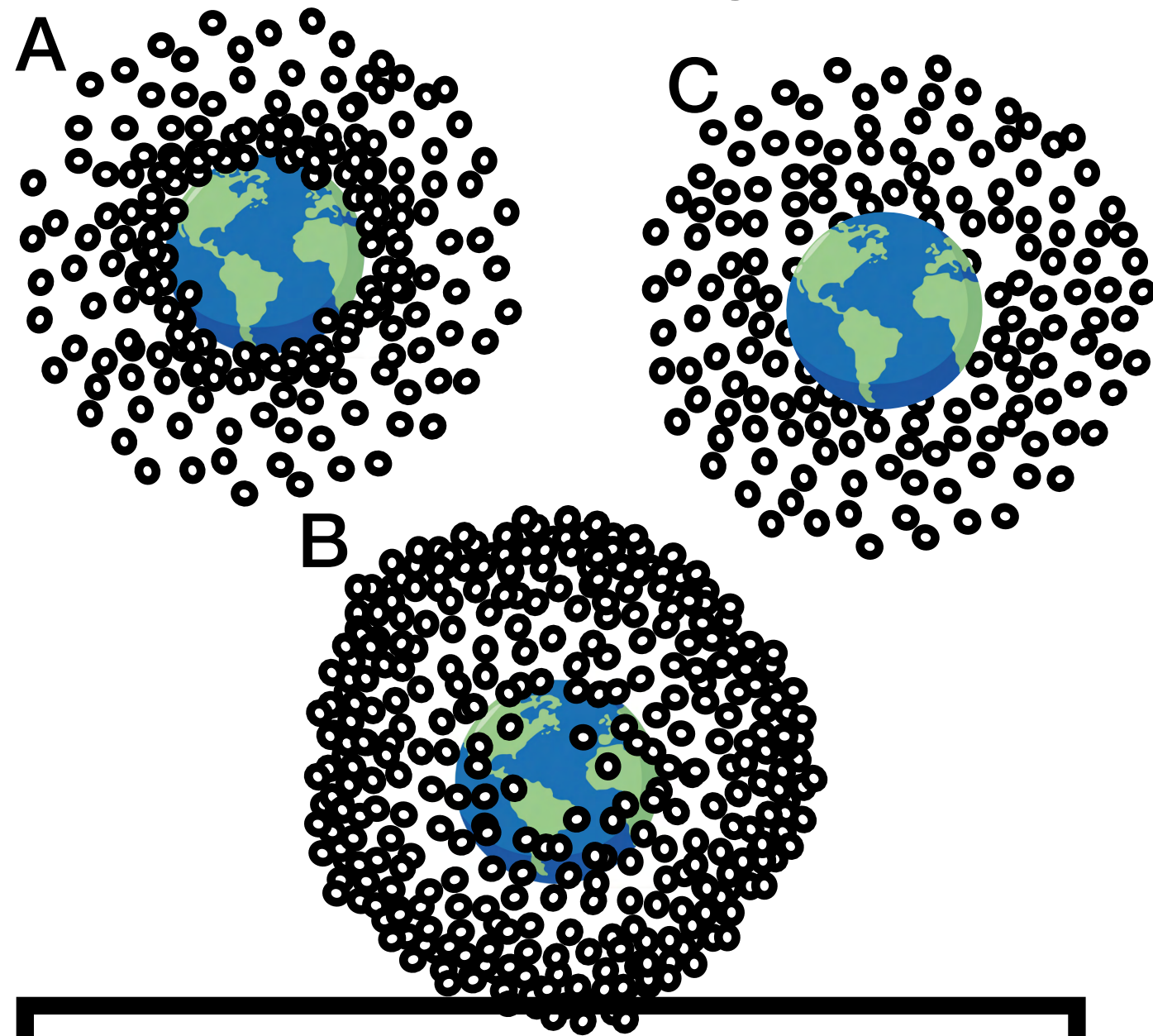




Theatre of Science Weather Lesson 1: The Atmosphere

To join in bring: Small empty jar with lid (spice jar ideal), pint glass, warm & cold water, food colouring, spoon, baking tray

Which image best shows how air particles are arranged around Earth?

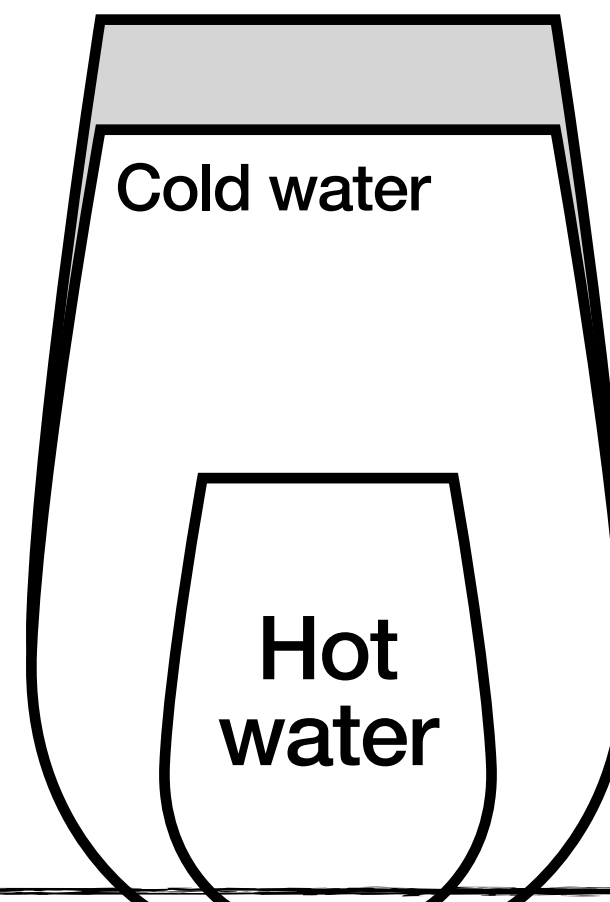


Optional notes on the Troposphere:

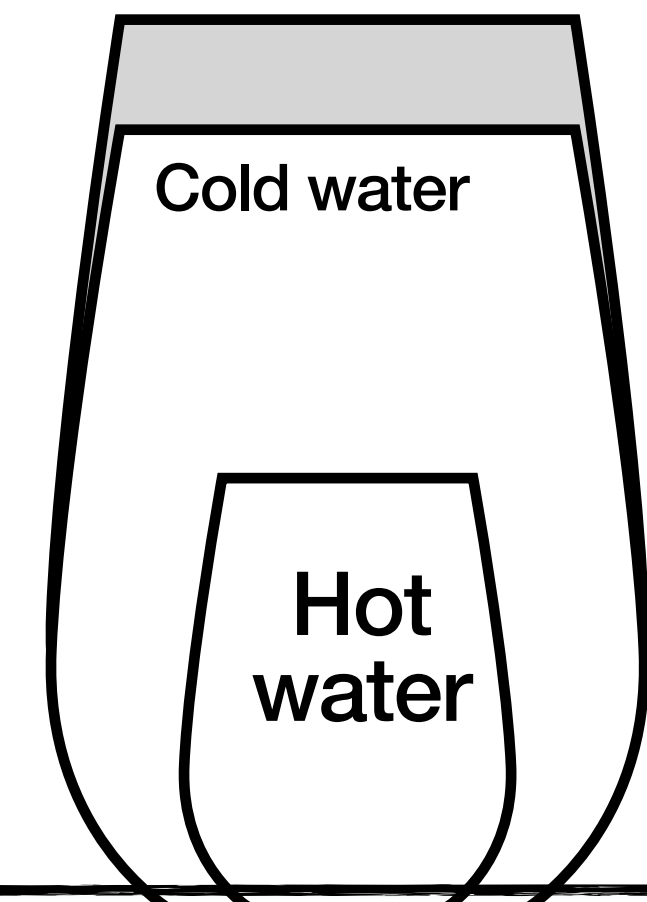
Tough Challenge! You don't breathe the same air every day; new air is constantly circulating. What causes air to circulate?

Gravity The Sun Earth's Spin

Draw arrows to show where you think the hot water will go when the lid comes off



Draw arrows to show where the hot water *did* go when the lid came off!



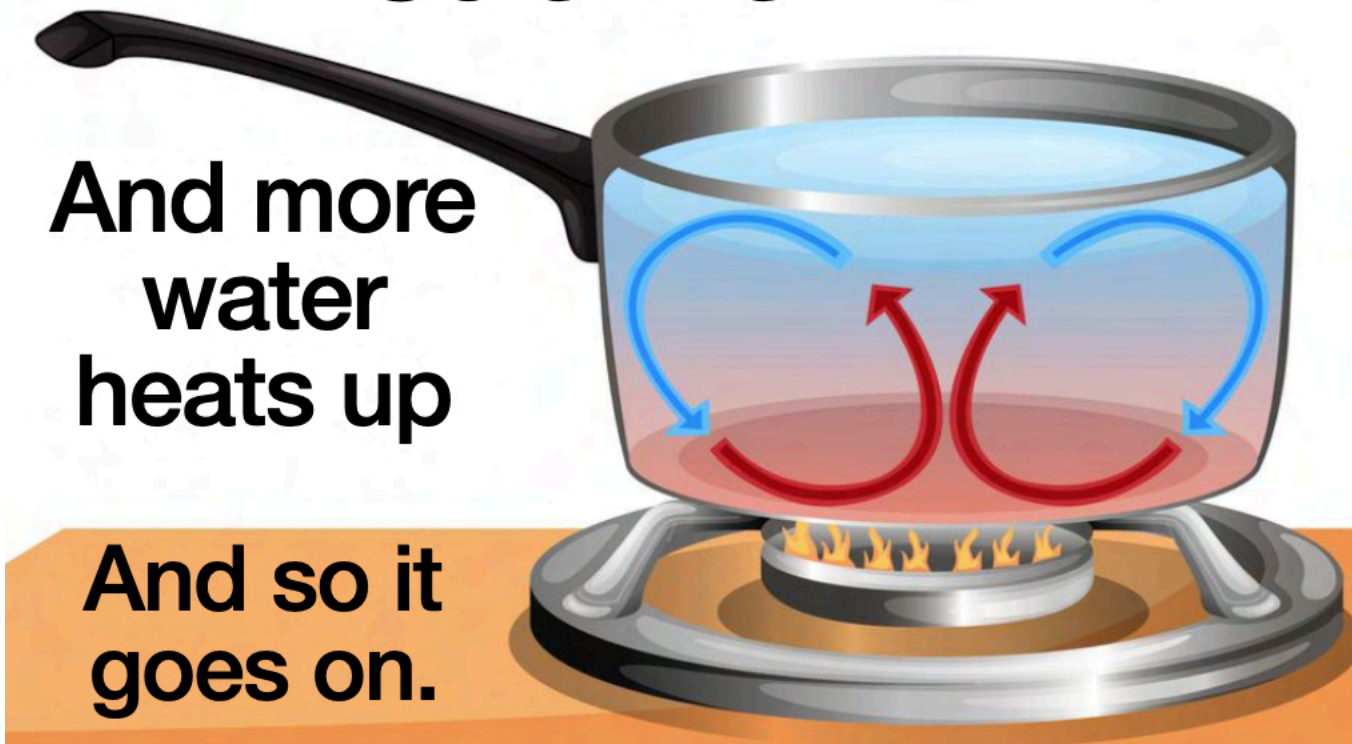
Hot air (or water!) rises.

Then cools down

So sinks

And more
water
heats up

And so it
goes on.

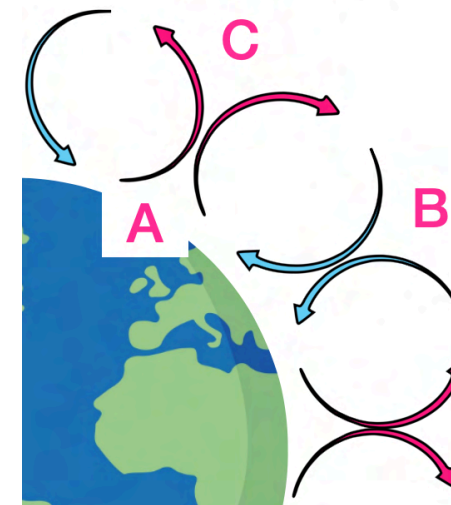


Final Quiz

1) What's the name of the atmospheric layer where most clouds and weather happen?

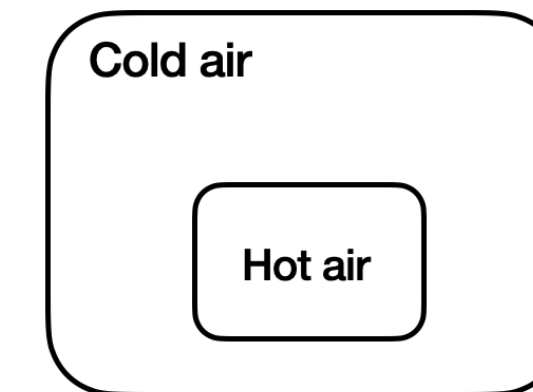
2) How high is it? _____ miles

4) At which point is the air warmest?



3) Choose a question or answer both!

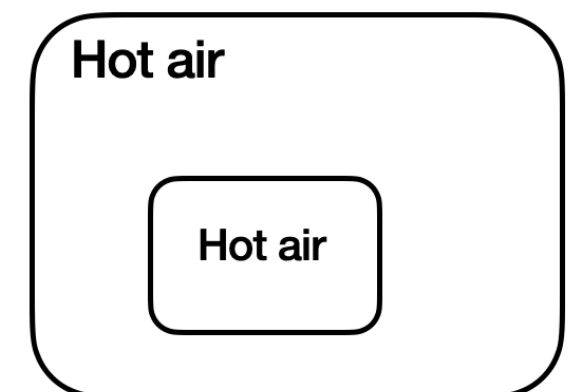
Where will the hot air in this room go?



A: Up
B: Down
C: Nowhere in particular

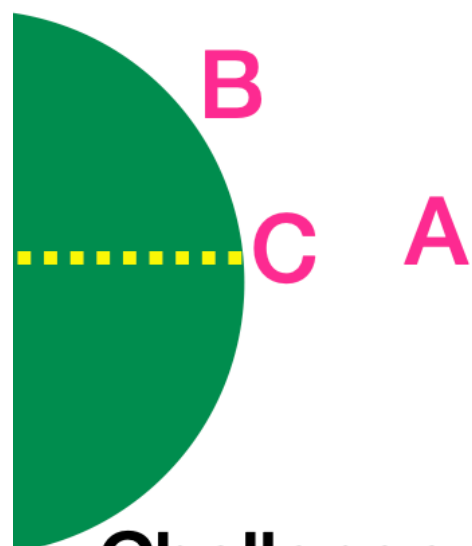
← Easier
Tough →

Where will the hot air in this room go?



A: Up
B: Down
C: Nowhere in particular

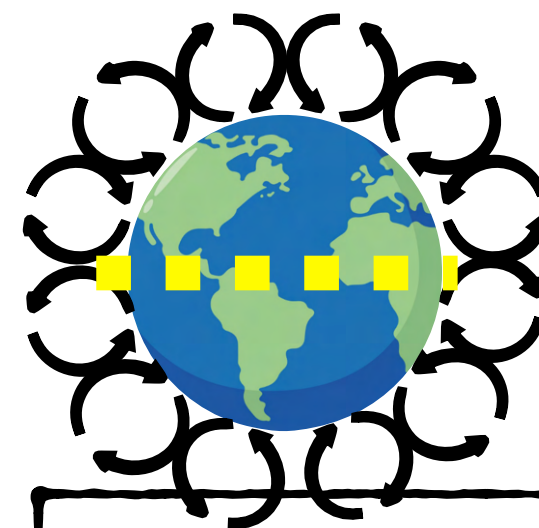
Match the letter to the box (use one letter twice)



Air gets warm ☐ Air is rising ☐

Air cools down ☐ Air is sinking ☐

Challenge: There are at least three things *on Earth*, or *that Earth is doing*, that make air movement more complicated than this! Can you name any?



Want More?!

The circulation cells have different names and features. Searching 'NOAA Global atmospheric circulation' and 'BBC Bitesize Hadley Cells' brings up two good pages. You might want to draw a big poster describing the different cells.

Thank you for coming!
If you enjoyed this lesson and want to help me out, you can!

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Theatre of Science Weather Lesson 2: Pressure!

To join in bring: Bowl of hot water, bowl of cold water, clear narrow-necked bottle (glass best), small cup of water, washing up liquid, pen, A4 paper.

After today you might:

Be able to *recognise* cold fronts and warm fronts from diagrams.

Understand what happens during a cold front and a warm front.

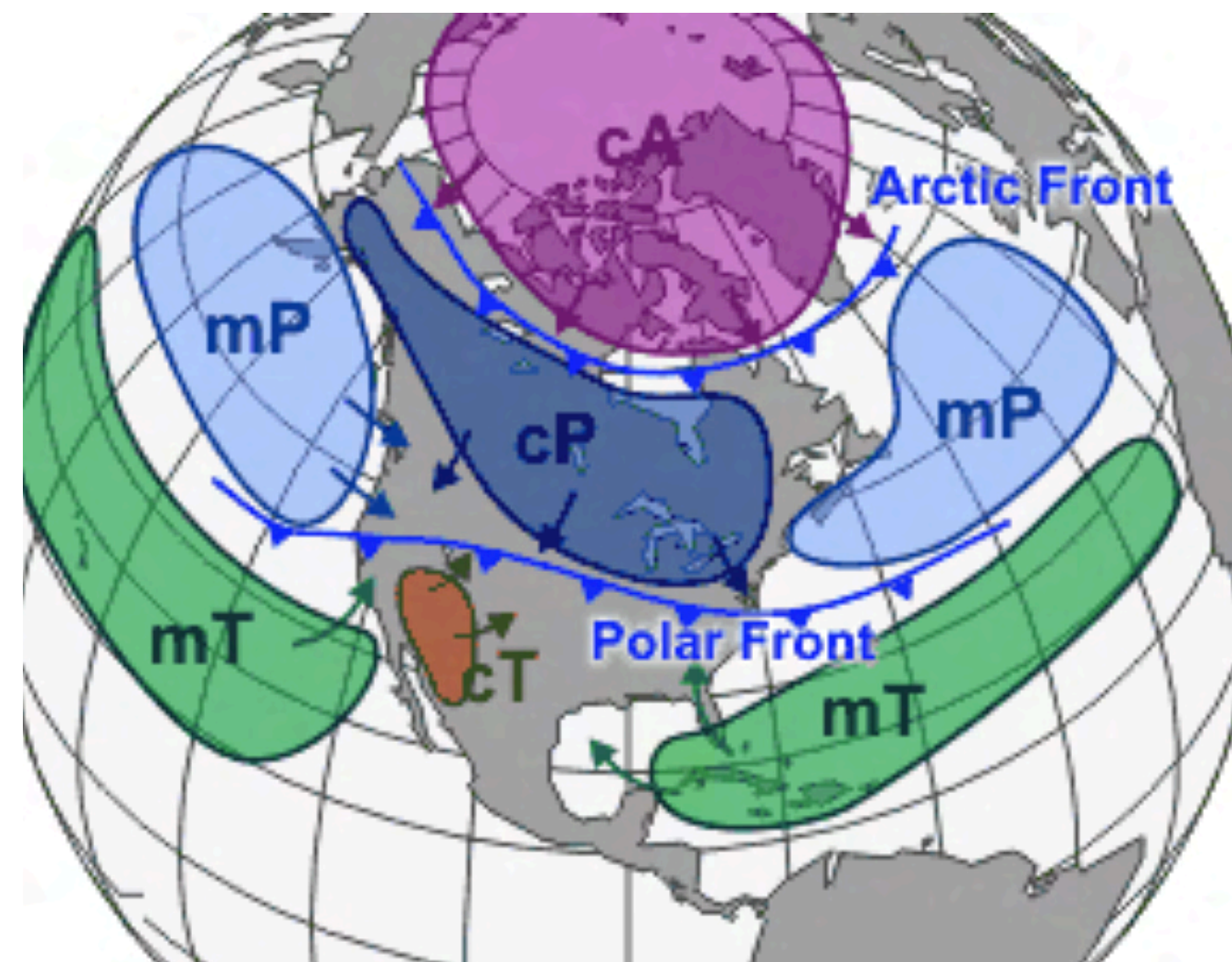
Be able to give simple *explanations* for the meaning of the phrases 'air mass', 'cold front' and 'warm front'.

Recognise isobars from diagrams. Learn how to *identify* areas of high and low pressure on maps.

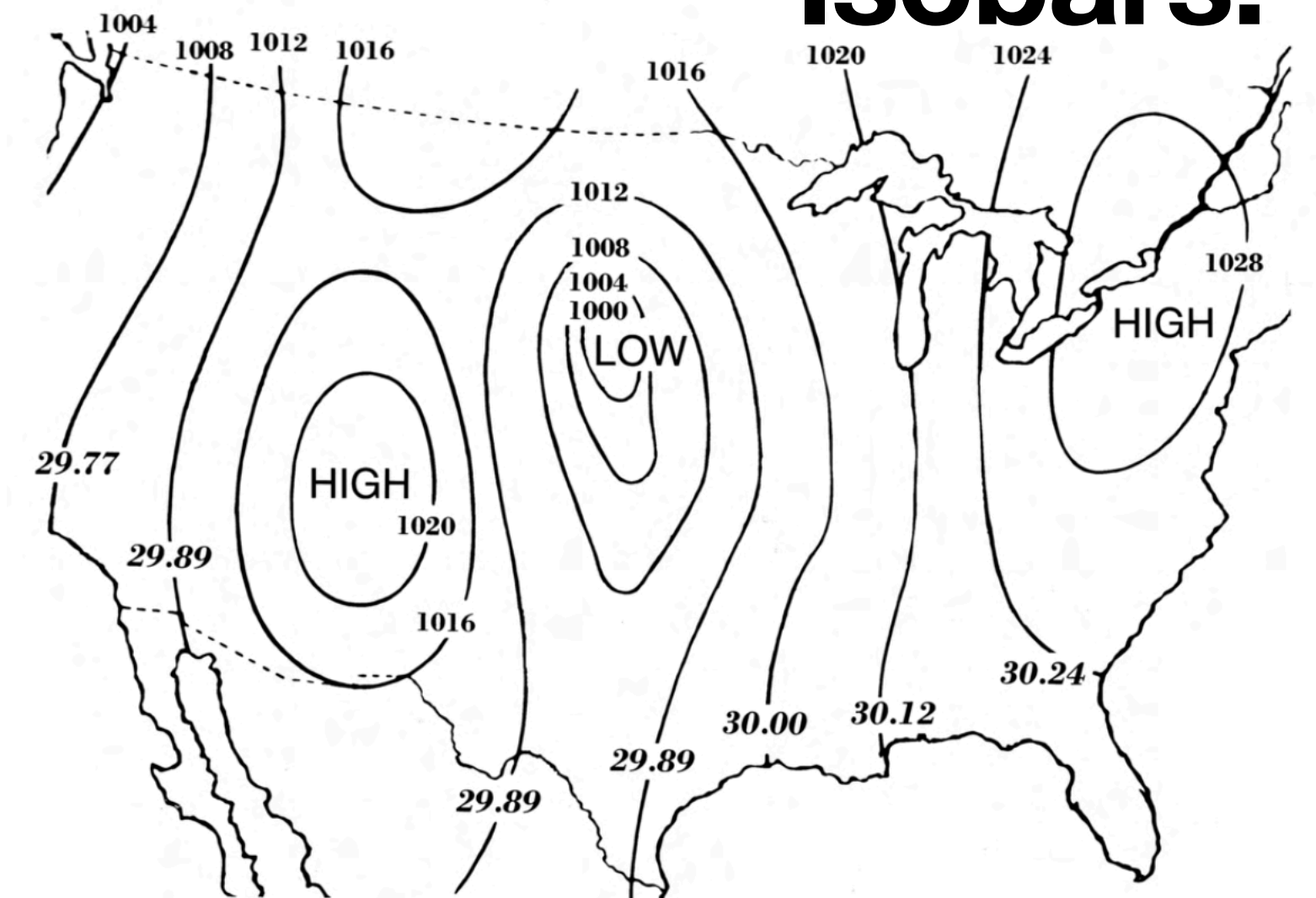
Be able to *explain* what isobars represent.

Air masses

P: Polar
T: Tropical
A: Arctic
c: form over land (continents) and are dry.
m: Form over ocean (marine) and are moist.



Isobars!

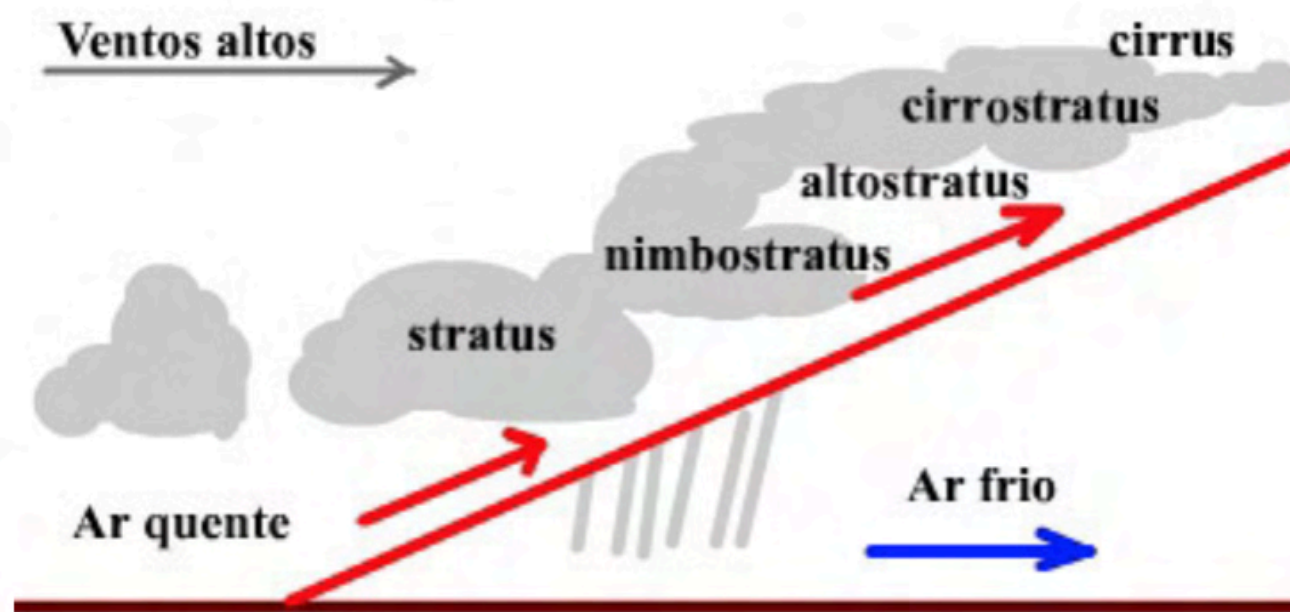


If you enjoyed this lesson please consider supporting me at <https://ko-fi.com/theatreofscience>

It's the only way I earn a living! I'll send you rainbow glasses, sticker and Theatre of Science Magazine to say thank you.

(And I do mean thank you; it's the best job ever!)

1 What type of front is shown?



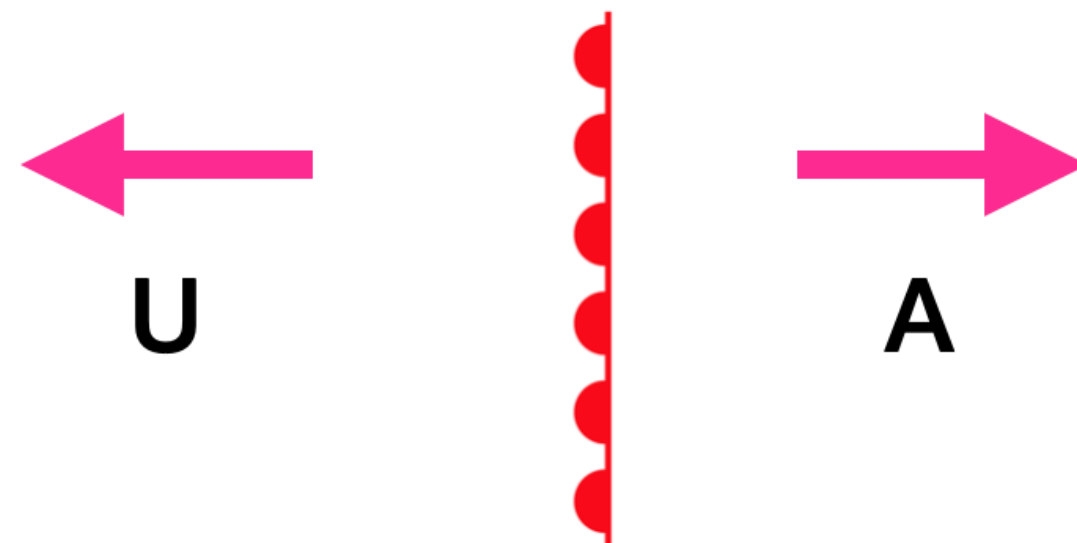
Warm: C
Cold: T

2 This weather front was printed on my black and white printer. What type of weather front is it?



Warm: R
Cold: H

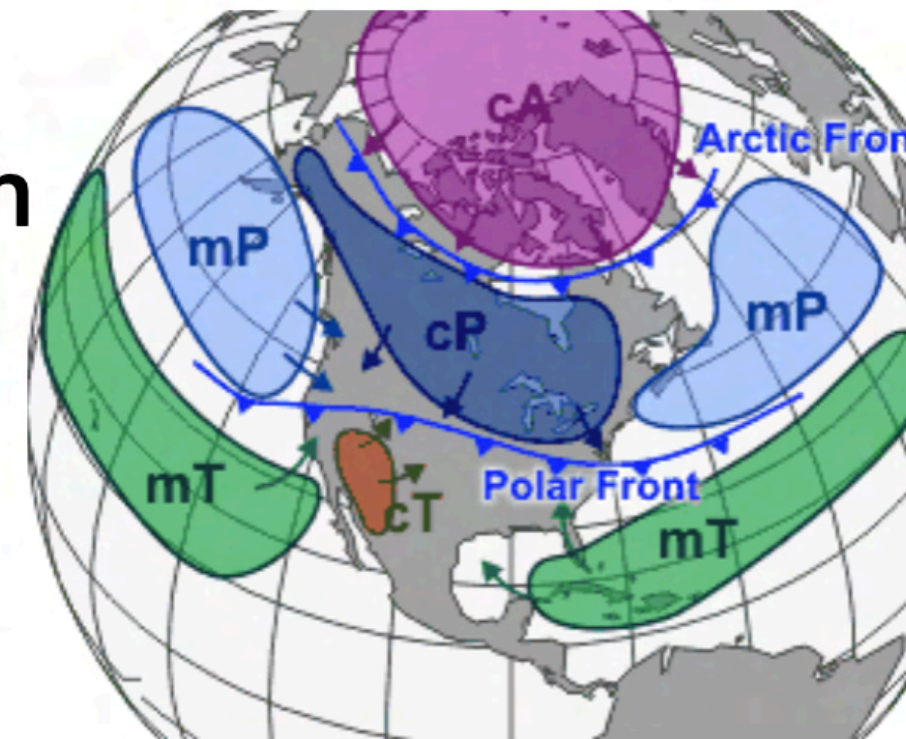
3 Which way is this warm air travelling?



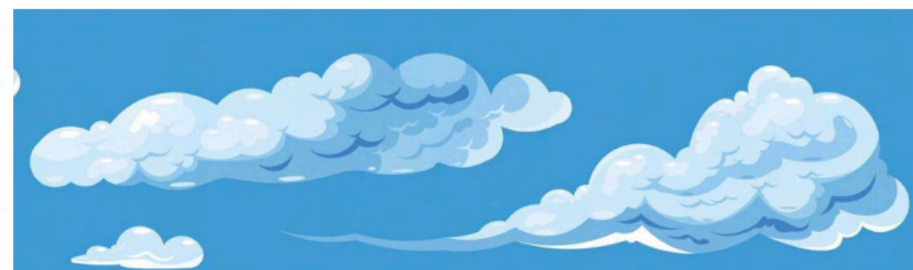
4 Each blob on this globe is an

What does this word begin with?

M or S ?



5 Clouds are formed when water vapour in the air...



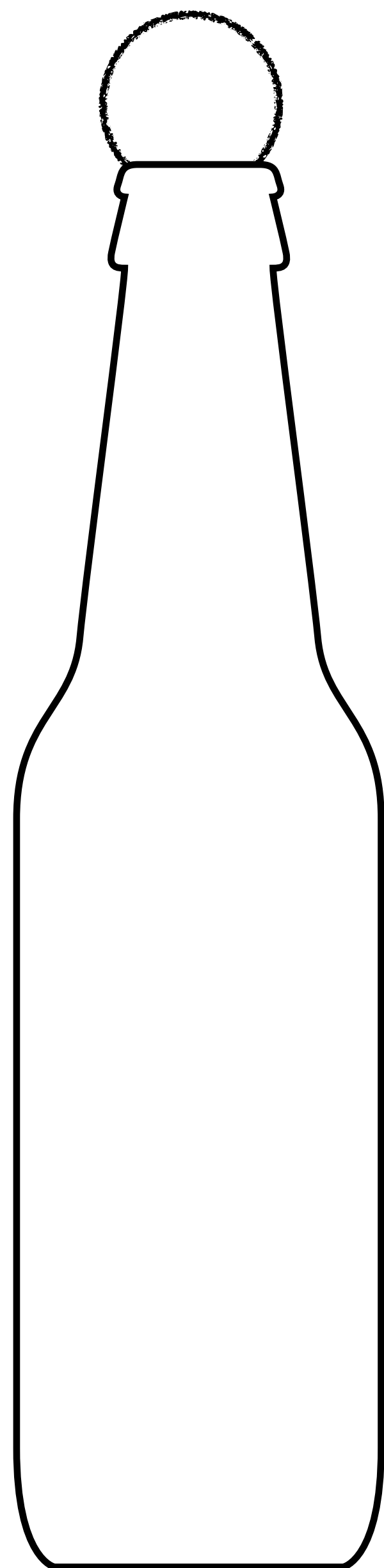
Turns into a gas: T

Turns into a liquid: P

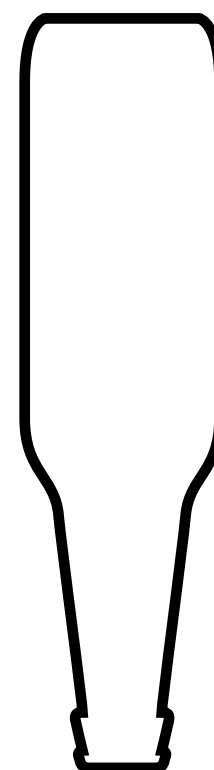
What's the Secret Word?

I found question
_____ the hardest.

Because:

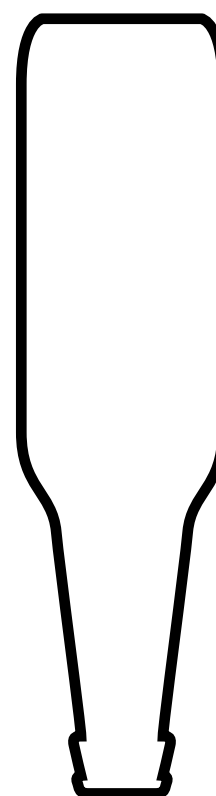


When we put a bubble film over a bottle and warmed the bottle with our hands, a bubble rose out out of the bottle.



I think if we do the same activity but hold the bottle upside down, this will happen:

Because:



I was right



or...

Actually, this happened! _____.

Because:

88

What animal can you see? (I'm really asking I don't know what it is)

84

80

80

80

80

80

80

88

88

84

80

76

76

80

84

(They're
Isobars)



Draw lines between
matching numbers
where you can

84

76

80

84

Lines can't cross

84

80

No sharp angles,
just smooth curves.

80

84



84

84

86

86

86



Theatre of Science Weather Lesson 3: WIND!

After today you might:

Be able to *recognise* cold fronts and warm fronts from diagrams.

Understand what happens during a cold front and a warm front.

Be able to give simple *explanations* for the meaning of the phrases 'air mass', 'cold front' and 'warm front'.

Recognise isobars from diagrams.

Learn how to *identify* areas of high and low pressure on maps.

Be able to *explain* what isobars represent.

To join in bring: Tall clear jar of water (eg pint glass), teaspoon, tablespoon of oil, any dried herb (oregano/basil/mint etc!)

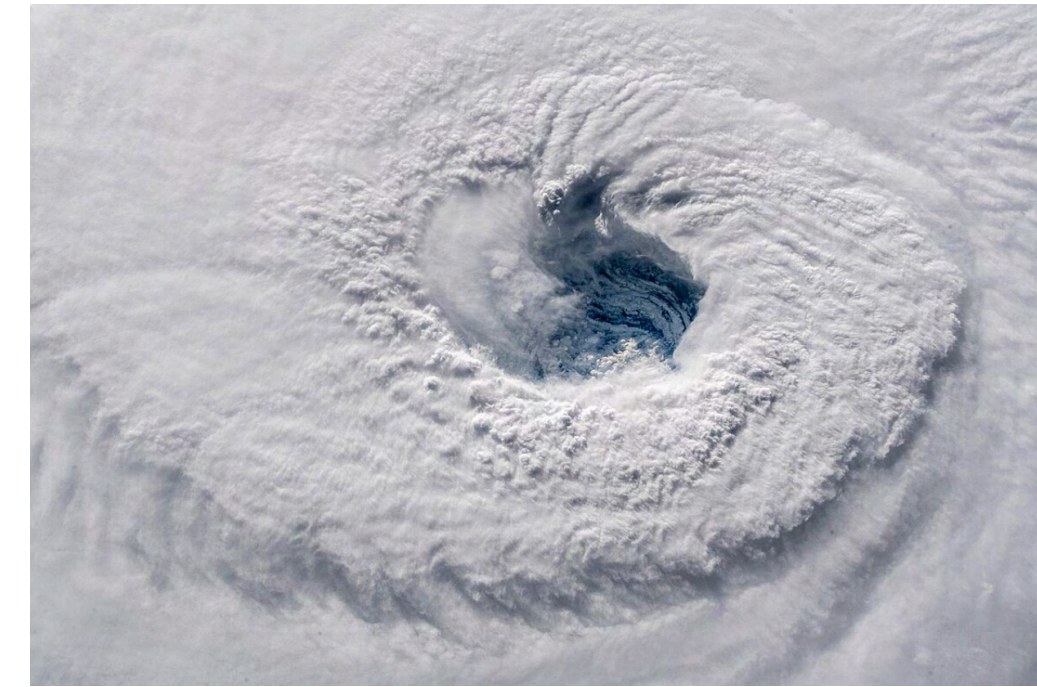
Starter Question:

Which horses on the carousel travel the fastest?

A: The ones on the outside

B: The ones on the inside

C: They all travel the same speed



The eye of a hurricane taken by an astronaut on the International Space Station



The American Air Force collecting data in the eye of Hurricane Irma



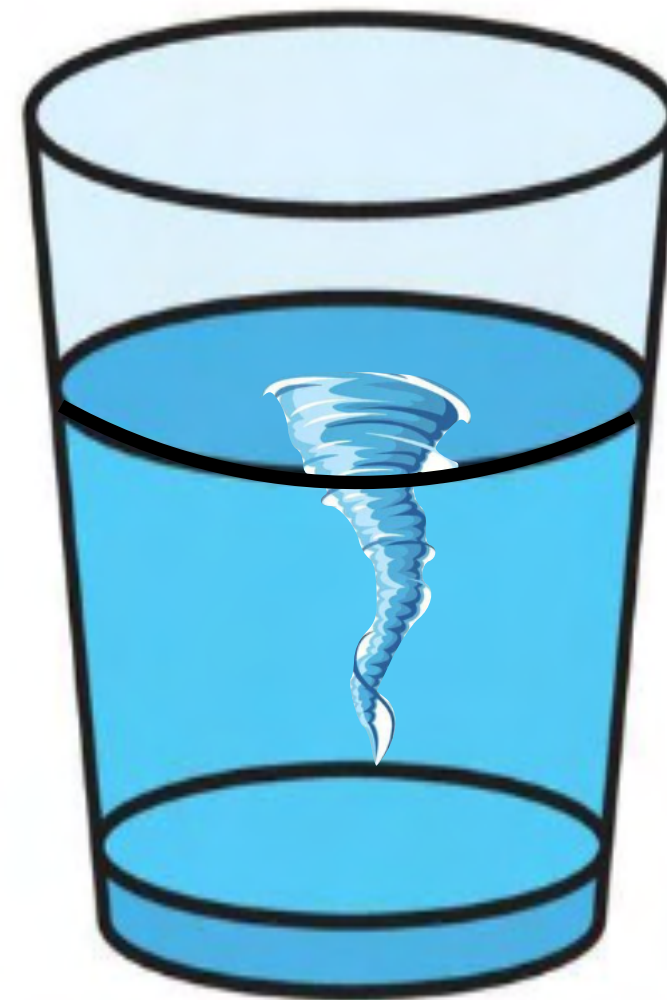
Are any of these picture tornadoes?!

How was our 'tornado in a glass' a good model for a tornado?

(What did it have in common with a real tornado?)

How did the model fall down?

(How was it different to a real tornado?)



Note: It doesn't matter if yours didn't work very well. "Good model" means "is it good at explaining how a tornado works in real life?". For example, they both spin round, so that's one way that it IS a good model.

Circle the correct facts, and explain why the wrong ones are wrong!

Hurricane and tornadoes
only form over the ocean

Tornadoes can be
thousands of miles wide

The air is calm in the
eye of a tornado

The air is calm in the eye
of a tropical cyclone

All typhoons are
tropical storms

All tropical storms
are hurricanes

Hurricane can
last weeks

The UK has hurricanes but
they don't cause much
damage

All tornadoes touch
Earth's surface



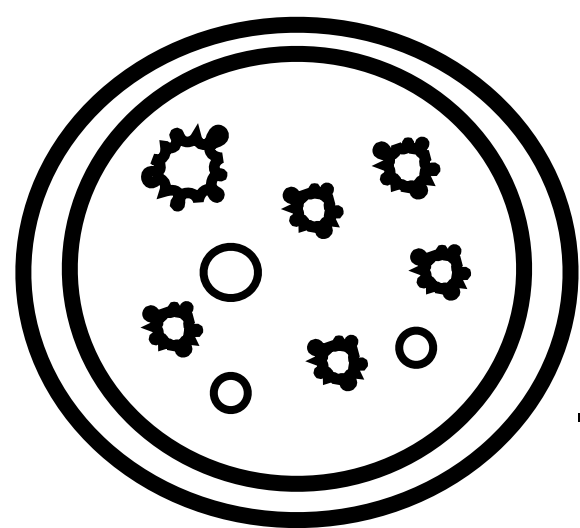
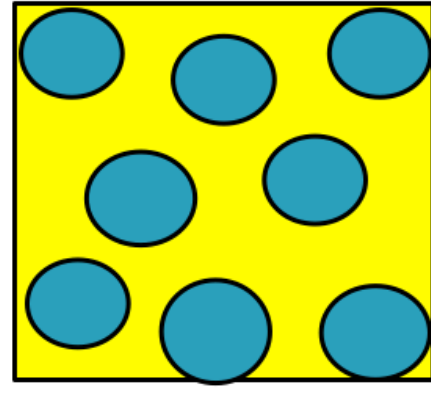
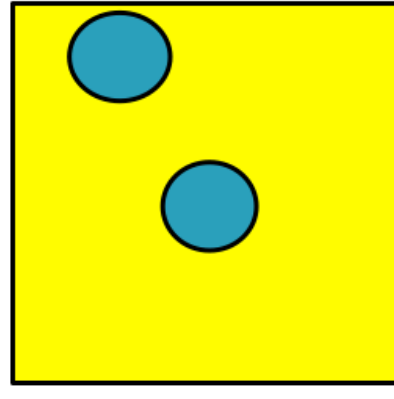
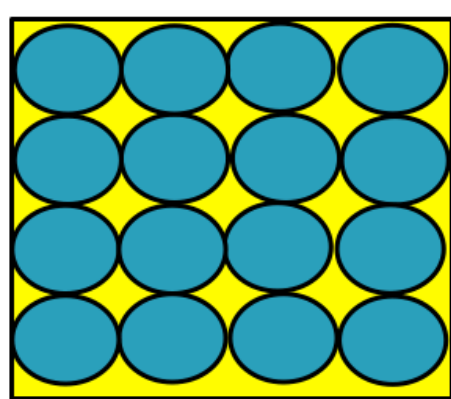
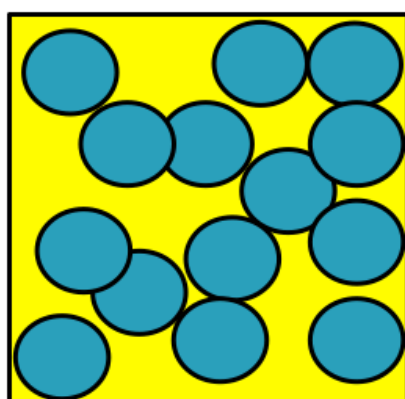


Theatre of Science Weather Lesson 4: Precipitation

1)

To join in bring: Empty aluminium can (eg old bean can), ice cubes, salt, spoon, freezer!

Which box would be a good diagram of a typical solid, liquid, and a gas? Which box isn't anything?!

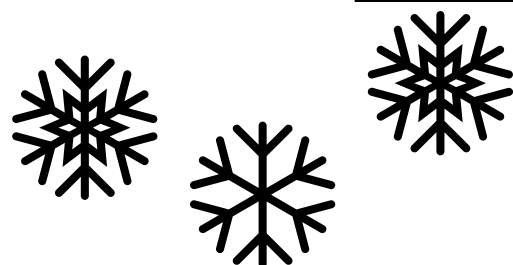


2) A cloud is small water droplets hanging in the atmosphere; like water droplets on a plate! For rain fall, enough droplets have to come together to form heavy drops. What would you do to this plate to get the drops to come together?

- Add more drops?
- Shake it?

It's the same with clouds!

4) What are these?



Quick note: what is a snowflake?!

Draw lines from the name to the image to the description!

Snow



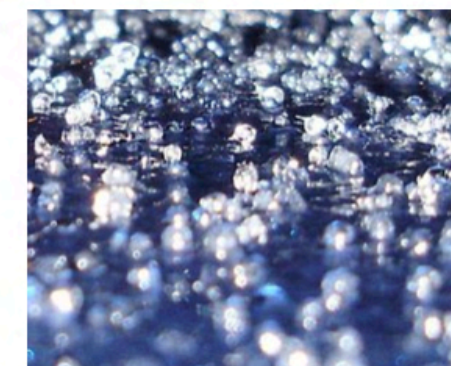
Snow that's melted and refrozen on the way to the ground

Sleet



Water particles attach to a snow crystal in branches.

Graupel



Rain that goes upwards and freezes. It spends a long time in the clouds collecting water droplets.

Hail



Very cold water freezes onto a snow crystal.

Want More?!

Visit the incredible <http://snowcrystals.com/> to learn everything you could possibly want to know about snowflakes!

My Ice Lego Show on fb has more ice activities and explains why snow flakes are hexagons and salt affects the temperature ice freezes at:

<https://www.facebook.com/theatreofscience/videos/325776665527165/>

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3) Draw a line from the type of precipitation to its picture (best guess!)

Sleet:
Small clear ice pellets



Snow:
Soft. Single or clusters of
snow crystals.



Graupel:
Small soft pellets.



Hail:
Clear or cloudy ice pellets over
0.5cm wide.



Box for optional notes you might want to make as I'm talking!

Box for optional notes you might want to make as I'm talking!

Box for optional notes you might want to make as I'm talking!

Box for optional notes you might want to make as I'm talking!



Theatre of Science Weather Lesson 5: Clouds!

To join in bring: A jar or glass, matches (lighter won't work!), small plate, ice cubes, hot water, ADULT SUPERVISION!

First we need to learn these words!

Cumulus

Means:
Heaped
up/puffy



Stratus



Means:
Cover with a
layer, blanket.

Cirrus



Always
high up

Alto



Medium
level

Nimbus



Brings
rain

What's that cloud?



Stratocumulus
Cirrus



Cirrus
Cirrostratus



Altostratus
Nimbostratus



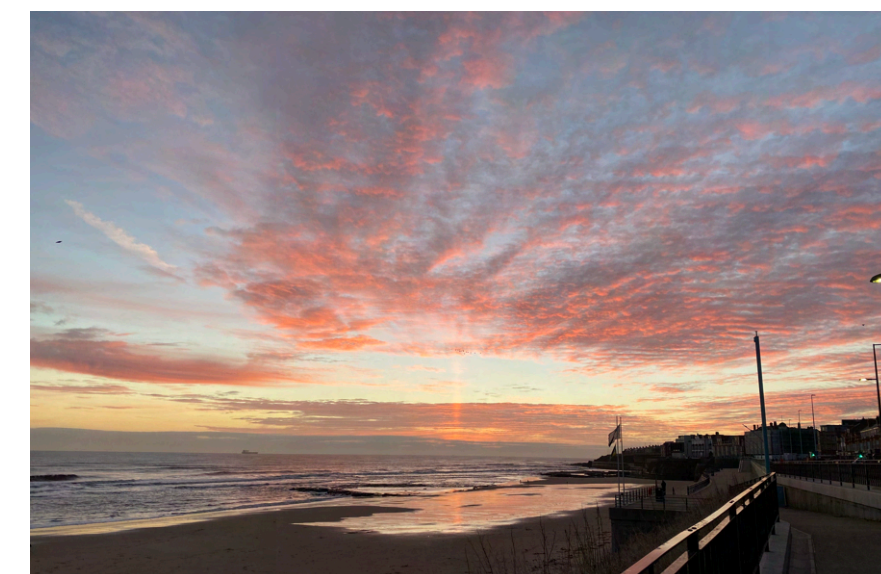
Stratocumulus
Cumulus

Stratocumulus
Cumulonimbus



Image by Arnold Paul via wikimedia commons. License: <https://creativecommons.org/licenses/by-sa/2.5/deed.en>

Altostratus or cirrostratus?



Making a cloud!



Anything you want to remember from the final quiz?

Want More?!

- Visit <https://cloudatlas.wmo.int/en/home.html> and click the 'clouds' tab for beautiful, simple descriptions of alllllll the different types of cloud.
- Go to where you store your photos on your phone or computer and search 'clouds'. You will have taken loads of pictures of clouds without noticing! How many different kinds can you identify from your own photos?

...If you can pay me, please do!

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Theatre of Science Weather Lesson 6: Predicting the Weather!

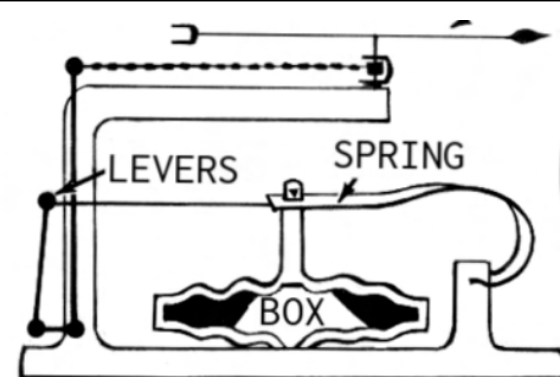
1) What the temperature *is*, and what it feels like, aren't always the same! Scientists have to factor in the difference when producing the weather forecast.

Why does wind make us feel cooler?



Want More?!

Have you got the dedication to make a rain gauge and take regular measurements? That's one of the first projects I had to complete when I studied science at university! The best website I found describing how to do it is here: <https://manoa.hawaii.edu/sealearning/grade-3/earth-and-space-science/weather-patterns/activity-build-rain-gauge>
Click the 'student worksheet' for instructions and a table of results.



And instructions for how to make-your-own barometer to measure air pressure are here! <https://www.wikihow.com/Make-a-Simple-Weather-Barometer>

To join in bring: A piece of A4 paper, glass of water, piece of card and access to a sink would be good!

2) To predict the weather, we have to know the weather *now*, and feed it into a computer.

Amount of cloud

What do weather stations measure? Guess the blanks!

Wind

Air temperature above

of any snow

Pressure

Wind

Air temperature above concrete

S temperature

Amount of



Type of

How much is in the air

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Wormy enters a Rain Gauge Competition. The other contestants are evil kittens who laugh at her lack of fur. But they have made mistakes! **Spot** their mistakes, and **say why they're wrong**, to help Wormy claim victory.

Pour me.
Water
disaster.



Bunbun



- Puts it under a tree so the water won't evaporate in the sun.
- Measures at 7am each day.

Floofloo



- Puts it next to a wall so the dog won't knock it over.
- Measures at 9am or 8pm most days.

Brad

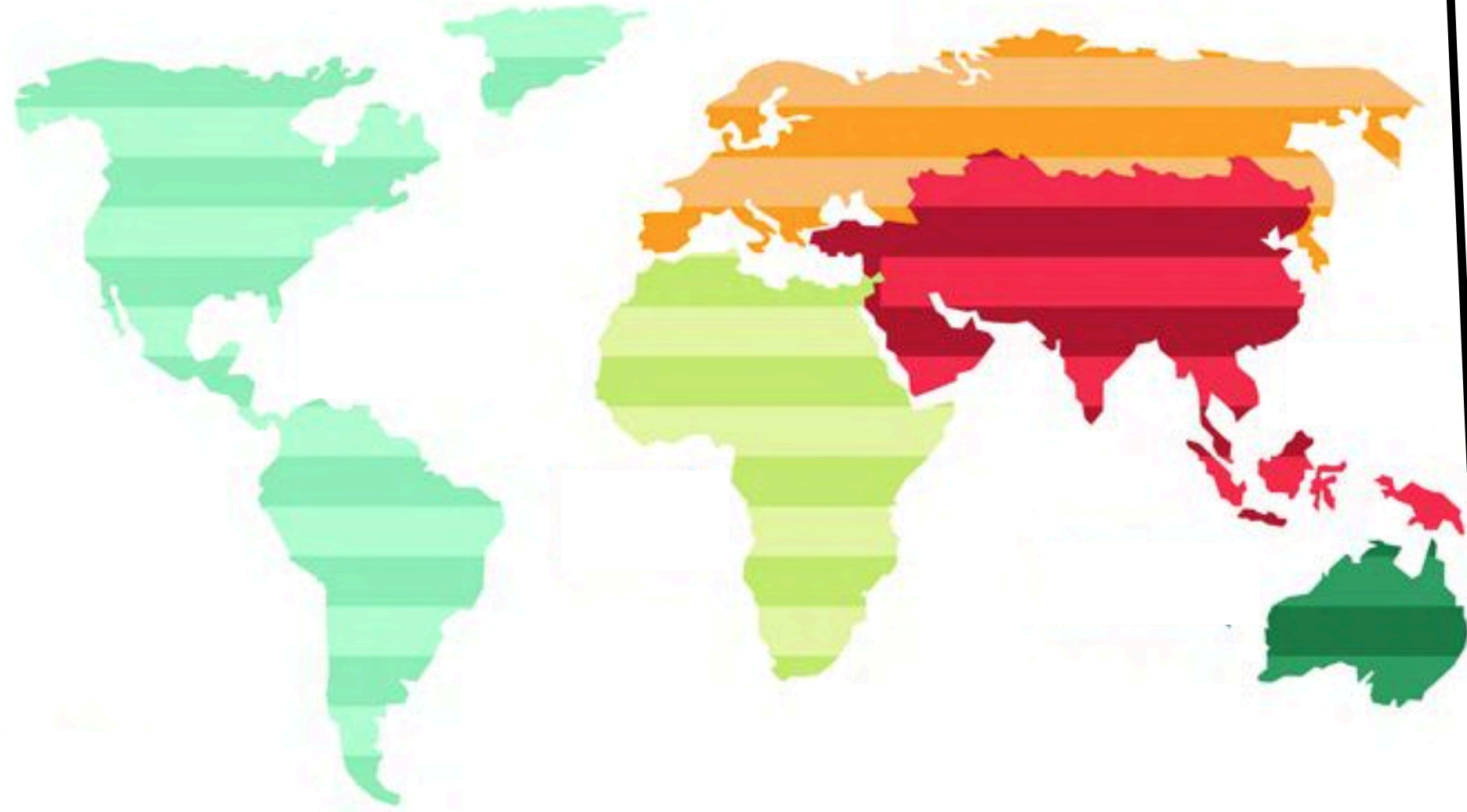


- Measures daily at 8pm.
- Keeps it away from trees & buildings.
- Uses the bottoms of two bottles so no water evaporates



Theatre of Science Weather Lesson 7: Earth's Climates!

To join in bring: A4 paper, pen, fork, small bowl, felt pens, glue, scissors.



Is this a map of Earth's climate zones? Explain your answer with as many reasons as you can! "Yes because..." "No because..."

Thoughts before the lesson:

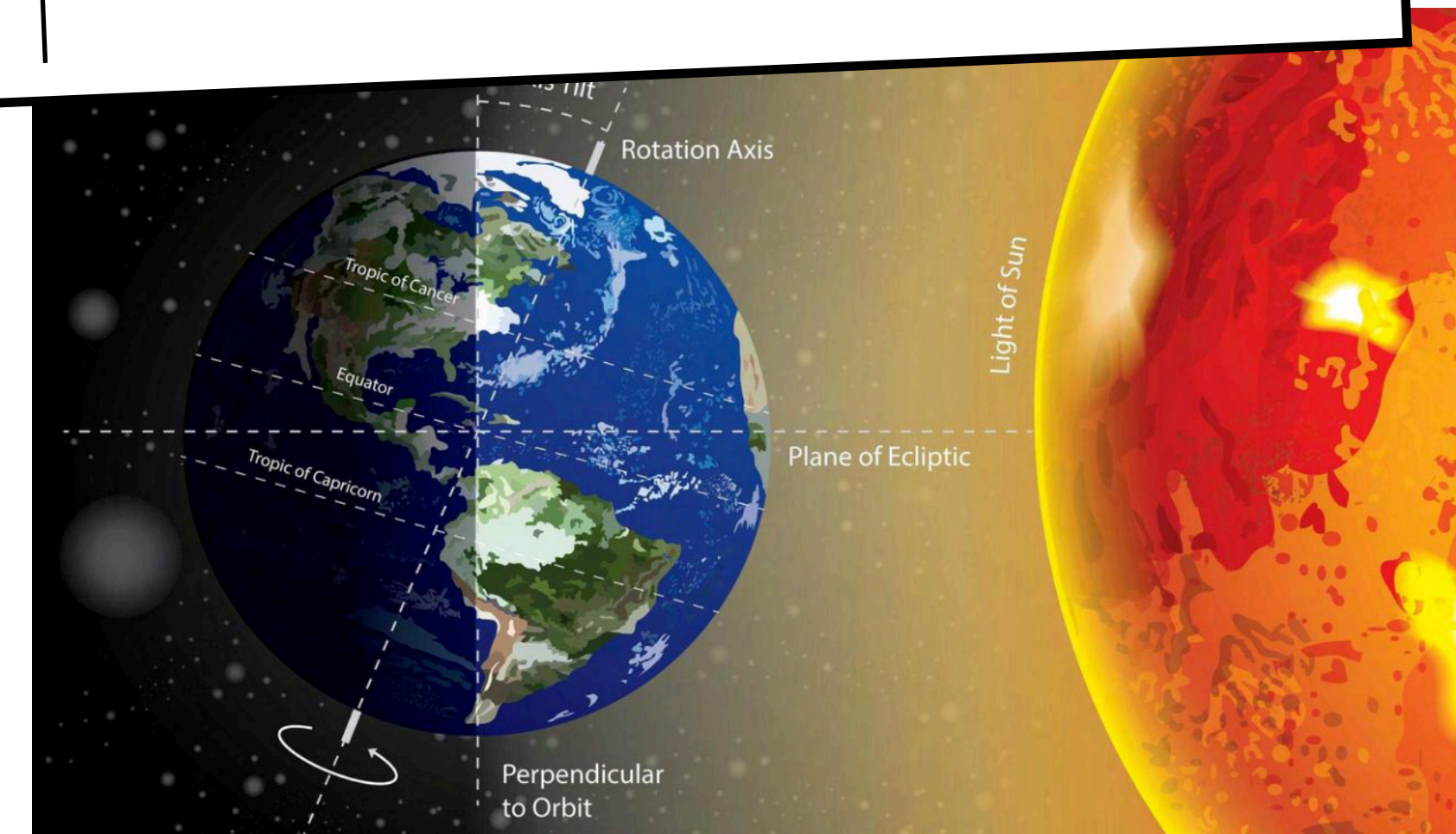
Thoughts after the lesson:

Want More?!

Twinkl have a whole series of live lessons just on climate, looking at it from the Geography side. Krissy who teaches them is a Geography specialist and you can tell! The one about why we have different climates in the UK might be particularly interesting after this lesson: <https://www.twinkl.co.uk/blog/climate-live-lessons-for-home-educators>

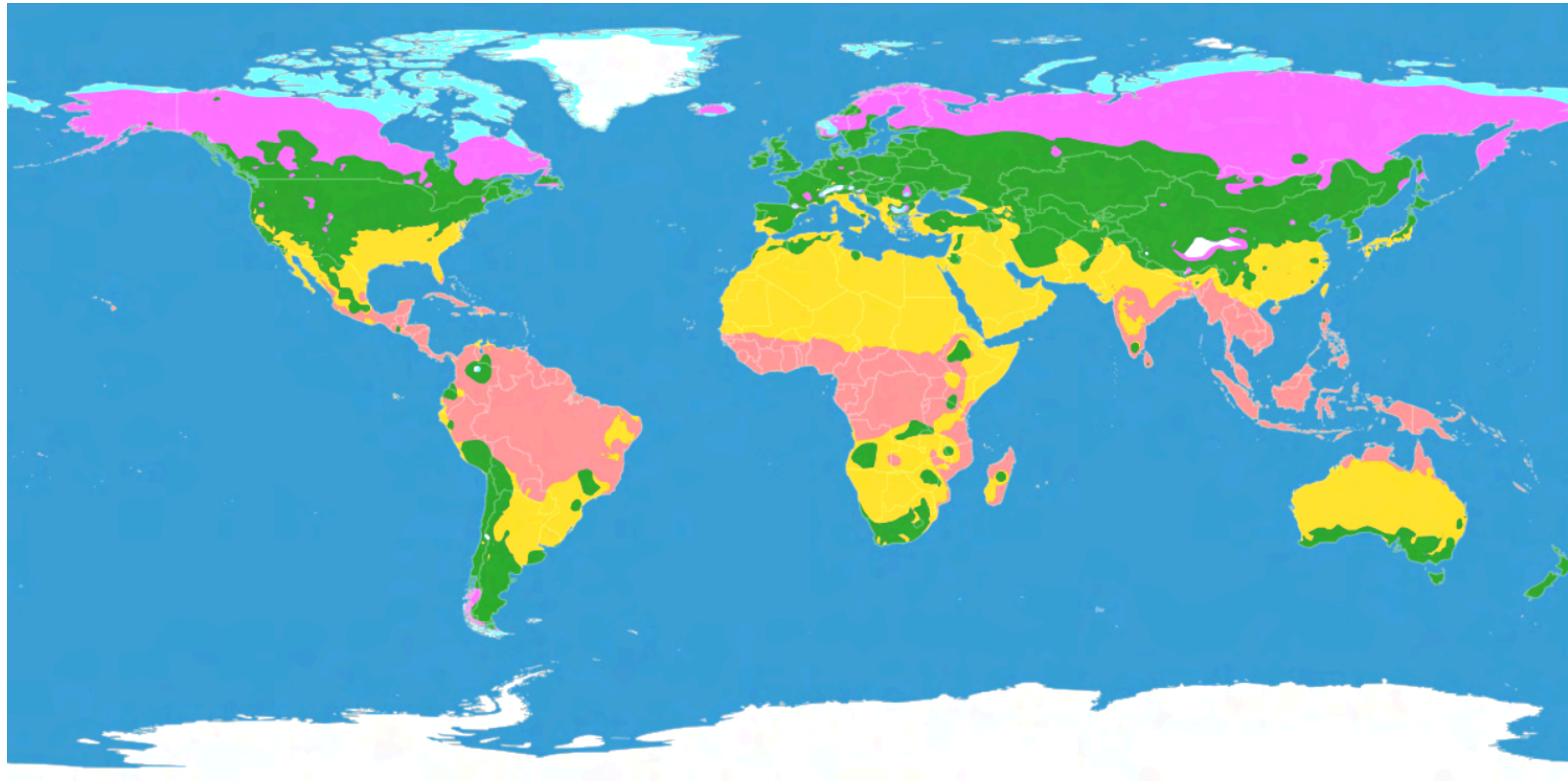
The UK (where I am!) has seasons because Earth is on a tilt. We're not going to go into detail about that today but this picture might help if you want to understand it.

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Which bits are the:
Polar Temperate Arid (Very dry) Tropical regions?





Theatre of Science Weather Lesson 8: Climate Change

I just want you to guess first then correct it at the end if you need to.

To join in bring: Glass, small jug of water, ice, bowl (Activity 1) . Empty spice jar, flour/cocoa powder/powdered spice/herbs/anything you don't mind 'wasting'! (Activity 2).

Today we will:

Think about what greenhouse gases cause the climate the change.

Evaluate the methods we use to discover how the climate is changing.

Discuss some of the consequences of climate change.

Analyse conversations about climate change on the internet to decide whether they are reliable sources of information.

What will happen when the ice cubes melt?



- a) Water will overflow
- b) Water level will go down
- c) Water level will stay the same

Want More?!

Twinkl have a whole series of live lessons just on climate, looking at it from the Geography side. Krissy who teaches them is a Geography specialist and you can tell! The one about why we have different climates in the UK might be particularly interesting after this lesson: <https://www.twinkl.co.uk/blog/climate-live-lessons-for-home-educators>

Tick a box for each type of ice!

If these melt ↓	What will happen? →	Sea level will rise	Sea level will go down	Sea level will be pretty much the same
Land Ice				
Sea Ice				
Icebergs				

(But which one affects polar bears?)



If you enjoyed this lesson and want to pay me, you can!



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Ice on Land

Glaciers form on land. Snow falls and doesn't melt. It builds up and up, gets squashed into sheets of ice, then slowly flows towards the sea!

An ice sheet is a glacier over 19 000 square miles.

Ice caps sit on top of mountains and are less than 19 000 square miles.

Ice shelves are where glaciers meet the ocean.



Sea Ice

Sea ice forms in the sea; it's frozen sea water floating on the ocean's surface.



Icebergs

Fresh water ice that has broken off from a glacier and is now in the sea.

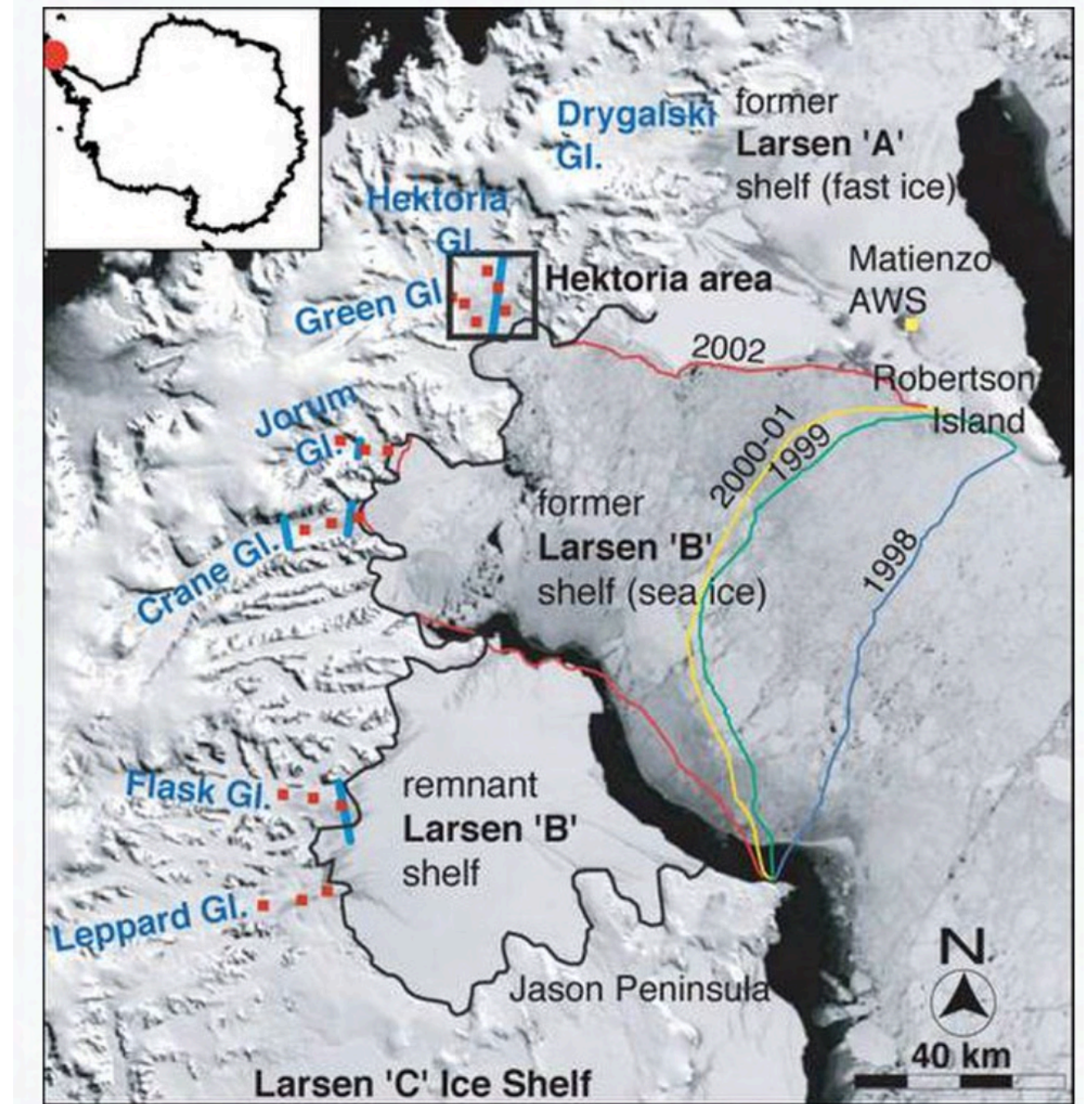




Humans have only been recording the amount of carbon dioxide in the atmosphere for about 70 years.



How could you find out what the atmosphere was like before that?!



The Larsen B Ice Shelf over time.