. What is the temperature in °C?

1. Celsius is the smaller number, so subtract.
2. 200 − 273 = −73 °C.

Slide 5 of 6 · STP and SATP

You can now give any temperature in kelvin. Chemists have agreed on two temperatures and pressures to use.

name	temperature	in kelvin	pressure
STP	0 °C	273 K	101.325 kPa
SATP	25 °C	298 K	100 kPa

SATP is close to a normal room.

Key ideas

STP means standard temperature and pressure.

STP is 0 °C and **101.325** kPa.

SATP means standard ambient temperature and pressure.

SATP is **25** °C and 100 kPa.

Example

Name the temperature and pressure of STP. Give the temperature in kelvin as well.

1. STP is 0 °C and 101.325 kPa.
2. In kelvin, 0 °C is 273 K.

Try it

Name the temperature and pressure of SATP. Give the temperature in kelvin as well.

1. SATP is 25 °C and 100 kPa.
2. In kelvin, 25 °C is 298 K.

Slide 6 of 6 · Method: how to change a temperature between °C and K

Two slides ago you changed two temperatures. Here is what you did, as steps.

1. **Read** the unit you are given.
2. **Add** 273 to go from °C to K.
3. **Subtract** 273 to go from K to °C.



Check: the kelvin value is the bigger one, and it is never negative.

Used again in: lessons B4, B5 and B8

Key ideas

Step 1: **read** the unit you are given.

Step 2: **add** 273 to go from °C to K.

Step 3: **subtract** 273 to go from K to °C.

Example

Use T (K) = t (°C) + 273. Use the steps to convert −10 °C to kelvin.

1. Step 1: the unit given is °C.
2. Step 2: −10 + 273 = 263 K.
3. Step 3 is not needed.

Try it

Use T (K) = t (°C) + 273. Use the steps to convert 350 K to degrees Celsius.

1. Step 1: the unit given is K.
2. Step 2 is not needed.
3. Step 3: 350 − 273 = 77 °C.