



MAKING SCIENCE CLASSROOMS ACCESSIBLE TO STUDENTS WITH SPECIAL EDUCATIONAL NEEDS (SEN)

There are a number of approaches to making Science lessons accessible to students with disabilities – **Accommodations**, **Universal Design for Learning (UDL)** and **Differentiated Instruction**.

Accommodations are alternate formats, assistive technology and other adjustments for specific students once they are in a class.

UDL is an educational framework based on research in the learning sciences, including cognitive neuroscience. UDL guides the development of flexible learning environments that can accommodate individual learning differences.

Recognising that the way individuals learn can be unique, the UDL framework, first defined by Rose (1990) for creating a curriculum from the outset that provides:

- Multiple means of representation to give learners various ways of acquiring information and knowledge
- Multiple means of expression to provide learners alternatives for demonstrating what they know
- Multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn.

Differentiated Instruction and **UDL** are similar concepts sharing many of the same ideas about learning and even classroom practices. Differentiated Instruction suggests a framework for modifying and adapting the curriculum in response to learner needs or styles. UDL, in contrast to this, focuses on a more proactive approach. Differentiated Instruction focuses on content, process and product while UDL focuses on three networks for providing accessibility to the curriculum.

Challenges	Accommodations
Reading standard text or viewing graphic images due to visual impairments	<ul style="list-style-type: none"> - Materials in large print or Braille, on tape, or via computer; enlarged or tactile drawings; access to assistive technology that provides enlarged voice, or Braille output
Seeing materials on blackboard or overhead projector due to visual impairments	<ul style="list-style-type: none"> - Binoculars; verbalization of the content and oral descriptions of all visually displayed materials
Reading output from standard equipment because of a visual impairment	<ul style="list-style-type: none"> - Interfacing lab equipment with computer and providing large print or speech output; scientific equipment with Braille and large print markings
Hearing presentations and instructions due to hearing impairments	<ul style="list-style-type: none"> - FM system; interpreter, printed materials; facing student for lip reading; overhead projector or blackboard
Hearing multimedia presentations due to hearing or speech impairment	<ul style="list-style-type: none"> - Electronic communications (e.g.: email) where the ability to hear or speak is not required; portable computer with speech input
Understanding concepts due to a specific learning disability	<ul style="list-style-type: none"> - Visual, aural, and tactile demonstrations incorporated into instruction
Taking notes in class because of mobility or visual impairment	<ul style="list-style-type: none"> - In-class access to a computer with assistive technology and a word processor
Operating lab equipment and conducting lab experiments due to mobility impairment	<ul style="list-style-type: none"> - Accessible facility; adjustable-height tables; lab partner; scribe; computer-controlled lab equipment with alternative input devices (e.g.: speech, alternative keyboard); modified scientific equipment
Seeing demonstrations while seated in a wheelchair; viewing lab experiments	<ul style="list-style-type: none"> - Adjustable-height tables and flexible seating arrangements
The student who has difficulty; completing homework or lab reports because of a health impairment	<ul style="list-style-type: none"> - Flexible scheduling arrangements
Completing and submitting worksheets and tests because of visual impairment or specific learning disability	<ul style="list-style-type: none"> - Worksheets and tests in large print or Braille, on tape, or via computer; access to assistive technology that provides enlarged voice or Braille as well as standard print output

Barriers to Learning/Challenges	UDL & Differentiated Instruction Strategies
Vocabulary & Language	<ul style="list-style-type: none"> - Pre-teach vocabulary - Key Words - Key concepts - Visual supports - Mind maps - ICT
Fear of Failure/Poor Self-Esteem	<ul style="list-style-type: none"> - Confidence building activities - Positive reinforcement - Group work - Project work
Fine/Gross Motor Difficulties	<ul style="list-style-type: none"> - Exemplar 1: NCCA Mild GLD Guidelines SESE Primary - Allow time for drawing diagrams etc - Give students the option to explain work orally
Body Image/Awareness	<ul style="list-style-type: none"> - Exemplar 1: NCCA Mild GLD Guidelines SESE Primary - Use P.E to support this area
Vocabulary & Language	<ul style="list-style-type: none"> - Pre-teach vocabulary - Key Words - Key concepts - Visual supports - Mind maps - ICT
Organisation & Planning	<ul style="list-style-type: none"> - Clarify the purpose of activities for the student. - Demonstrate collection and organisation of resources, planning out loud - Break tasks into small manageable steps - Model and verbalise instructions - Provide checklists (pictorial or written) for regular routines, teaching the student how to use them.

(Continued)	
Short-term memory	<ul style="list-style-type: none"> - Translate information in students own words - Use words multiple times in different formats - Provide picture images - Practice - Use Visual Maps/Organisers
Classification	<ul style="list-style-type: none"> - Work slowly from one stage to the next - Use concrete examples, for example students in the class with brown hair/ students with brown eyes/students with both - Choose similarities/differences that are easily observable
Time	<ul style="list-style-type: none"> - Measurement of time can be built into investigations where possible - Observe changes occurring over a day, a week, a month and the seasons - Visual images of time passing
Safety	<ul style="list-style-type: none"> - Teach safety rules explicitly - Practice safety regularly - Use visual reminders of safety during investigations
Developing Ideas	<ul style="list-style-type: none"> - Keep ideas as simple as possible - Discuss ideas with the whole group - Repeat and record suggestions from students and refer back to them - Encourage work in small groups and in pairs
Communicating Ideas	<ul style="list-style-type: none"> - Ask students to describe observations verbally or nonverbally using an increasing vocabulary - Display findings from investigations with drawings and pictures - Use ICT: simple written or word-processed accounts taking photographs, making video recordings of an investigation

(Continued)	
Overwhelmed by course content	<ul style="list-style-type: none"> - Provide alternative forms of information, for example: visual presentations of materials - Focus on key areas/concepts of the curriculum - Use a highlighter for important sections/words - Avoid presenting the student with too much content
Concentration/attention span	<ul style="list-style-type: none"> - Organise interesting tasks that require a short timescale in the early stages of the science programme - Vary the processes and move students to new and achievable tasks if concentration is seen to diminish - Group/pair work
Writing up mandatory experiments	<ul style="list-style-type: none"> - Provide a pro forma sheet with the required headings and some guiding questions - Encourage students to complete each stage in the report as it is being done - Use word processor to support writing - Encourage students to sketch and glue in pictures

Checking Readability using Microsoft Word (Flesch-Kincaid Score)

When Microsoft Word finishes checking spelling and grammar, it can display information about the reading level of the document, including the readability scores. Each readability score bases its rating on the average number of syllables per word and words per sentence.

Text is rated on a US school grade level. For most documents, aim for a score of about 7.0 to 8.0.

The formula for the Flesch-Kincaid Grade Level score is:

$(.39 \times ASL) + (11.8 \times ASW) - 15.59$ where:

ASL = average sentence length (the number of words divided by the number of sentences)

ASW = average number of syllables per word (the number of syllables divided by the number of words)

To set your PC to give you the readability score in MS Word

- Press the F1 Key
- Type 'Fleisch-Kincaid' into the search box and follow the instructions for your version of Word

Your PC should now be set to show the readability statistics of any MS Word document.

You must first check the spelling and grammar and then the readability statistics will appear.

This table shows the comparisons between the American Education System and the Irish Equivalent:

American System	School Year	Ages	Irish Equivalent
Primary School	Kindergarten	5 – 6 years	Jr/Snr Infants
	1 st Grade	6 – 7 years	1 st Class
	2 nd Grade	7 – 8 years	2 nd Class
	3 rd Grade	8 – 9 years	3 rd Class
	4 th Grade	9 – 10 years	4 th Class
	5 th Grade (Functional Literacy)	10 – 11 years	5 th Class
	6 th Grade	11 – 12 years	6 th Class
Middle School (Sometimes includes 6 th Grade)	7 th Grade	12 – 13 years	1 st Year
	8 th Grade	13 – 14 years	2 nd Year
High School	9 th Grade (Freshman)	14 – 15 years	3 rd Year
	10 th Grade (Sophomore)	15 – 16 years	4 th Year
	11 th Grade (Junior)	16 – 17 years	5 th Year
	12 th Grade (Senior)	17 – 18 years	6 th Year

KEYWORDS: SCIENCE 1ST YEAR**NAME:** _____ **CLASS:** _____

1. Biology	Learning about plants and animals.
2. Growth	Plants and animals getting bigger.
3. Microscope	Allows us to see plants and animals at a bigger size.
4. Temperature	Is a measure of how hot or cold an object is.
5. Measurement	The distance between 2 places.
6. Ruler	Used to measure short straight lines.
7. Trundle Wheel	Used to measure long distances.
8. Experiment	A test to find something out.
9. Method	The way we do experiments.
10. Bunsen Burner	Is a gas burner used in a lab during experiments.

SESS Differentiation Template

Using the template below, consider these aspects of the lesson given to your students so that all learners can be included in order that they can participate in and benefit from the lesson.

KEY WORDS TO BE TAUGHT / PRE-TAUGHT			

1 DIFFERENTIATE BY CONTENT (In what ways can I vary what I am teaching?)		
(A) Complexity of content: (concrete, symbolic, abstract)		
Concrete	Symbolic	Abstract
(B) Variety of resources		
(C) Variety of learning environments		

KEY CONCEPTS IN THE LESSON (OBJECTIVES)		
What students must know or be able to do	What students should know or be able to do	What students could know or be able to do

2 DIFFERENTIATE BY PROCESS (How will I teach the lesson?)

3 DIFFERENTIATE BY OUTCOME / PRODUCT (How will the student demonstrate understanding?)

FINALLY - ANY OTHER POSSIBILITIES FOR THIS LESSON?

TOPIC:	Balanced Diet (Learning outcomes by syllabus reference: OB1 and OB2)
HOW MANY LESSONS?	3 – 4 lessons

KEYWORDS / TERMS TO BE TAUGHT			
Carbohydrates	Fibre	Starch	Constipation
Protein	Vitamins	Vitamins	Calcium
Iron	Pyramid	Fat	Water

KEY CONCEPTS IN THE LESSON (OBJECTIVES)		
What students must know or be able to do	What students should know or be able to do	What students could know or be able to do
<p>To recall that a balanced diet is important for health</p> <p>To identify the six constituents of a balanced diet and give the function of each</p>	<p>To label a food pyramid</p>	<p>To be able to compare and contrast different diets</p>

SEQUENCE OF LESSON

1. Introduce the concept of a balanced diet. Seek level of prior knowledge of class. This could be facilitated by using the Balanced Diet Introduction PowerPoint
2. Analyse typical diets using volunteers in the class. Discussion of key vocabulary
3. Review – whole class discussion / dissemination of ideas / extra information
4. Further class work/homework. Devise extension activities as required

1 DIFFERENTIATE BY CONTENT (In what ways can I vary what I am teaching?)		
(A) Complexity of content: (concrete, symbolic, abstract)		
Concrete	Symbolic	Abstract
<p>Real materials associated with food e.g. fruit, sweets, food packaging</p> <p>A 3-dimensional food pyramid could be constructed in consultation with woodwork teacher</p>	<p>Food pyramid and other images</p>	<p>The interaction of lifestyle, age and diet in healthy living</p>
(B) Variety of resources		
As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to diet		
(C) Variety of learning environments		
Classroom, school laboratory, computer room/library in school		

2 DIFFERENTIATE BY PROCESS (How will I teach the lesson?)

Sequence of lesson as laid out above

- Introduction – using concrete material or a general class discussion
- Divide class into groups. Differentially support groups through assisting students in discussing and analysing their own diets and drawing conclusions as appropriate and encouraging students to extend their thinking and language use
- Possible Use of Graphic Organisers

3 DIFFERENTIATE BY OUTCOME / PRODUCT (How will the student demonstrate understanding?)

- Students may use a food diary to assist them to analyse their own diet
- Whole class review work completed at end of class
- Specify time to be allocated to this work at home

FINALLY - ANY OTHER POSSIBILITIES FOR THIS LESSON?

Collage of scenes showing different types of food

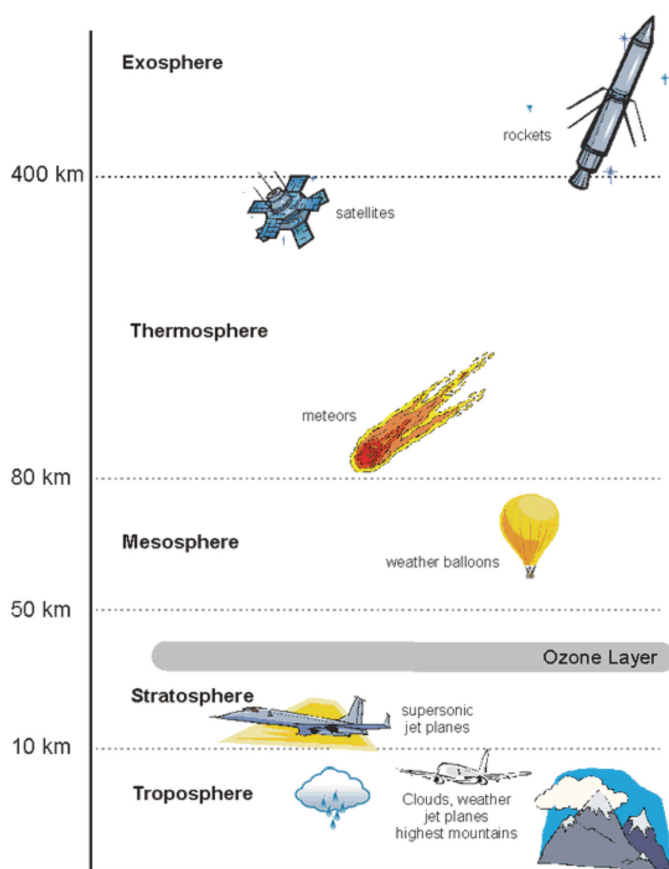
- Dramatisation, e.g. possible use of role play to highlight the importance of a balanced diet
- Other activities, e.g. create a menu containing balanced meals
- Internet search for material on a healthy lifestyle?
- Suggested Internet links include
 - www.kidshealth.org
 - www.safefood.eu
 - www.scoilnet.ie
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
- Visit to a local vegetable garden or shop
- Highlight problems associated with diet and how they can be overcome with a balanced diet
- Mathematics

The restless atmosphere

1 What is the atmosphere?

The atmosphere is a blanket of air around the Earth.

Look below and see the different layers of the atmosphere and what happens in them:

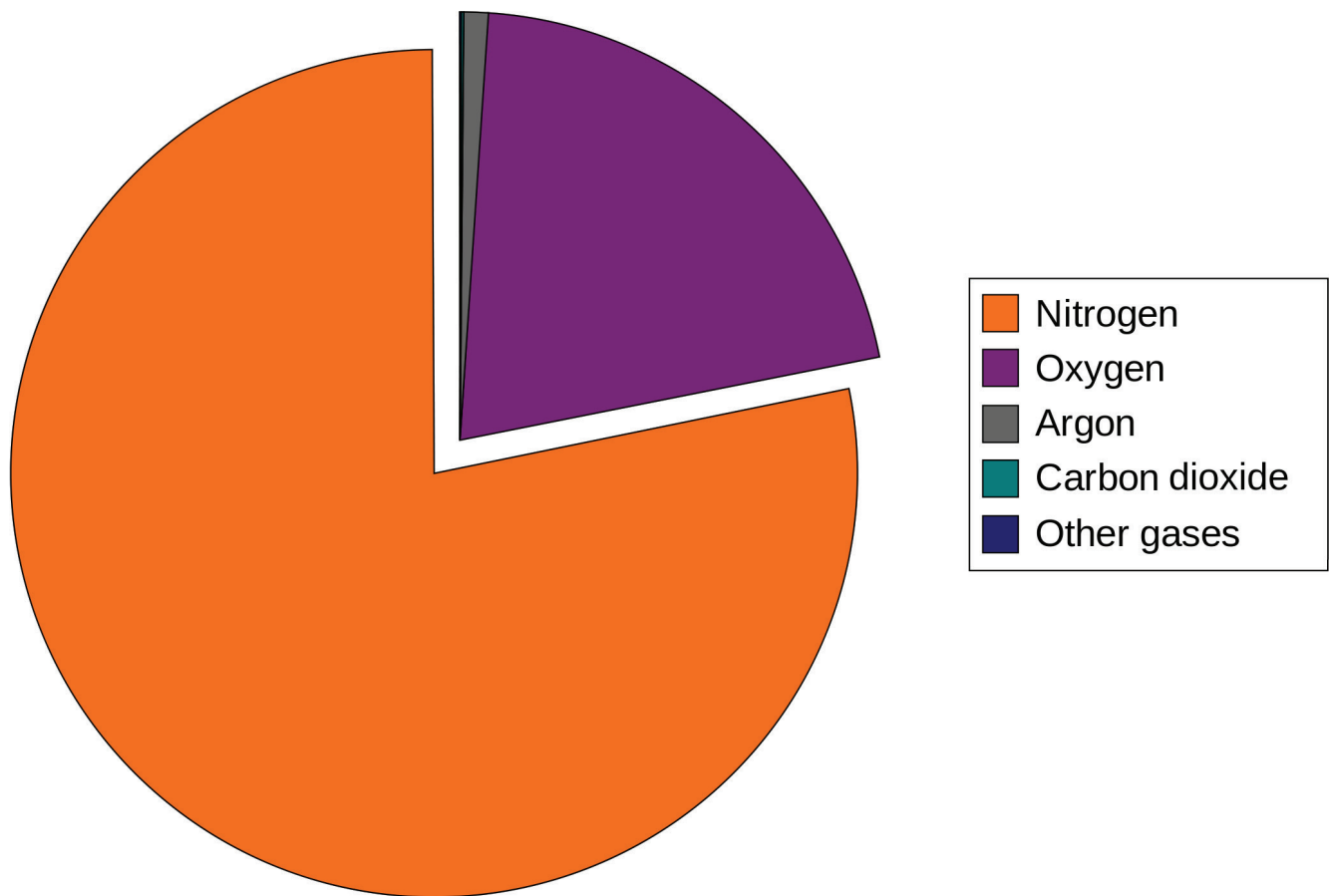


Why do we need the atmosphere?

- The atmosphere gives us the air we breathe.
- The atmosphere absorbs (takes in) heat from the sun by day.
- The atmosphere keeps the heat in at night.
- The atmosphere protects us from the sun's harmful rays.

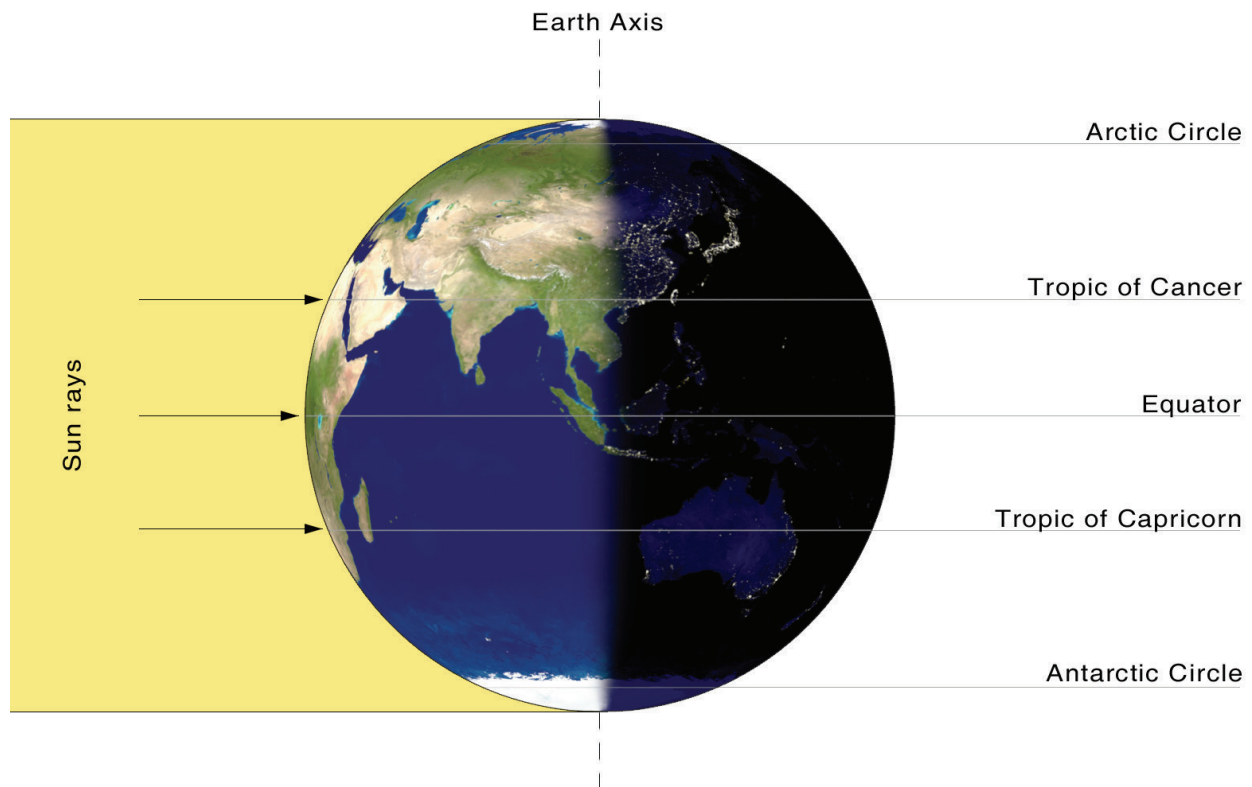
The ozone layer is part of the atmosphere.
It protects us from the sun's harmful UV rays.

What are the gases that make up the atmosphere?



2 How is the Earth heated?

The sun gives off solar energy. This energy brings **heat** and **light** to the Earth's surface. It also influences our climate and weather.



Not all solar energy reaches the surface of the Earth.

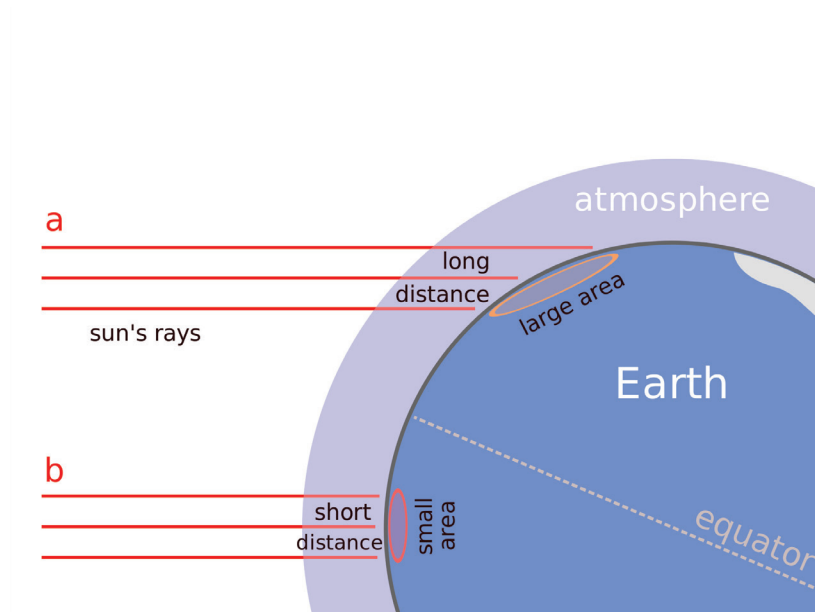
The sun shines directly on the Equator.

The Equator is at 0°.

Latitude is the distance North and South from the Equator, it is measured in degrees (°) .

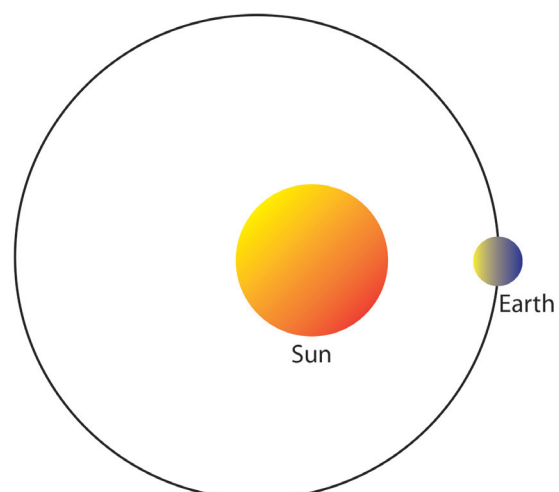
Why are places that are near the Equator (at low latitudes) much warmer than places that are near to the poles (at high latitudes)?

- The angle of the sun in the sky: the sun rays have a bigger distance to travel to places at high latitudes.
- The curve of the Earth's surface.
- The layer of atmosphere around the Earth.

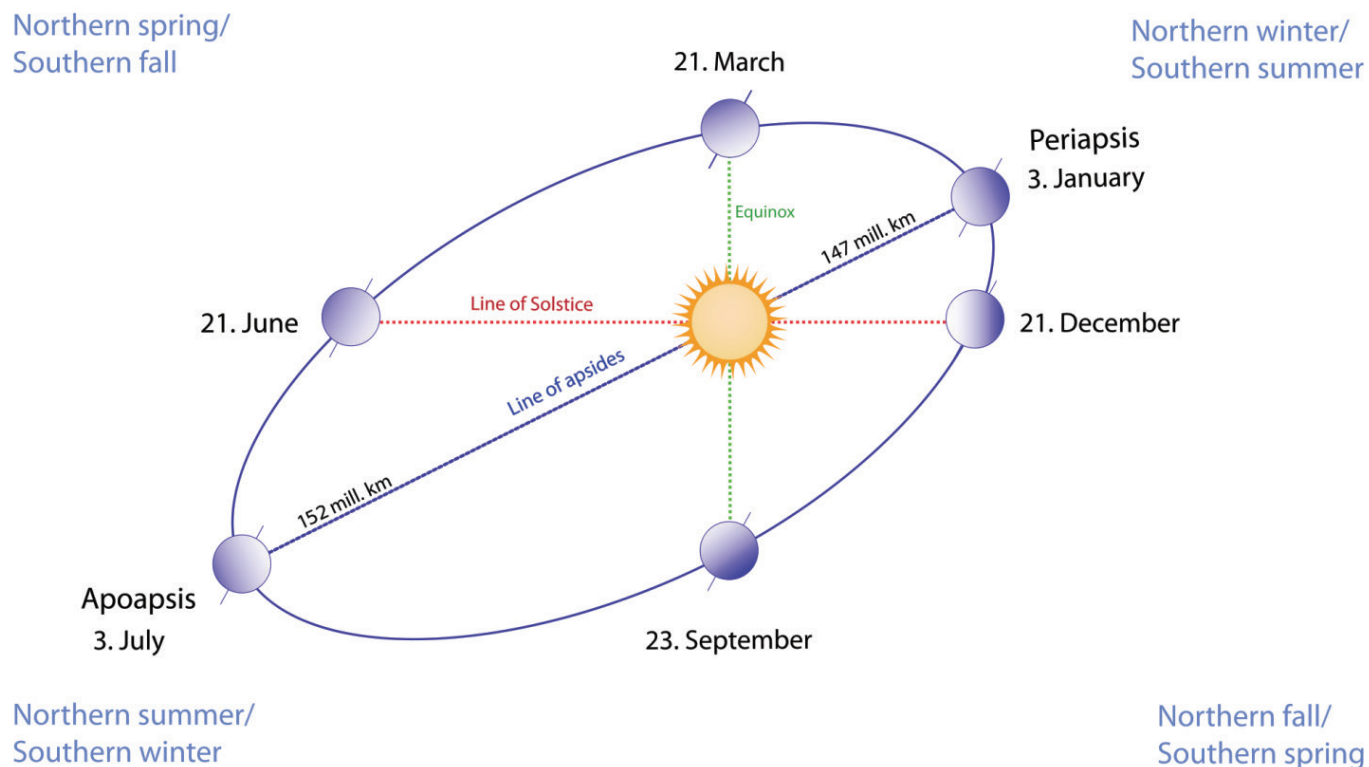


Seasons and the sun.

- It takes a full year (365 1/4 days) for the Earth to go around the Sun.



The Earth is tilted towards or away from the Sun on an **axis**.



In the Northern Hemisphere (in Ireland for example)

SUMMER:

- We are tilted towards the sun.
- We have long days.
- We have short nights.
- The weather is warmer.

WINTER:

- We are tilted away from the sun.
- We have short days.
- We have long nights.
- The weather is colder.

At the same time it is the opposite in the Southern Hemisphere!

3 Wind

- What is wind?
Wind is moving air.
- Why do we have winds?
The wind is caused by the fact that the Earth is heated unequally.
- What is the atmospheric pressure?
It is the weight of the air pressing down on Earth's surface.
- Where do the winds get their names from?
Winds get their names from where they come
- What is a prevailing wind?
It is the wind that is most common in an area.
In Ireland for example the south-westerlies prevail.
These winds are warm and filled with moisture so that is why we have a mild and moist climate.



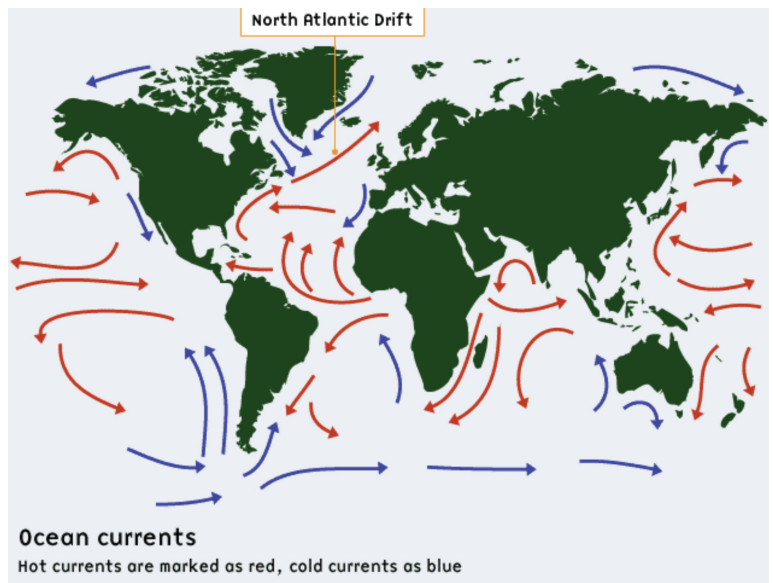
Cold or hot winds?

- Winds that blow from the equator towards the poles are warm winds.
- Winds that blow from the poles towards the equator are cold winds.

4 Ocean Currents

What are ocean currents?

- They are slow and regular river-like movements of water in the oceans.



Why do they exist?

- Ocean currents are caused by the fact that the Earth is heated unequally.
- Prevailing winds move some water along.
- Because the Earth spins on its axis, water in the oceans move.

What are the effects of the ocean currents?

- They have an effect on the climate.
- They transfer heat around the Earth.
- Warm currents flow away from the equator.
- Cool currents flow towards the equator.

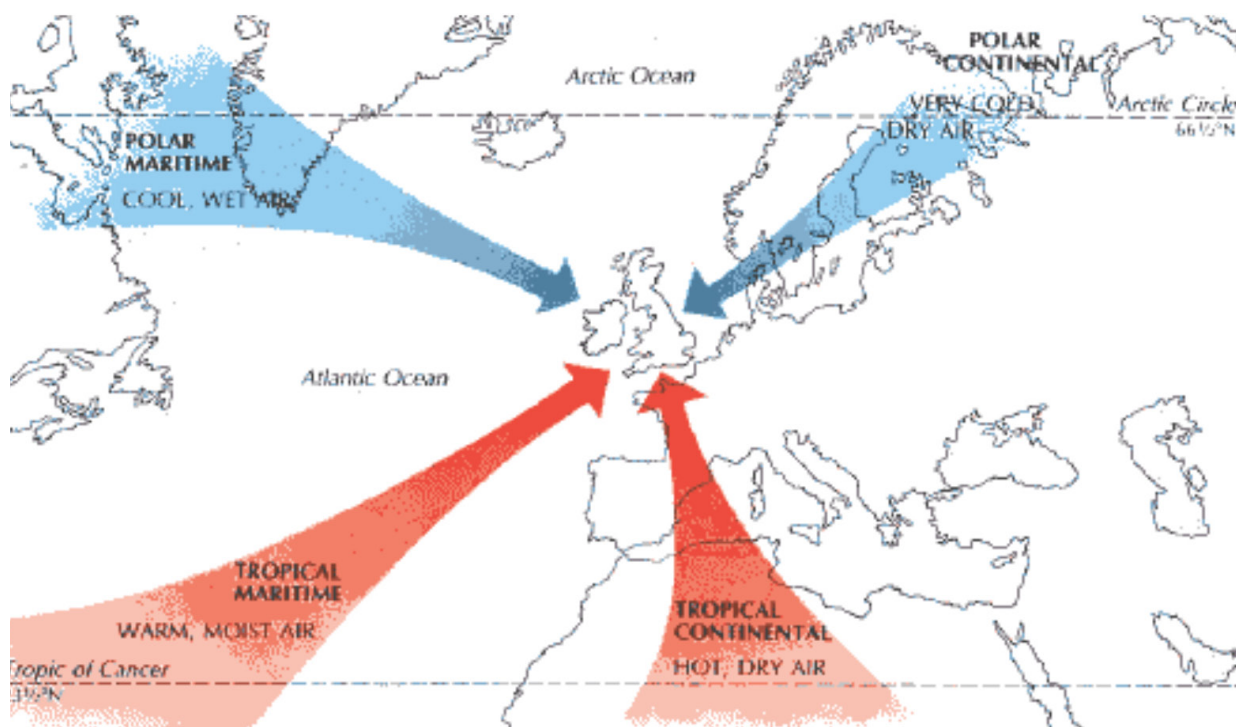
5 Air masses and weather systems

What are air masses?

- They are large bodies of air that have similar temperature, pressure and moisture.

What do air masses do?

They move around and influence the weather of countries.



- Maritime air masses bring rain
- Continental air masses are dry
- Polar air masses are cold
- Tropical air masses are warm

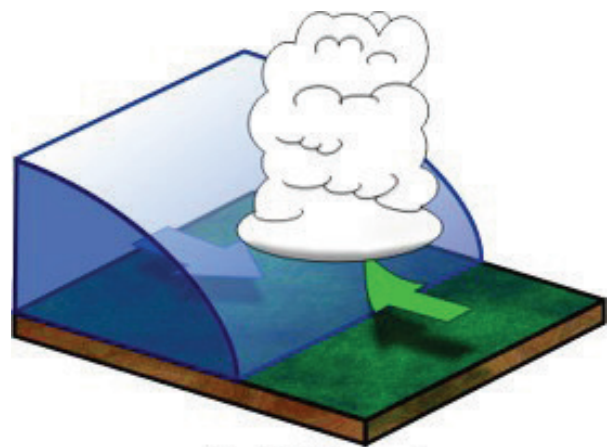
FRONTS

What is a weather front?

- It is where 2 different air masses meet.
- There are cold fronts and warm fronts.

What is a cold front?

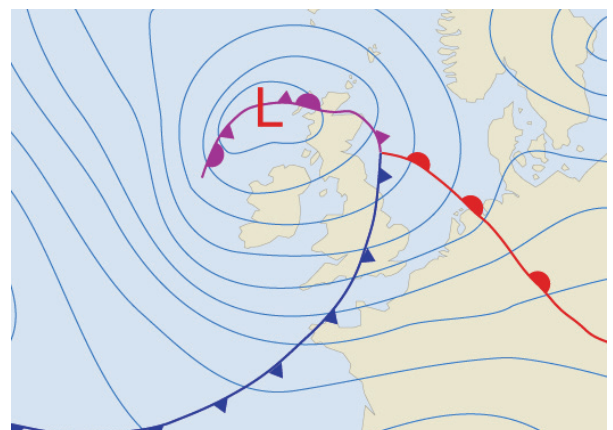
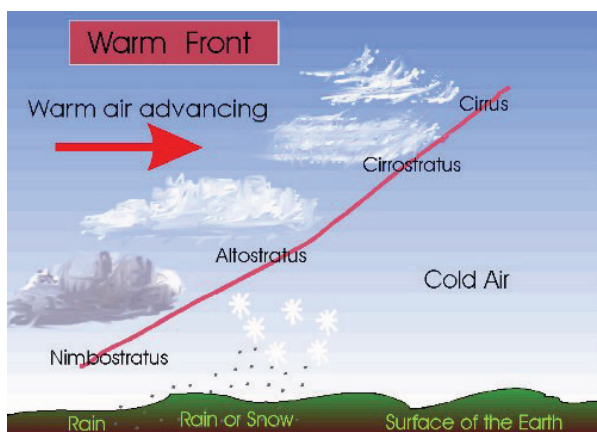
- Cold air mass pushes in and replaces warm air mass. Warm air rises and when it cools, you have clouds and heavy rainfall.



Cold Front

What is a warm front?

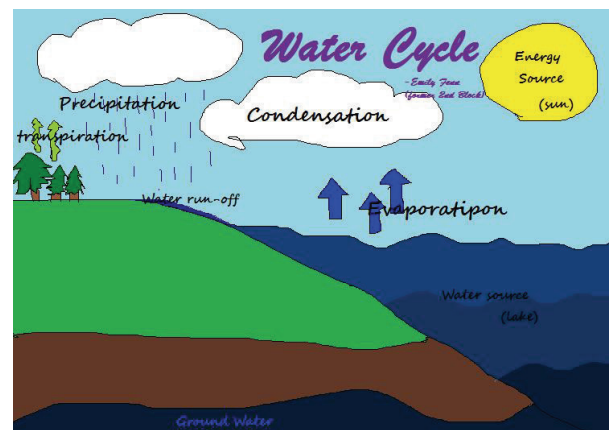
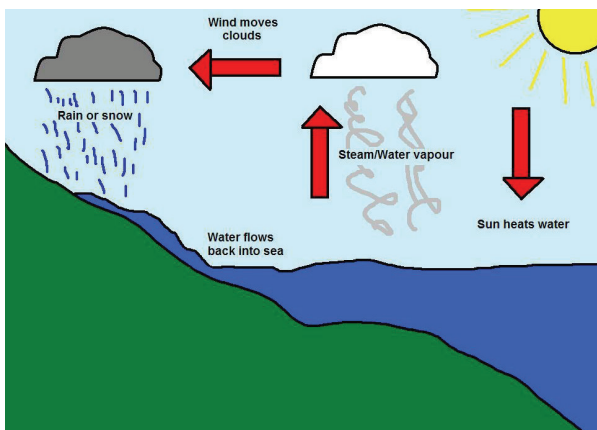
Warm air mass approaches the cold air and goes above it. As warm air rises it cools, you get clouds and a continuous rain.



6 Water in the atmosphere

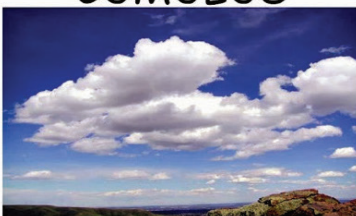
What is the water cycle?

- It is the movement of water between the atmosphere, the land and the oceans.
- It is the earth's way to recycle water.
- Water is a renewable resource.



Types of clouds

CUMULUS



Big, puffy balls of cotton.
Found below 6,500 ft.

CIRRUS



Thin or feathery clouds found with sunny weather. Found above 20,000 ft.

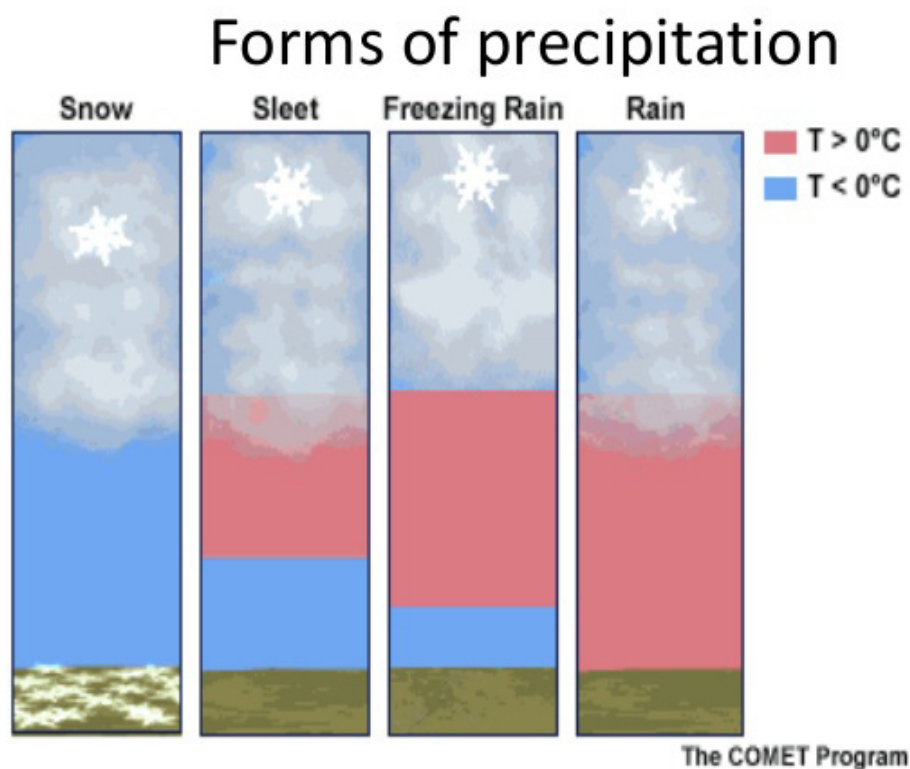
STRATUS



Low, gray clouds that usually bring rain or snow. Found below 6,500 ft

What is precipitation?

- It is water that falls down to the earth from the sky. Water can fall in 4 different forms:



- Rain is the most common form of precipitation.

7 The weather.

The weather is the state of the atmosphere at any particular time and place.

The study of weather is called meteorology. Elements of weather are measured.

What are the elements of weather?

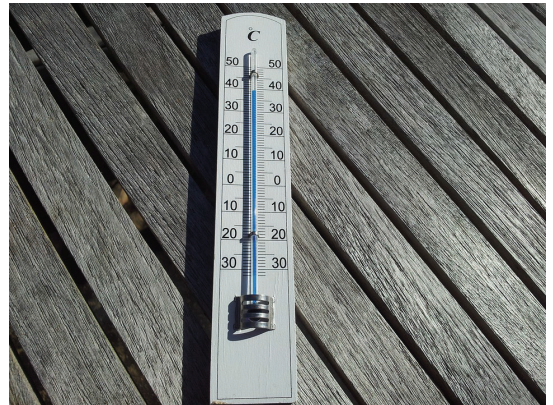
- Temperature ($^{\circ}$ C) (how hot or cold)
- Atmospheric pressure (High or Low pressure)
- Humidity (amount of water in air)
- Wind speed and direction
- Precipitation (rain, fog, snow etc)
- Sunshine

Meteorologists are people who prepare the weather forecast.

Weather instruments are used to measure the weather.

Weather Instruments:

1. **Thermometer** measures the temperature. The measurement is in degrees Celcius ($^{\circ}\text{C}$) or Fahrenheit ($^{\circ}\text{F}$).



2. **Barometer** measures the atmospheric pressure. The measurement is in millibars.

Isobars are lines on the weather map that join places of equal pressure.



3. **Hygrometer** measures the relative humidity in the air. The measurement is in %.

Wind

4. **Anemometer** measures the speed of the wind in kilometres /hour or miles/hour.



5. **The weather vane** indicates the direction of the wind, the direction from where the winds come from.



6. **The rain gauge** measures precipitation (rain, snow, hail etc) in millimetres (mm).



7. The Campbell-Stokes sunshine recorder measures the amount of sunshine (number of hours sunshine per day).



8. The Stevenson screen is a box which contains and protects instruments for measuring the weather.





Down
Syndrome
Ireland

National Leadership Local Support