Glenlola Collegiate School

excellence through commitment, contribution and caring

1.7A

Ecological relationships & energy flow

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abathit pilauonpot

species ecology

environment

biodiversity community

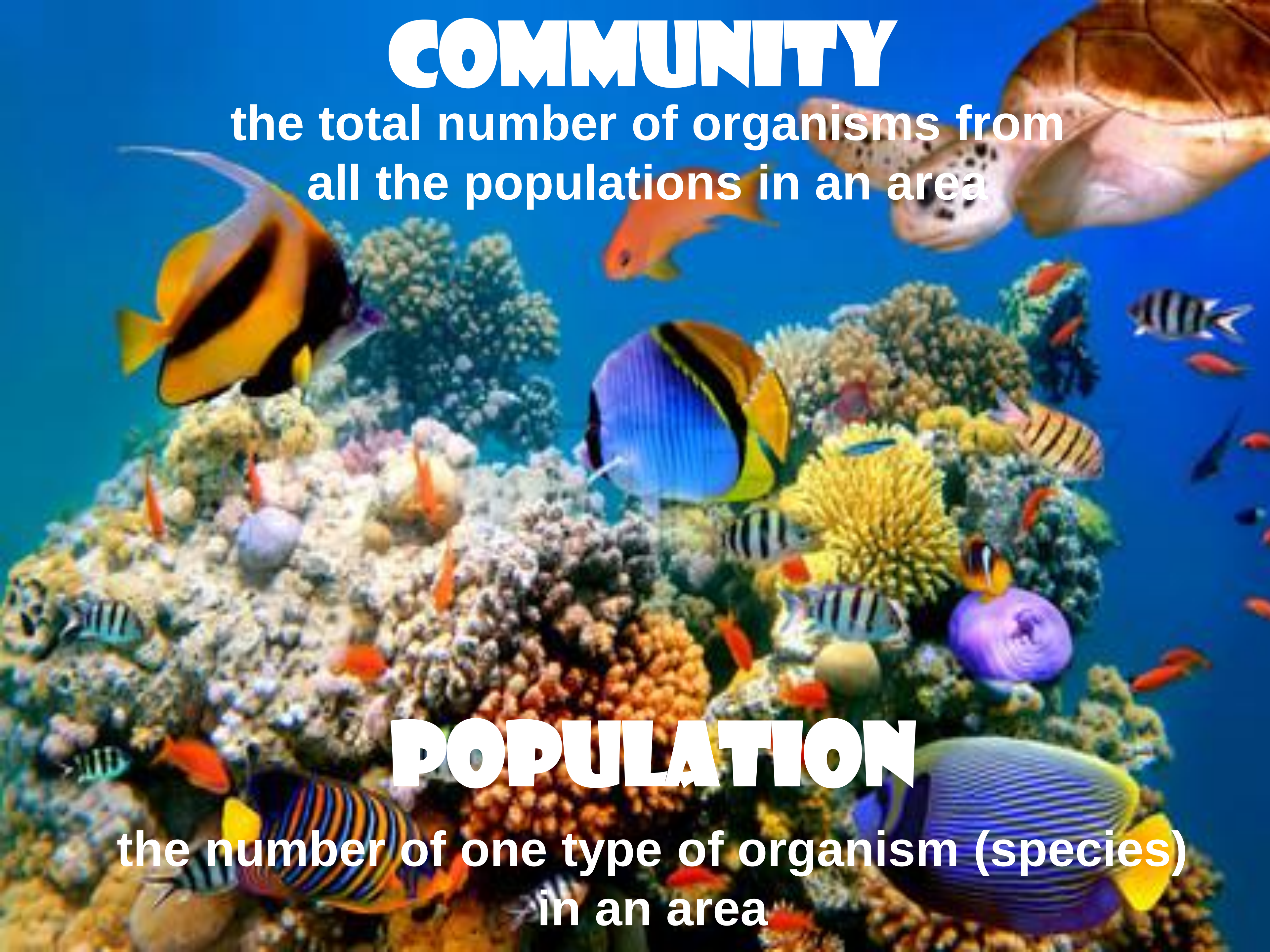
ecosystem

habitat population

LEARNING OUTCOMES

Understand the meaning of the terms biodiversity, population, habitat, environment, community and ecosystem

Ecology
is the study
of communities
in their environment


COMMUNITY
the total number of organisms from all the populations in an area
POPULATION
the number of one type of organism (species) in an area

SPECIES

A group of organisms with similar characteristics that can interbreed to produce fertile offspring

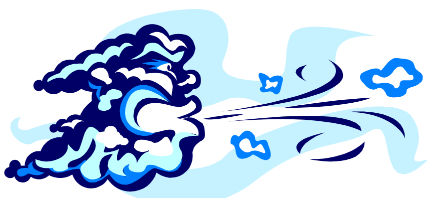
the environment

All the factors surrounding an organism

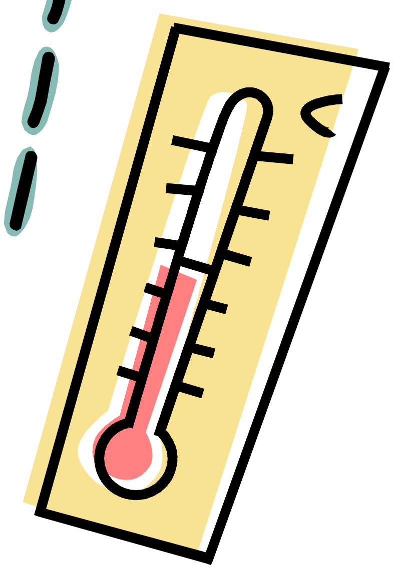
it is made up of abiotic and biotic factors

abiotic factors

These are the **non-living**, physical parts of the environment, including:



- **Wind**
- **Water**
- **pH**
- **Light**
- **Temperature**

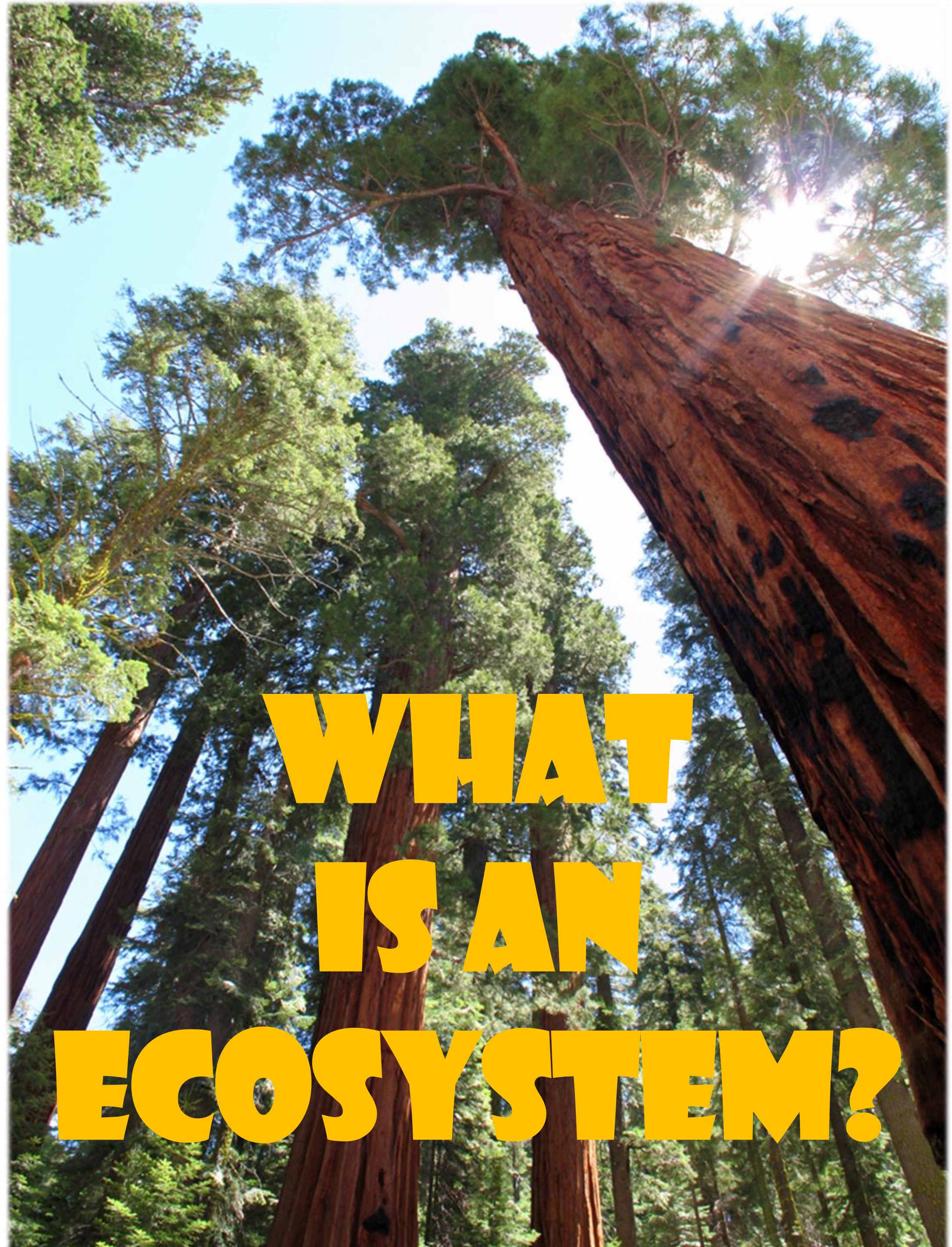


biotic factors

These are the **living parts** of the environment, including:

DISEASE

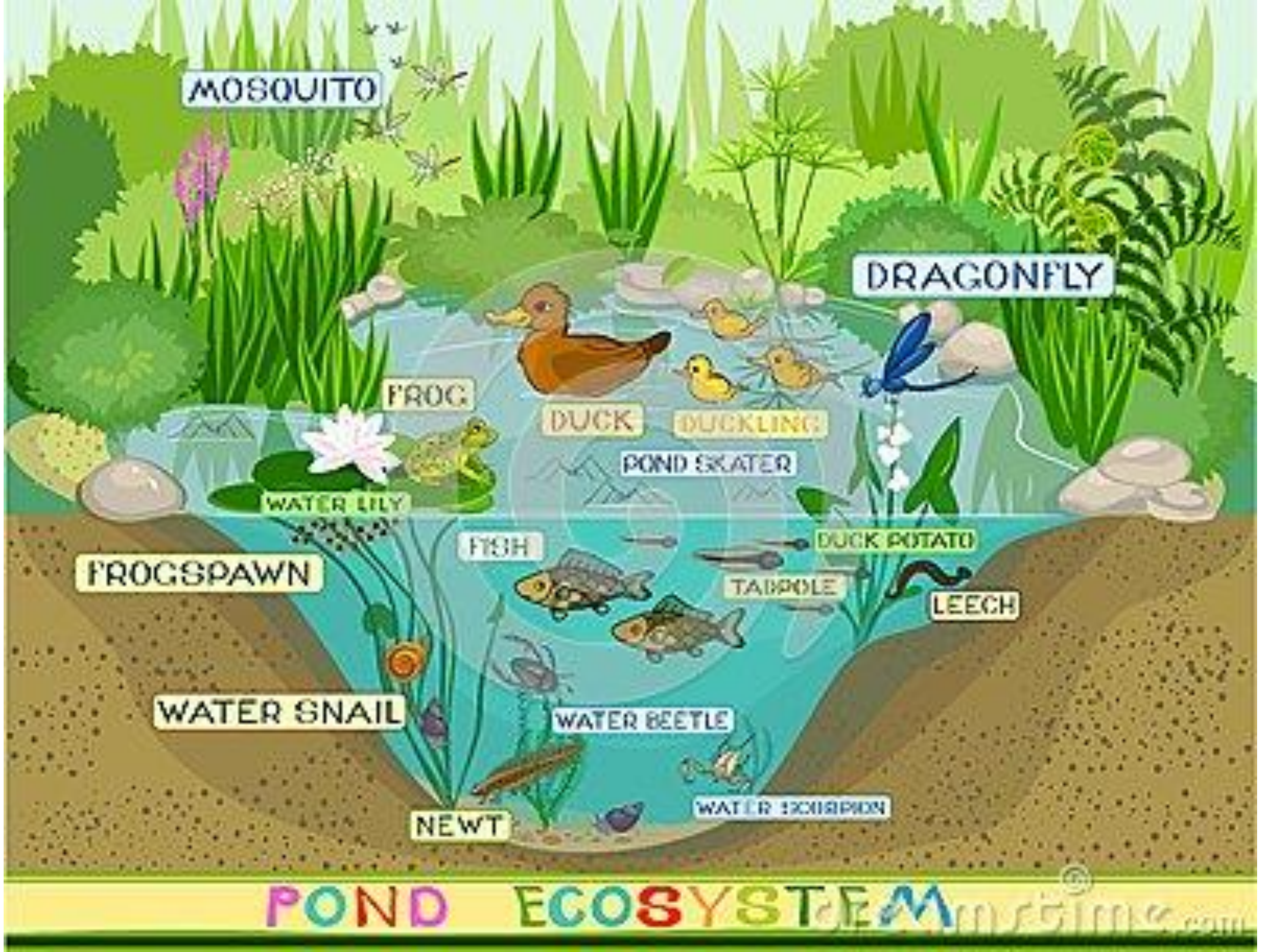
An **ECOSYSTEM** is the name given to all the living things, **COMMUNITY**, and their **ENVIRONMENT** in a particular area.



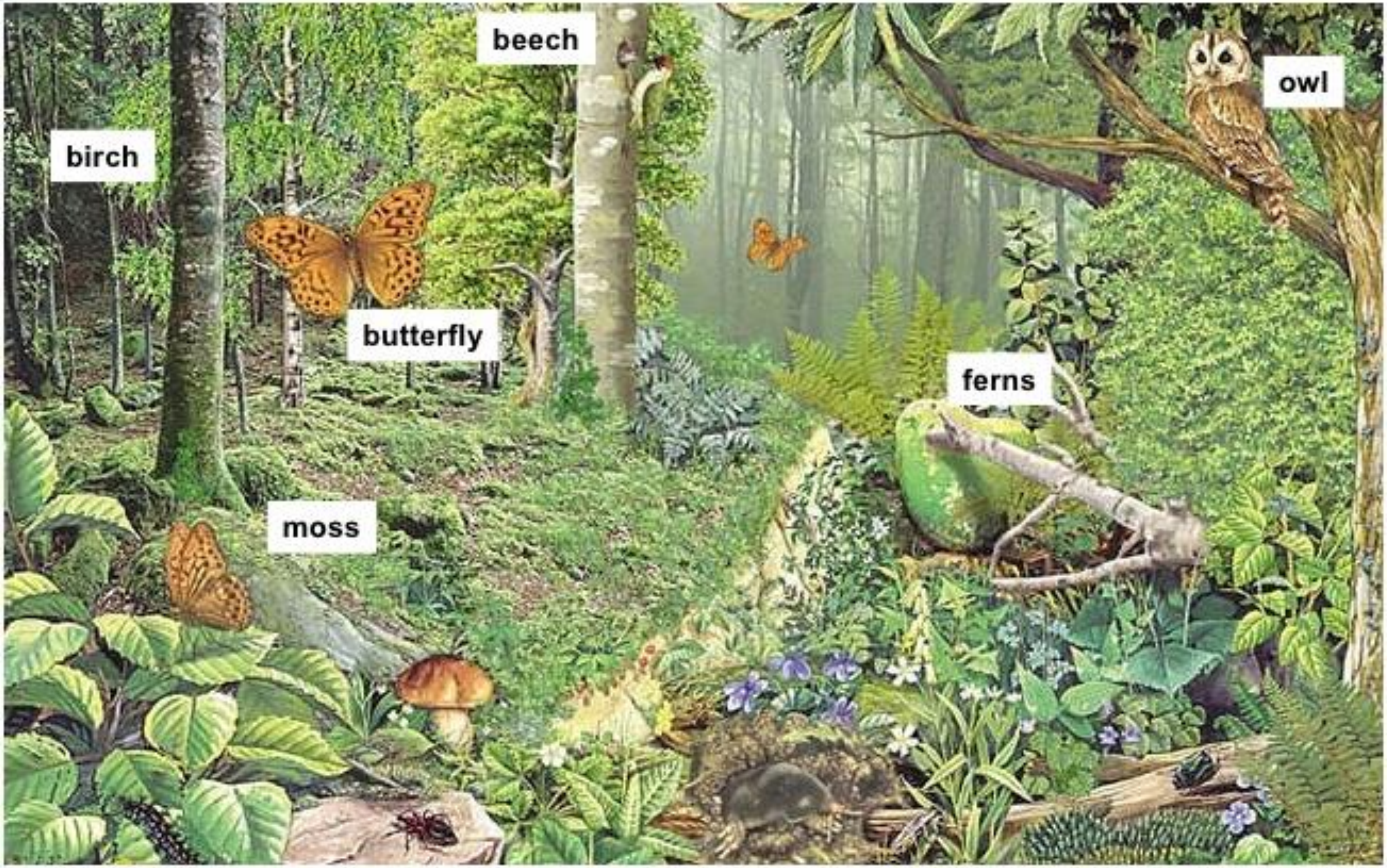

biOdiVerSity
a measure of the
number and types of
plant & animal species
in an area
© www.freeirishphotos.com


habitat
the place where an organism lives

http://www.bbc.co.uk/education/clips/zv69jxs


MOSQUITO
DRAGONFLY
FROG
DUCK
DUCKLING
POND SKATER
WATER LILY
FROGSPAWN
FISH
DUCK POTATO
TADPOLE
LEECH
WATER SNAIL
WATER BEETLE
NEWT
WATER SCORPION
POND ECOSYSTEM

Deciduous forests



population **ecology**	all the organisms of a single species in an area **consumer** **species**	An organism that eats another organism **habitat**
study of communities in their environment **biotic** **biodiversity**	Group of organisms with similar features able to reproduce fertile offspring living parts of the environment **community** **ecosystem**	place where an organism lives All the organisms of all the populations in an area **abiotic**
the number & types of species in an area **producer**	the community and its environment Organism that makes its own food e.g. plants by photosynthesis **environment**	non-living part of the environment All the factors surrounding an organism

Learning Outcomes

- Understand that the Sun is the source of energy for most ecosystems on Earth
- Understand the role of green plants as producers in capturing this energy and making it available to other organisms
- Understand food chains and webs and be able to identify producers, consumers and trophic levels;

The living organisms are all dependent on each other through feeding relationships.

However, all life on Earth relies on the energy from the Sun.

ENERGY FLOW

- Life can exist on Earth because of sunlight energy.
- Plants capture light energy through the process of **photosynthesis**.
- And make organic compounds such as **carbohydrates**

The compounds made by plants are eaten by other organisms, so **plants make the sunlight energy available to other organisms**.

produce

consume

primary

secondary

tertiary

plants are known as

PRODUCERS

they make their own food by photosynthesis

animals are known as

CONSUMERS

they feed on other organisms

Primary consumers eat green plants.

Secondary consumers eat primary consumers.

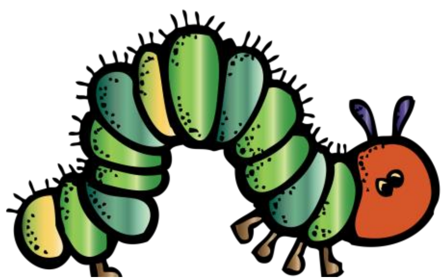
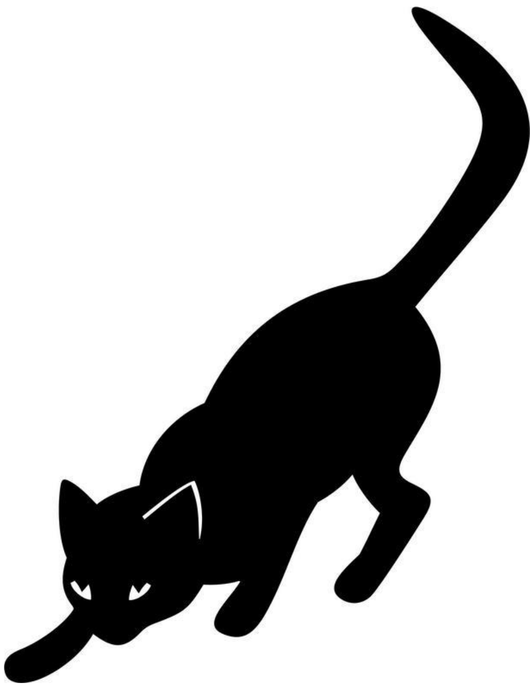
Tertiary consumers eat secondary consumers.

The sequence of producers trapping the Sun’s energy and this energy then passing on to other organisms as they feed is known as **energy flow**.

The sequence can be drawn as a **food chain** with **arrows** from producer to consumers.

The arrows **represent the direction of the energy flow**.

A FOOD CHAIN

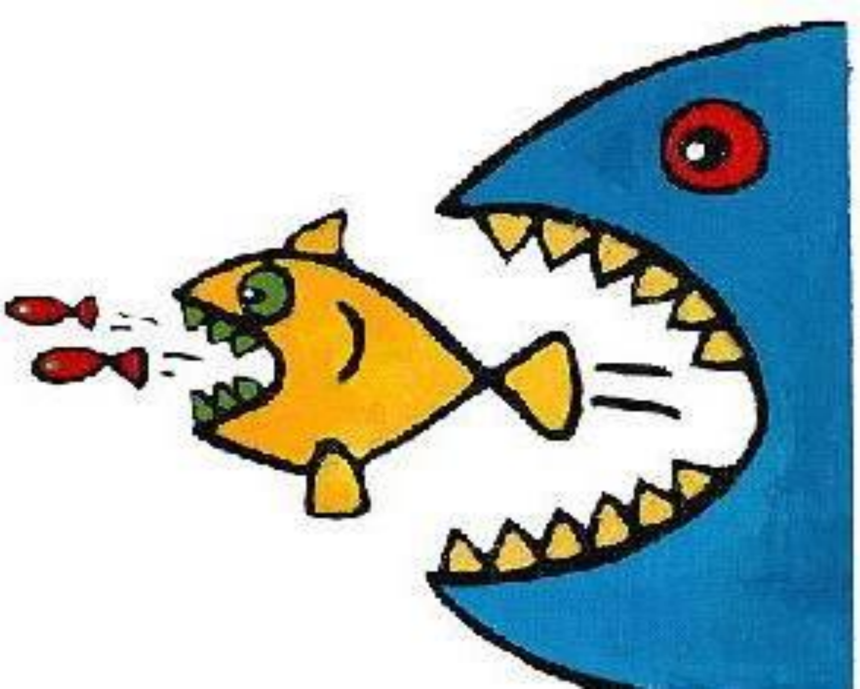
   

leaf → caterpillar → bird → cat

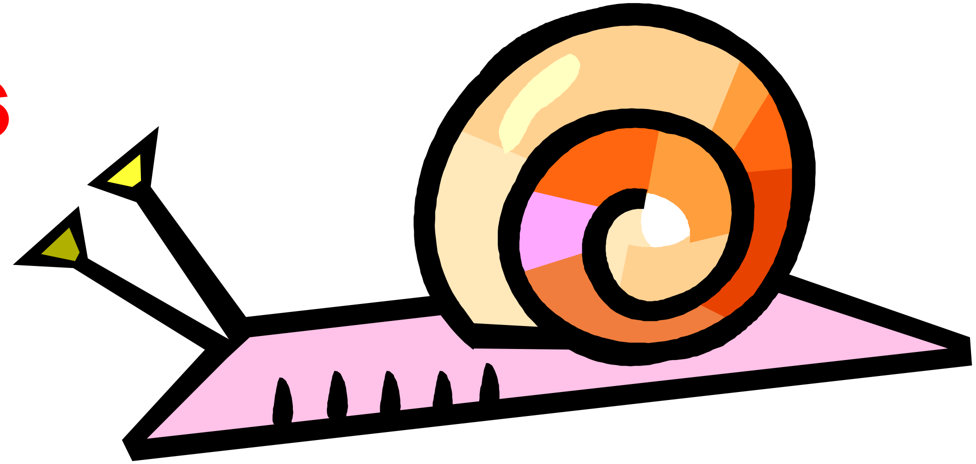
Producer	Primary consumer	Secondary consumer	Tertiary consumer

activity

- Your teacher will give you a card from a food chain.
- Find the other organisms in the food chain.
- Line up in the correct order



Herbivores eat only **plants**.



Carnivores eat only **animals**.

Omnivores eat both **animals and plants**.

The different stages in the feeding sequence are called **TROPHIC LEVELS** (or ‘feeding levels’).

The first organism in the food chain (the producer) is **TROPHIC LEVEL 1**

The second organism in the food chain (the primary consumer) is **TROPHIC LEVEL 2**

etc

Sample Food Chains

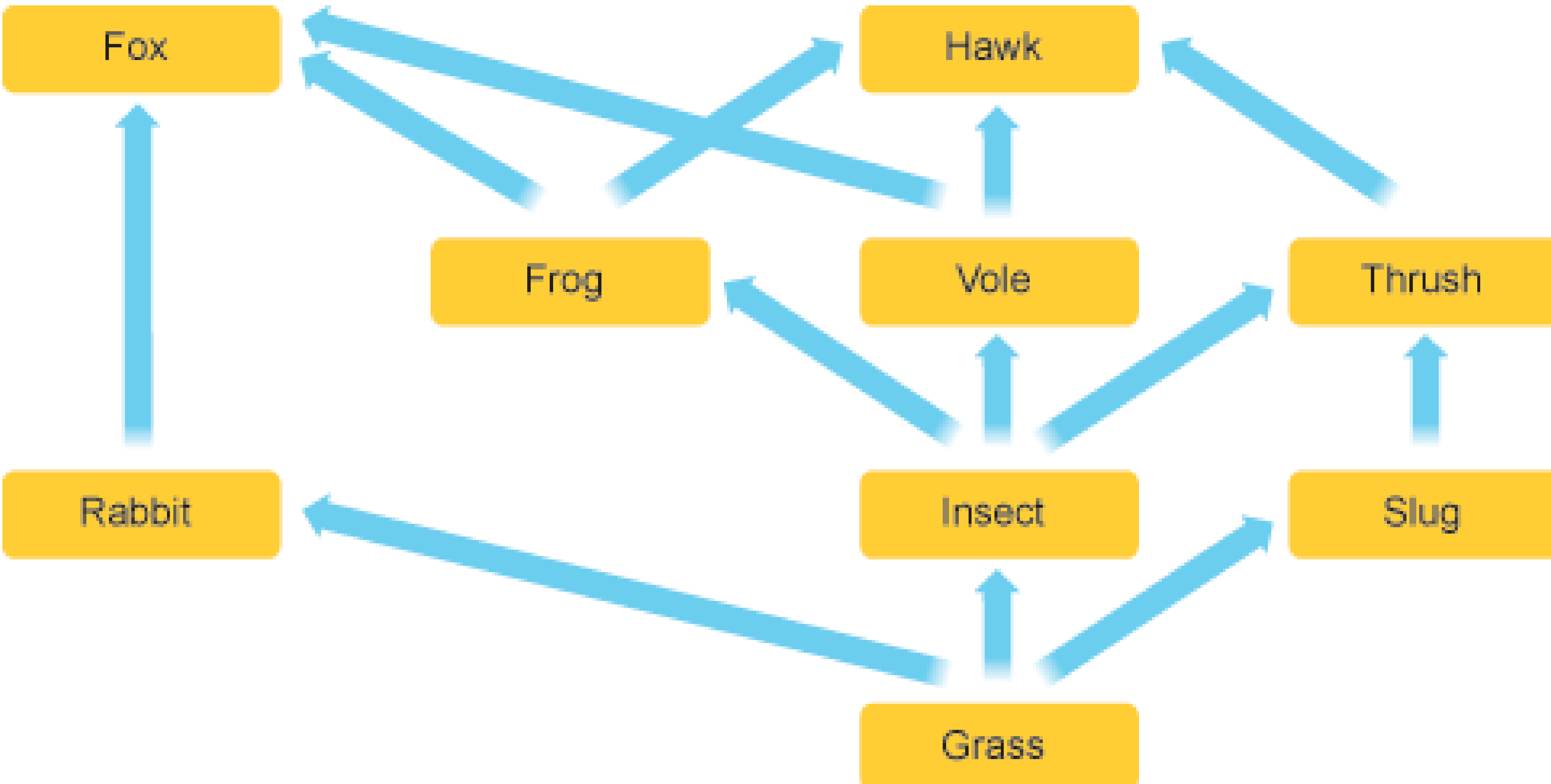
TROPHIC LEVEL	FEEDING POSITION	Grassland	Pond	Ocean
1	Producer	grass	algae	phytoplankton
2	Primary Consumer	grasshopper	mosquito larva	zooplankton
3	Secondary Consumer	rat	dragonfly larva	fish
4	Tertiary Consumer	snake	fish	seal
5	Quaternary Consumer	hawk	raccoon	white shark

Most organisms will not feed on only one other organism. This means that food chains are **interlinked** to form **food webs**.

FOOD WEB JIGSAW

Draw out a food chain containing 4 different organisms
& label the trophic levels and names for each level.

changes to food webs



What would happen if all of the grass died?

What would happen if the grass died?

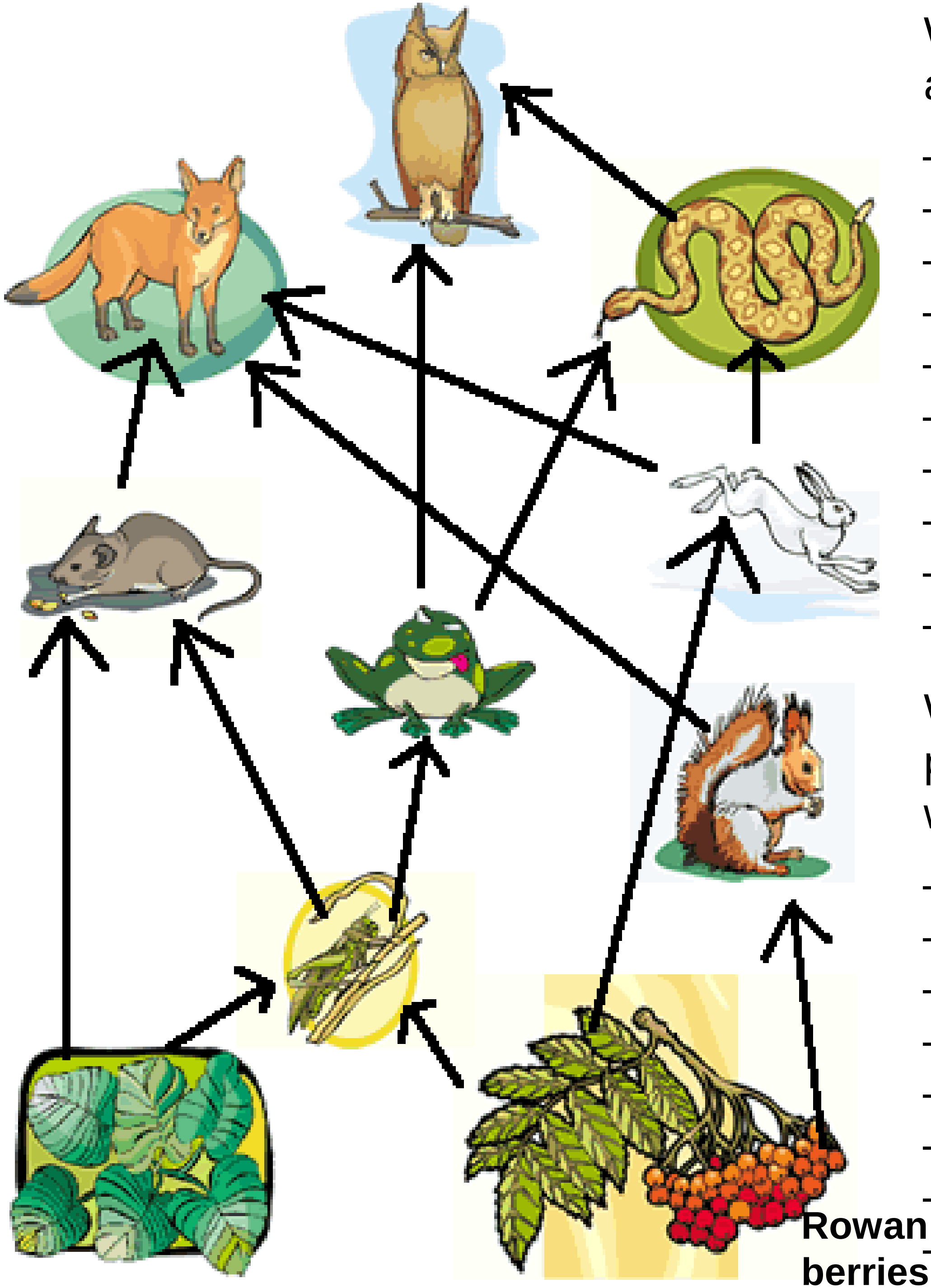
- The grass is the producer, so if it died the consumers that feed on it - rabbits, insects and slugs - would have no food.
- They would starve and die unless they could move to another habitat.
- All the other animals in the food web would die too, because their food supplies would have died out.
- The populations of the consumers would fall as the population of the producer fell.

What would happen if the population of slugs decreased?

- Slugs, rabbits and insects all eat grass.
- If there were fewer slugs there would be more grass for the rabbits and insects.
- With more food the populations of rabbits and insects would increase.
- However, the thrushes would have to eat more insects to maintain their population, so it is also possible that the population of insects could decrease.
- This in turn may reduce the populations of voles and frogs.

What would happen if the population of insects decreased?

- There would be more food for the rabbits and slugs, so their populations would increase.
- However, there would be less food for the frogs and voles, so their populations would decrease.
- This means less food for the foxes and hawks.
- However, there are likely to be more rabbits and thrushes for them to eat, so their populations are likely to stay the same.



What would happen if a disease killed all of the snakes?

____

____

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____

____

What effect would there be if, due to poor spring weather, the rowan flowers were not fertilised?

____

____

____

____

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____

____

LEARNING OUTCOMES

Use data to interpret and explain in terms of the amount of energy available at each trophic level, decreased due to heat from respiration, excretion and egestion and uneaten structures,

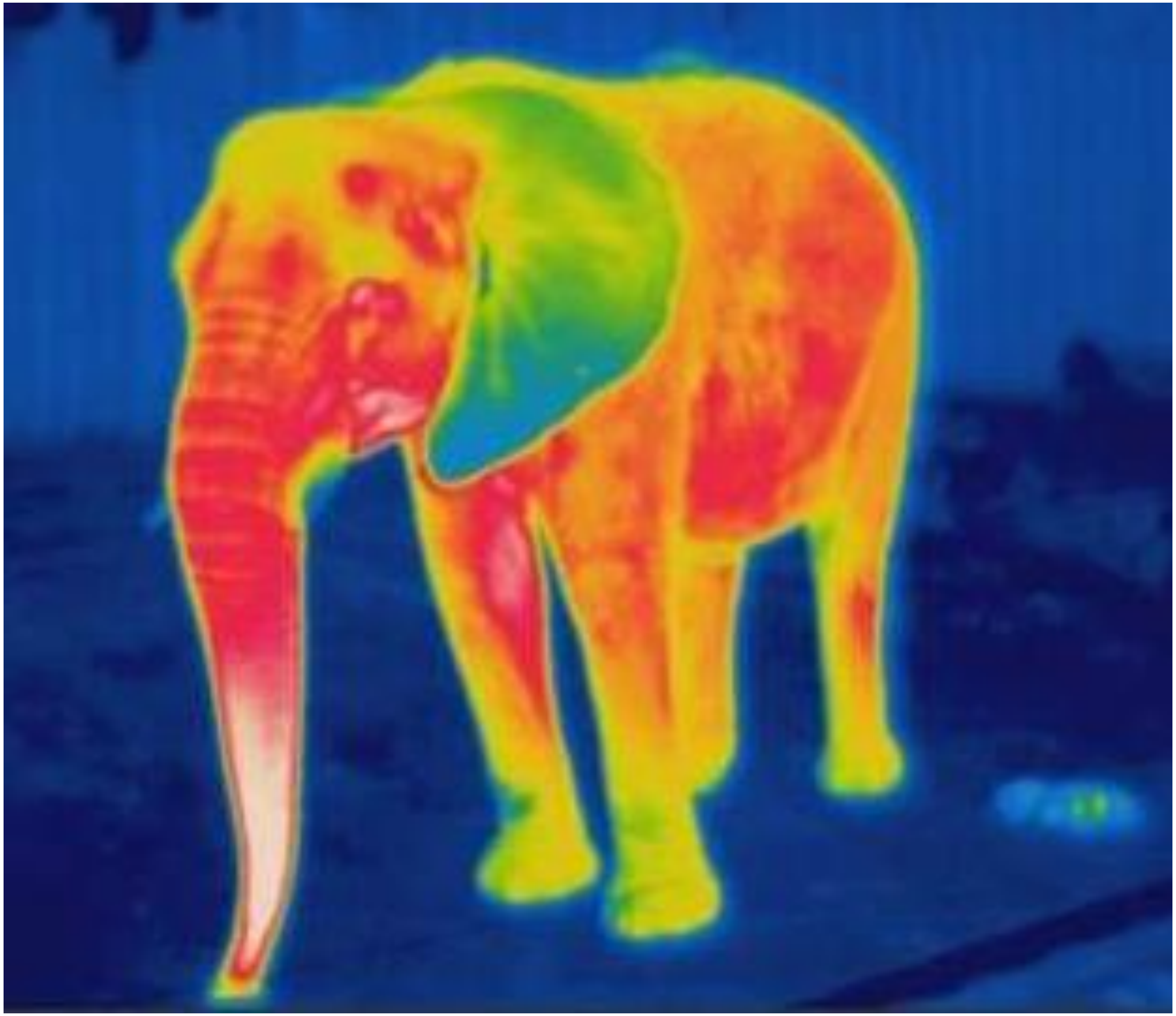
and understand why shorter food chains are more efficient

HIGHER TIER

food for a week

where does all the energy go?

changed into heat energy in respiration to keep animals warm



this heat is lost by conduction, convection and radiation, to the atmosphere

changed into kinetic energy for movement

animals need to move to

find a mate

catch food and
escape predators

energy is lost through excretion

urea in urine

is a waste product

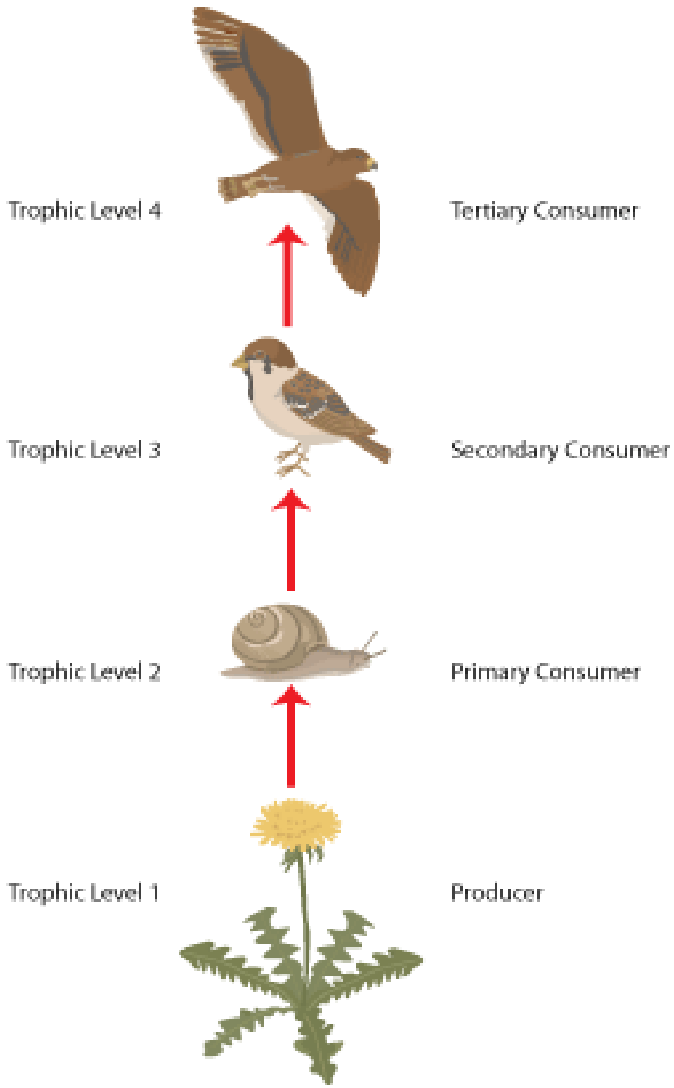
from proteins

in our diet

energy is used to produce new organisms

not all food eaten is digested

ENERGY LOSS & TROPHIC LEVELS



Most food chains are relatively short, with **just four organisms**.

This is because at each stage of energy transfer (including trophic level 1), some **energy is lost**.

Energy loss at trophic level 1

Not all of the energy from the Sun is trapped by producers. This is because:

- light is **reflected** from leaves
- light passes through leaves and **misses chloroplasts**
- light energy is used to **evaporate water** from leaves.

Energy loss at other trophic levels

The transfer of energy between plants and animals and between animals of different trophic levels is usually **10 – 20%.**

This means that for every 100g of food material available, only between 10 and 20g is used to **build animal tissue** (as 'biomass') in the primary consumer's body.

The loss of energy between plants and consumers and between consumers is due to three main reasons:

1. **Not all the available food is eaten.**

   Most carnivores do not eat the skeleton or fur of their prey, for example.

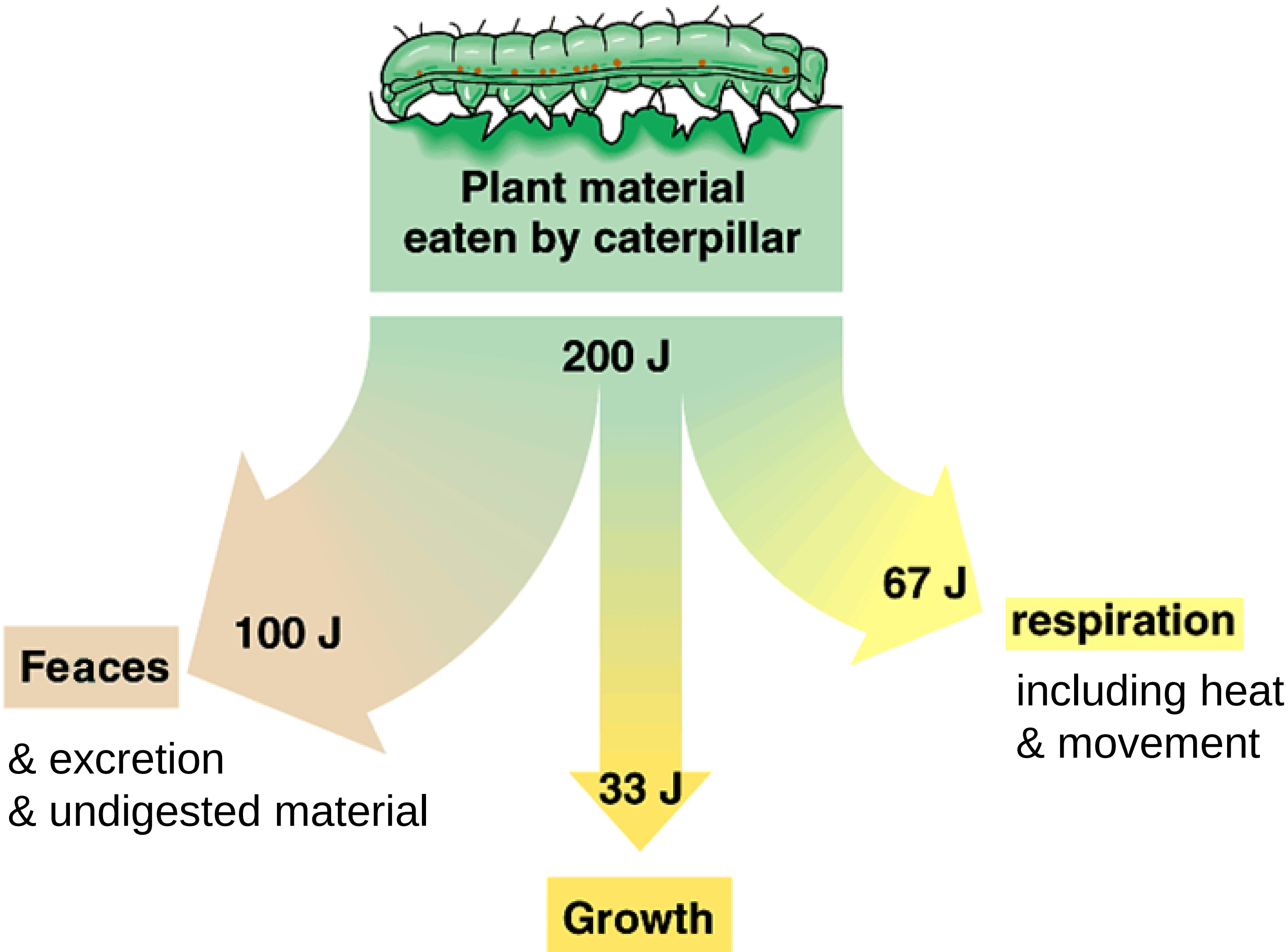
2. **Not all the food is digested**

   some is lost as faeces in egestion.

3. **A lot of energy is lost as heat in respiration.**

   Respiration provides the energy for movement, growth, reproduction etc. Heat is produced as a by-product of respiration. Heat is lost and cannot be passed on to the next trophic level.

Energy Flow


Plant material
eaten by caterpillar
200 J
100 J
Feaces
& excretion
& undigested material
33 J
Growth
67 J
respiration
including heat
& movement

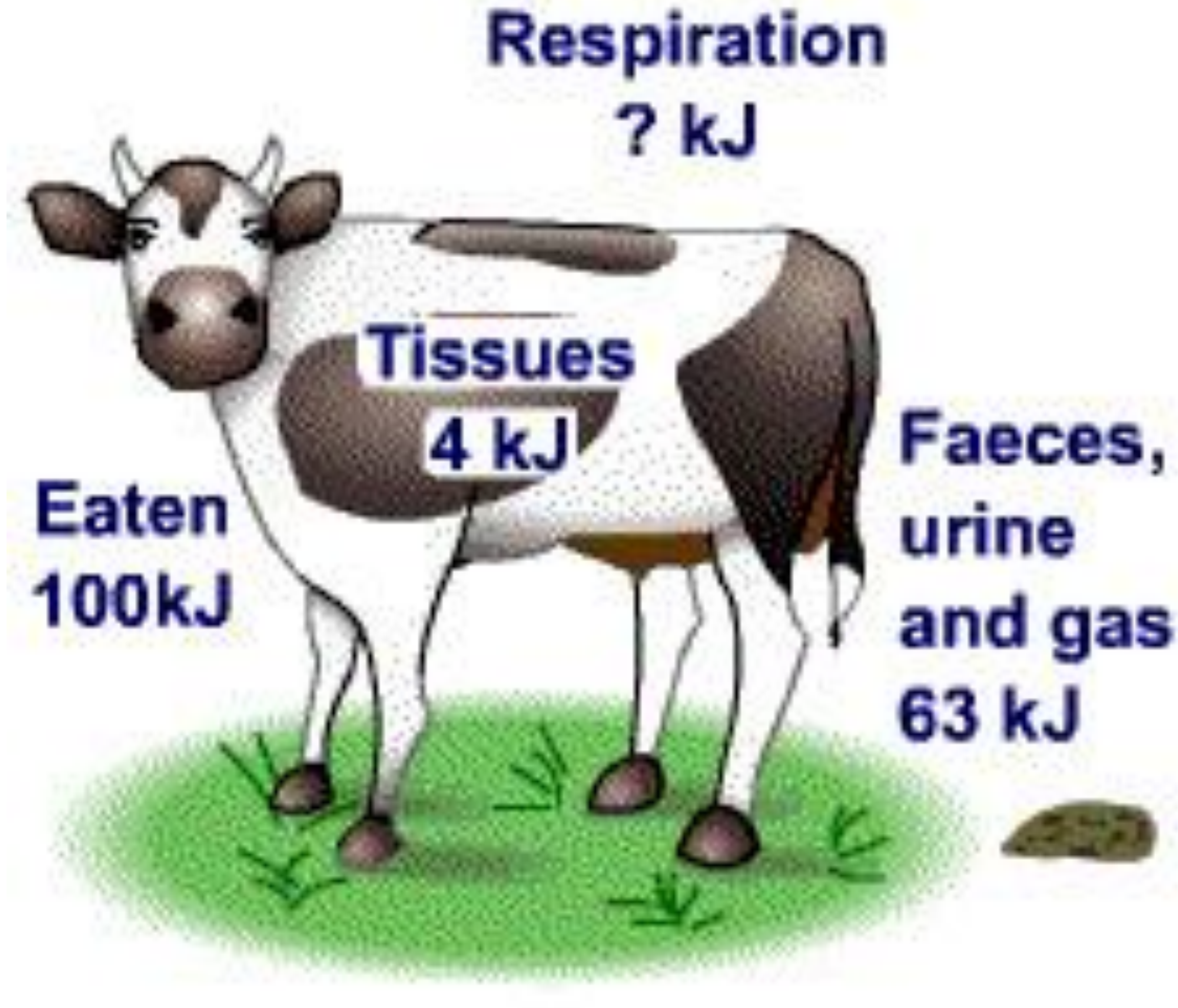
Calculate the percentage of the energy taken in by the caterpillar which is used for growth

ENERGY IN = 200J

ENERGY USED IN GROWTH = 33J

PERCENTAGE = 33/200 x100

= 16.5%



Calculate the energy lost in respiration and the percentage used to make new tissue.

Calculating energy efficiency

This bullock has eaten 100kJ of stored energy in the form of grass, and excreted 63kJ in the form of faeces, urine and gas. The energy stored in its body tissues is 4kJ. So how much has been used up in respiration?

The energy released by respiration

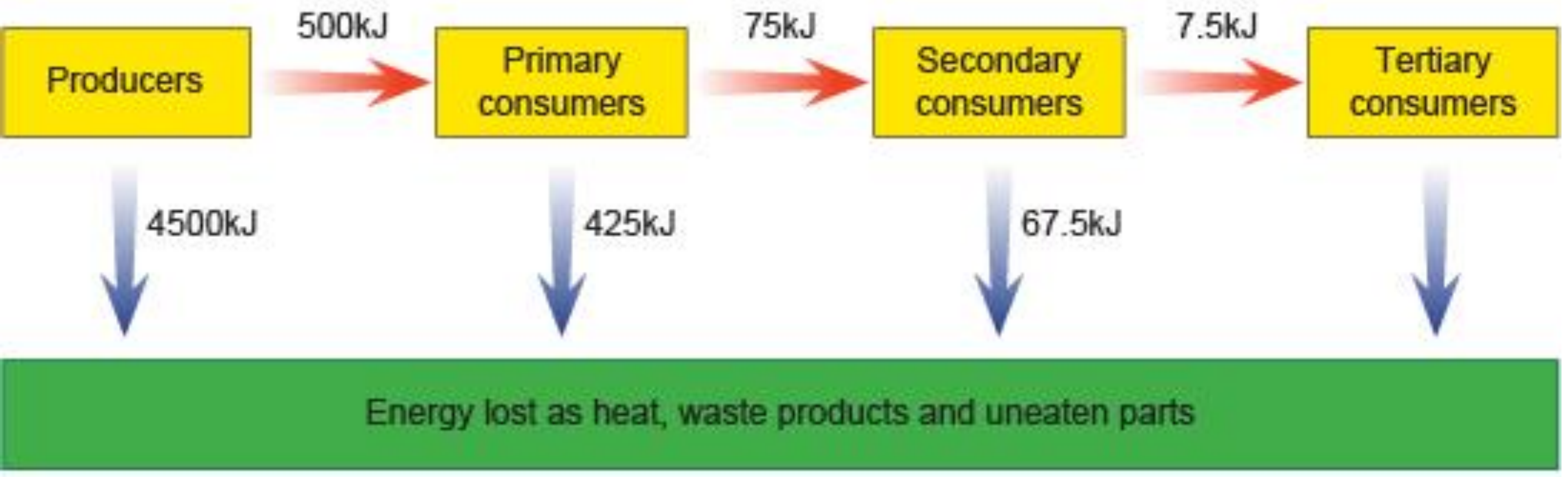
= 100 – 63 – 4 = 33kJ

Only 4 kJ of the original energy available to the bullock is made into new tissue and is available to the next stage, which might be humans.

The percentage of the original energy used to make new tissue

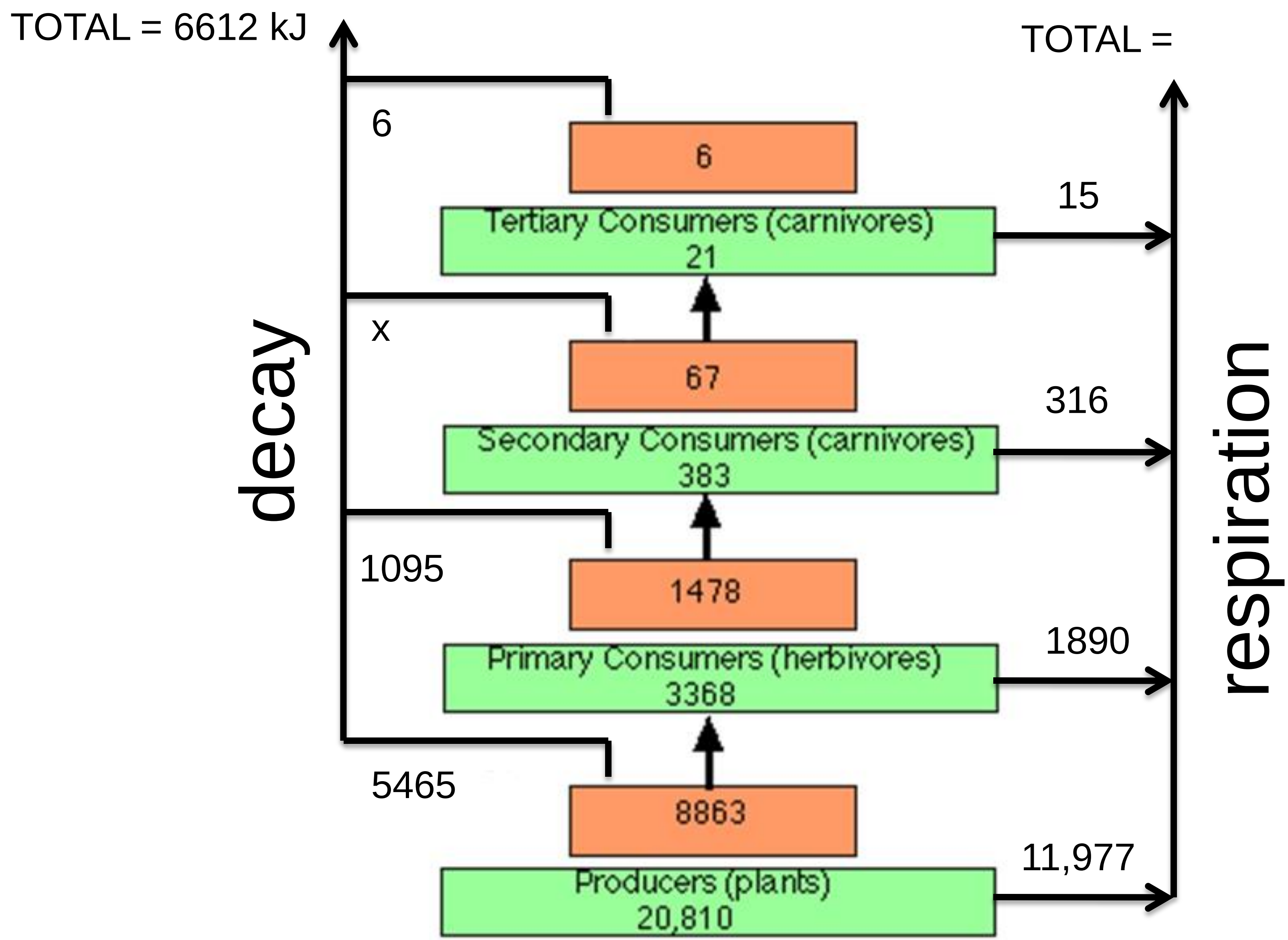
= 4/100 X 100 = 4%

The percentage of the original energy used to make new tissue is known as the energy efficiency of an organism.

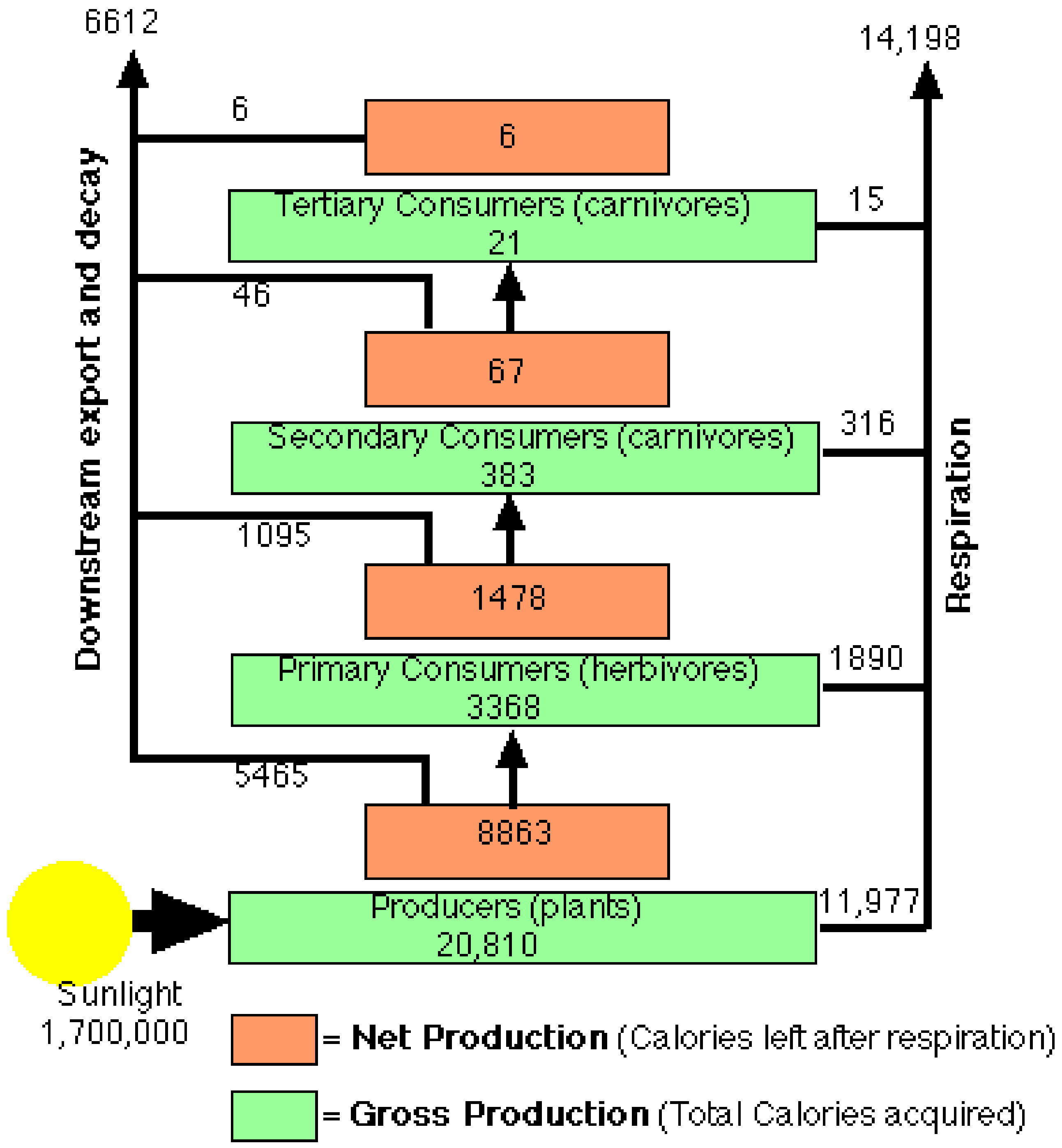

Producers
500kJ
Primary consumers
75kJ
Secondary consumers
7.5kJ
Tertiary consumers
4500kJ
425kJ
67.5kJ
Energy lost as heat, waste products and uneaten parts

Energy Efficiency

This is the percentage of the energy that an organism consumes that is used to make new tissue.



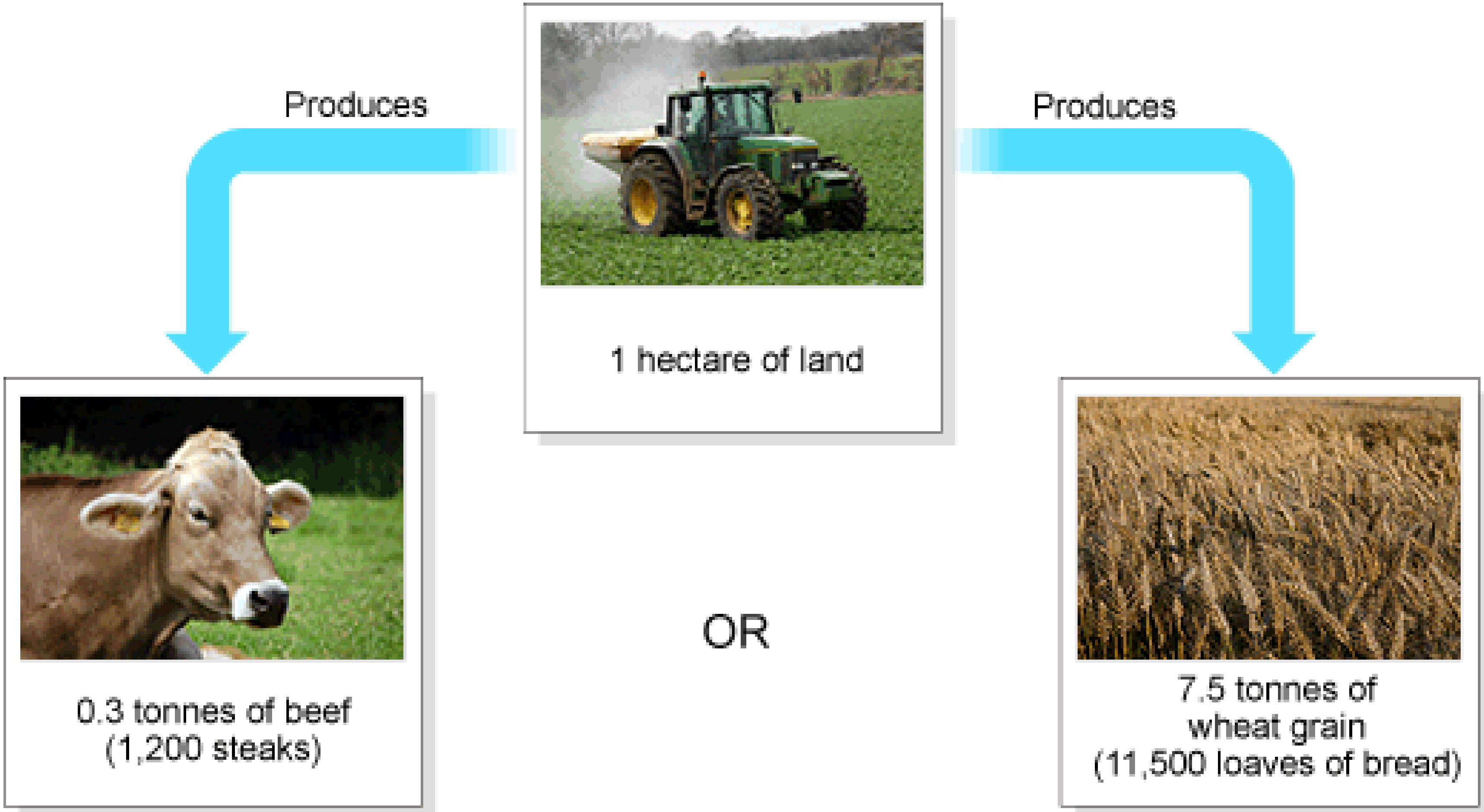
TOTAL = 6612 kJ
TOTAL =
decay
respiration
6
6
15
Tertiary Consumers (carnivores)
21
x
67
316
Secondary Consumers (carnivores)
383
1095
1478
1890
Primary Consumers (herbivores)
3368
5465
8863
11,977
Producers (plants)
20,810



6612
14,198
6
6
Tertiary Consumers (carnivores)
21
15
46
67
Secondary Consumers (carnivores)
383
316
1095
1478
Primary Consumers (herbivores)
3368
1890
5465
8863
Producers (plants)
20,810
11,977
Sunlight
1,700,000
Downstream export and decay
Respiration
= Net Production (Calories left after respiration)
= Gross Production (Total Calories acquired)

Shorter food chains

Food production is more efficient if the food chain is short, because a higher percentage of energy is available to us.

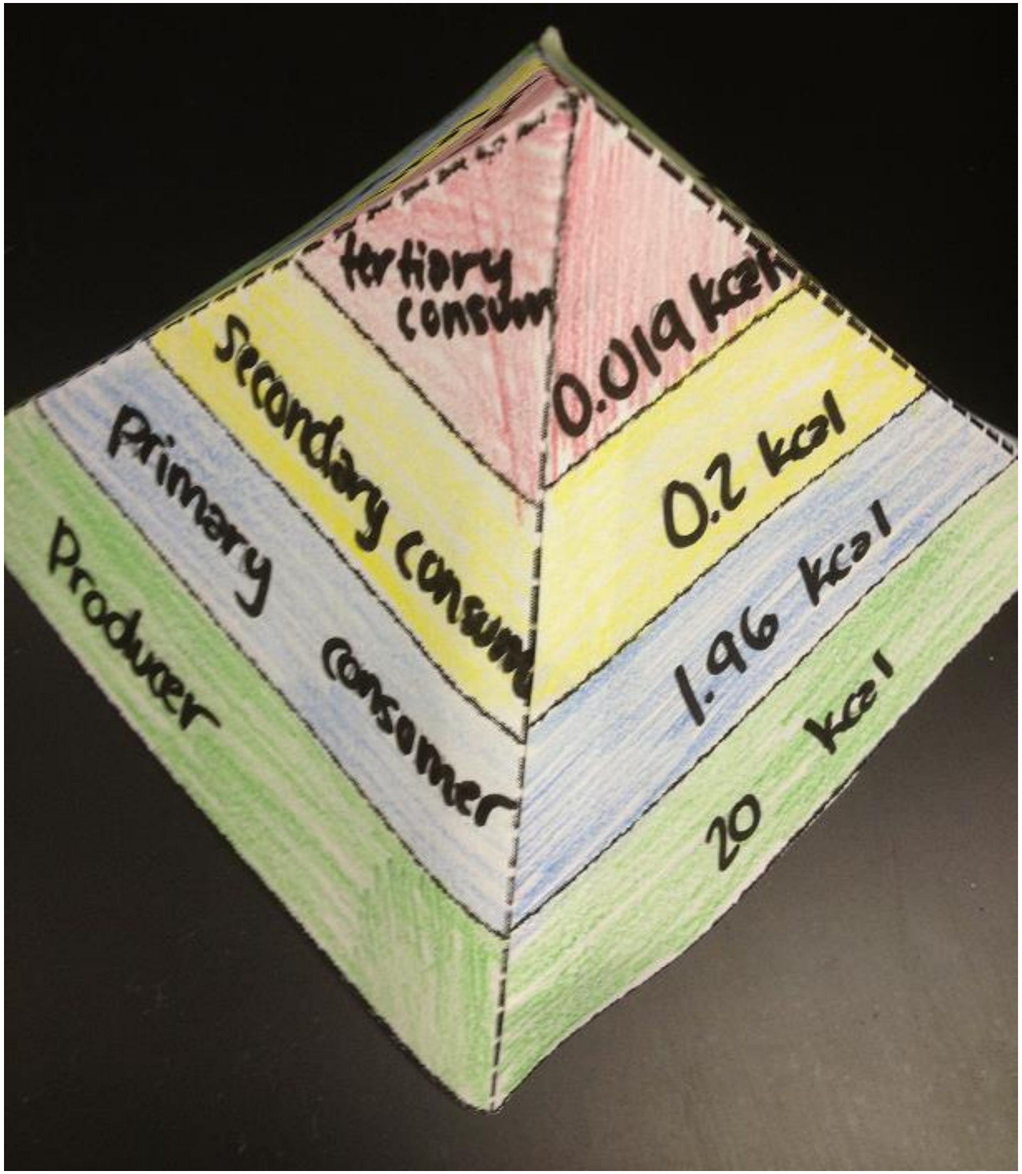


Products from the land

extension

http://www.bbc.co.uk/bitesize/ks3/science/organisms_behaviour_health/food_chains/revision/8/

http://www.bbc.co.uk/bitesize/ks3/science/organisms_behaviour_health/food_chains/revision/9/



Build an energy pyramid

GRASSLAND	POND	OCEAN
Grass 5000kJ	Algae 9700kJ	Phytoplankton 8500kJ
Grasshopper 500kJ	Mosquito larva 700kJ	Zooplankton 900kJ
Rat 75kJ	Dragonfly larva 60kJ	Herring 80kJ
Snake 7.5kJ	Roach 5kJ	Seal 8kJ

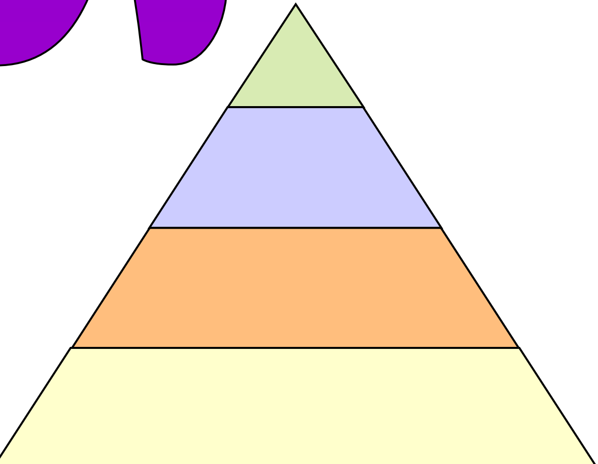
http://www.bbc.co.uk/education/guides/z2m39j6/activity

LEARNING OUTCOMES

- Construct pyramids of numbers and biomass as models of food chains and explain the difference
- Explain the advantages and disadvantages of each type of pyramid
- **Understand the difficulties caused by organisms feeding at two different trophic levels.**

HIGHER TIER

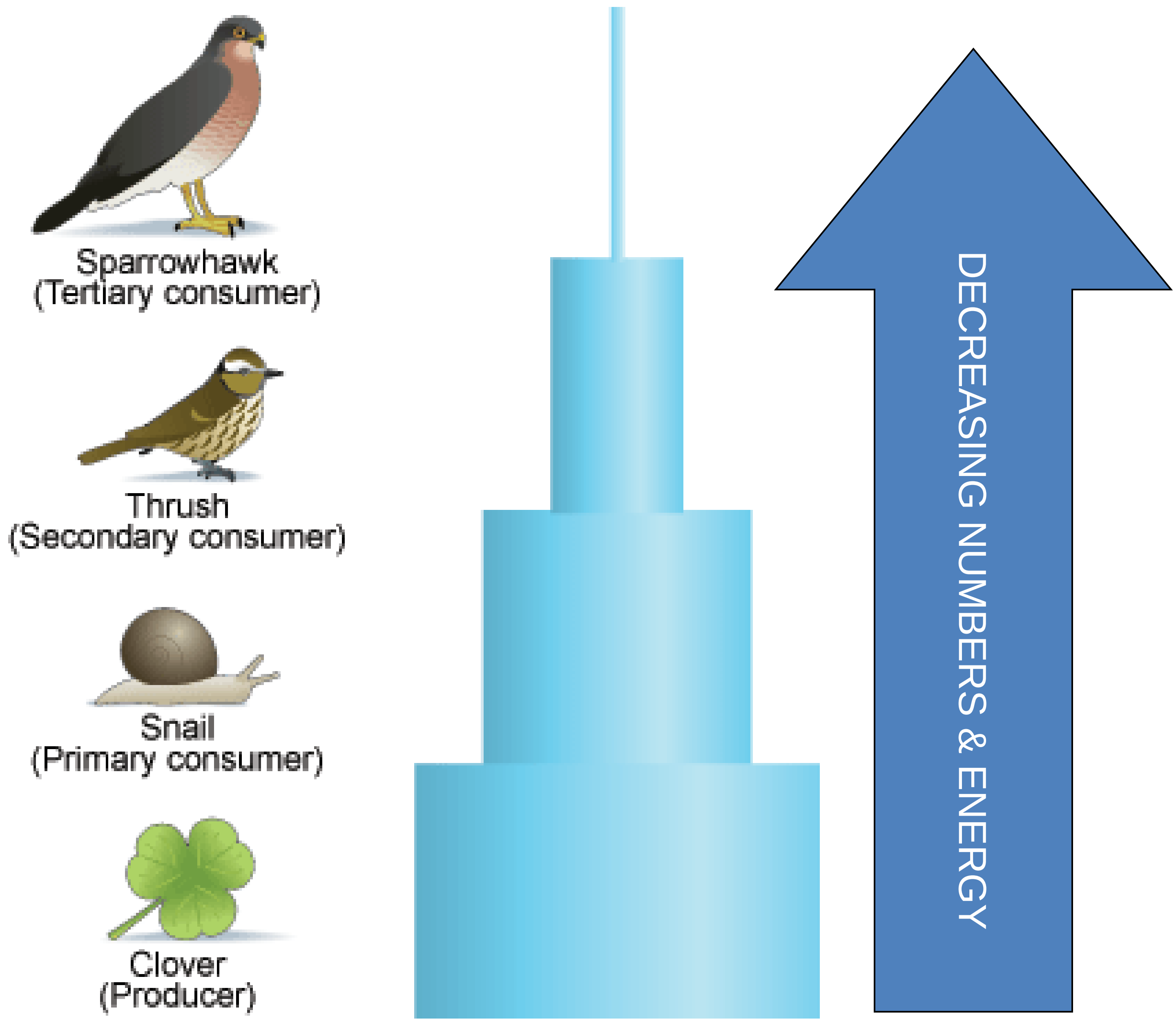
ECOLOGICAL PYRAMIDS



LEGO

Pyramids of Numbers

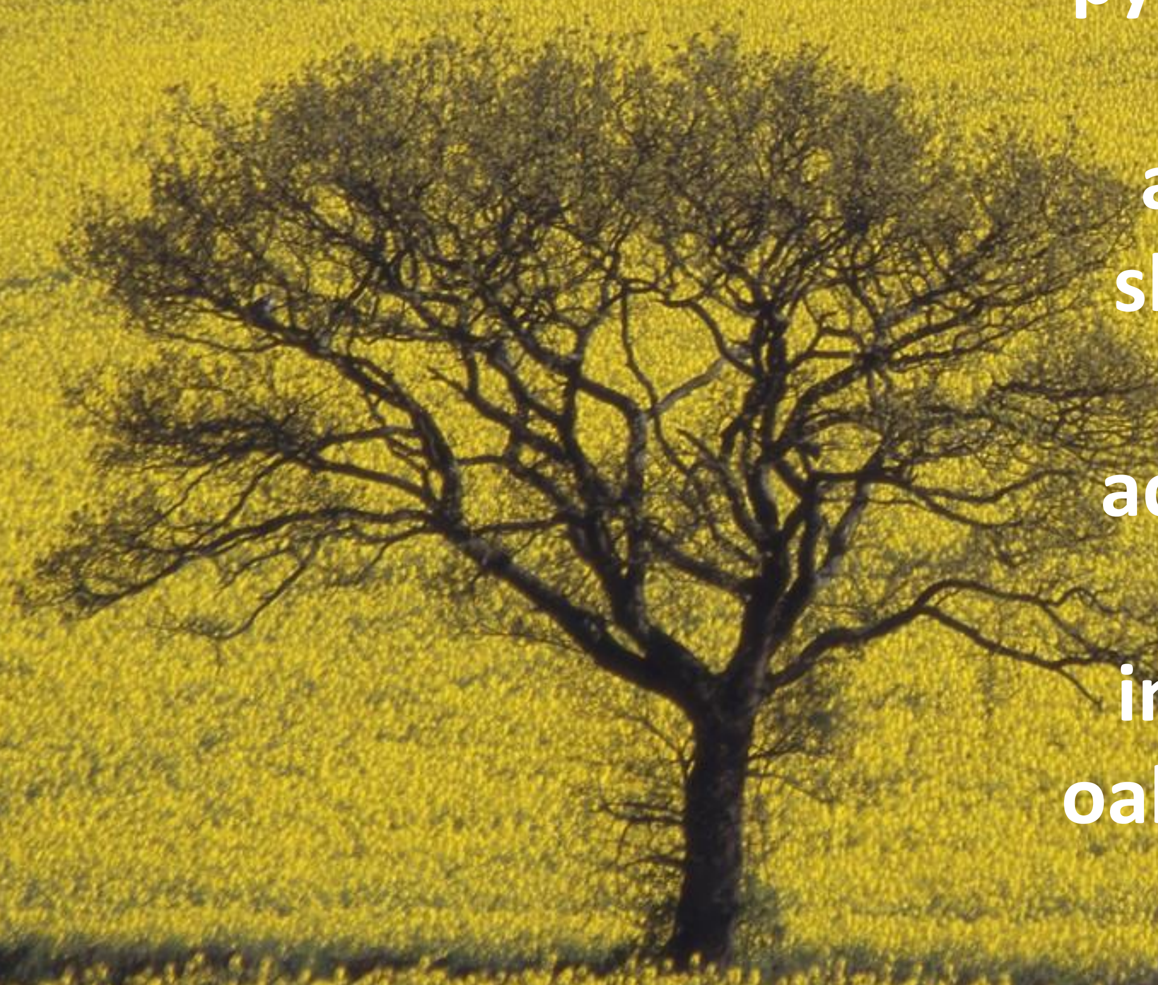
- The **number of organisms** at each stage of a food chain (i.e. at each trophic level) can be represented by a **pyramid of numbers.**
- Each **bar** represents a **trophic level** and is drawn the same height.
- The **width** of the bar represents the **number of organisms** at that trophic level.
- There are fewer organisms at each level because **energy is lost by each organism**.


Sparrowhawk
(Tertiary consumer)
Thrush
(Secondary consumer)
Snail
(Primary consumer)
Clover
(Producer)
DECREASING NUMBERS & ENERGY

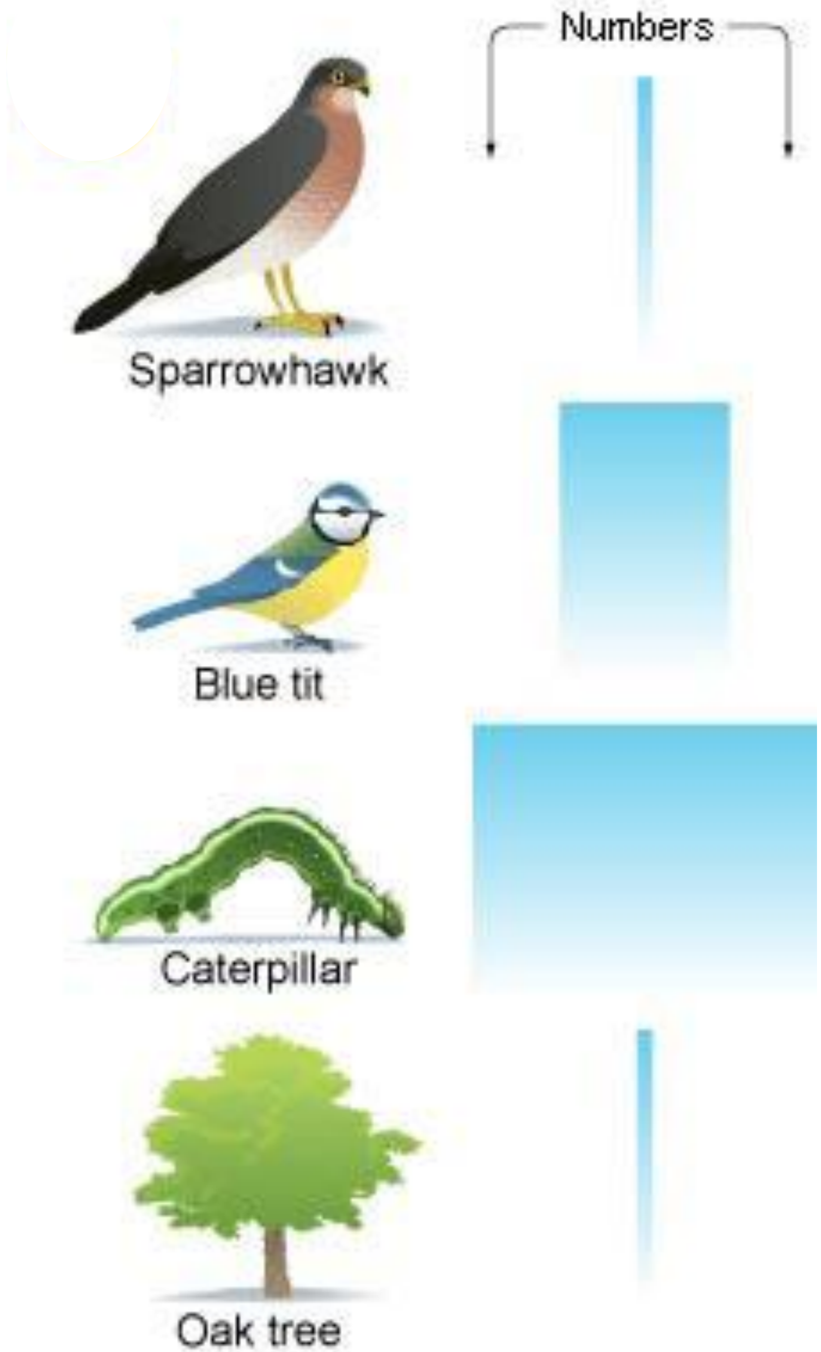
Draw Pyramids of Numbers for the following data.

Organism	Stinging nettle plants	Caterpillars	Robin
Numbers	15	12	1

Organism	Single hawthorne bush	Caterpillars	Dunnock
Numbers	1	12	1

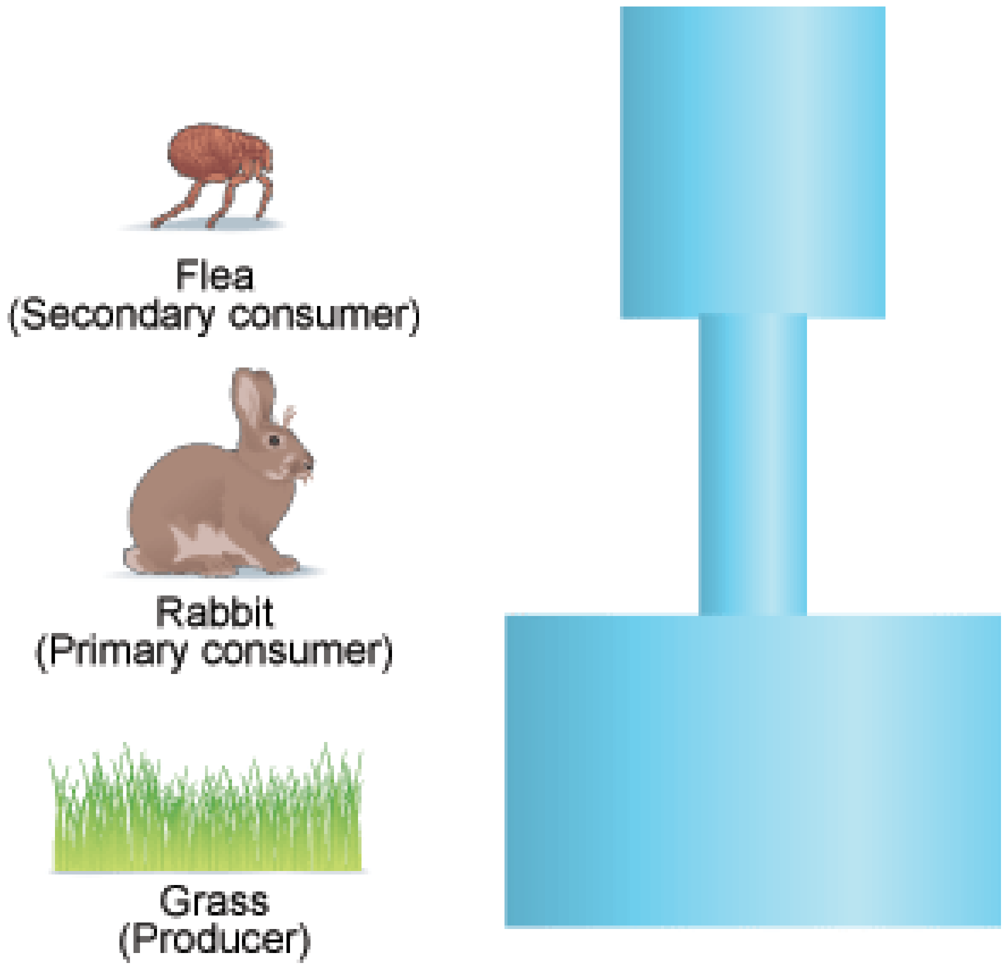


The problem with a pyramid of numbers is that it is not always pyramid-shaped, as it does not take into account the *size* of the organisms involved, e.g. one oak tree will support many more organisms than one grass plant



Inverted pyramid of numbers

Pyramids of numbers that include **parasites** may appear top heavy, as many parasites will feed on one consumer.



Advantages & Disadvantages of Pyramids of Numbers

ADVANTAGES	DISADVANTAGES
Easy to count	Ignores sizes of organisms
No organisms get killed	Difficult to convert e.g. grass plant leaves to numbers which can be worth comparing with others

Pyramids of Biomass

Biomass represents **chemical energy stored in the organic matter of a trophic level.**

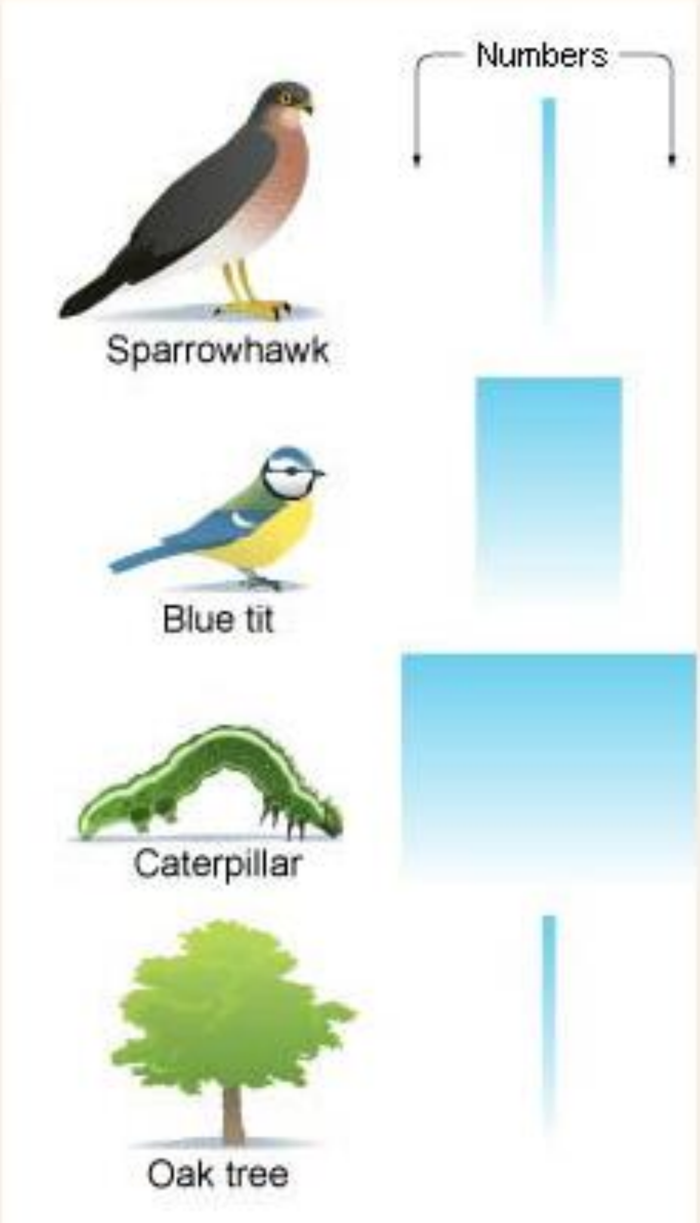
The units of a pyramid of biomass are

units of mass per unit area,

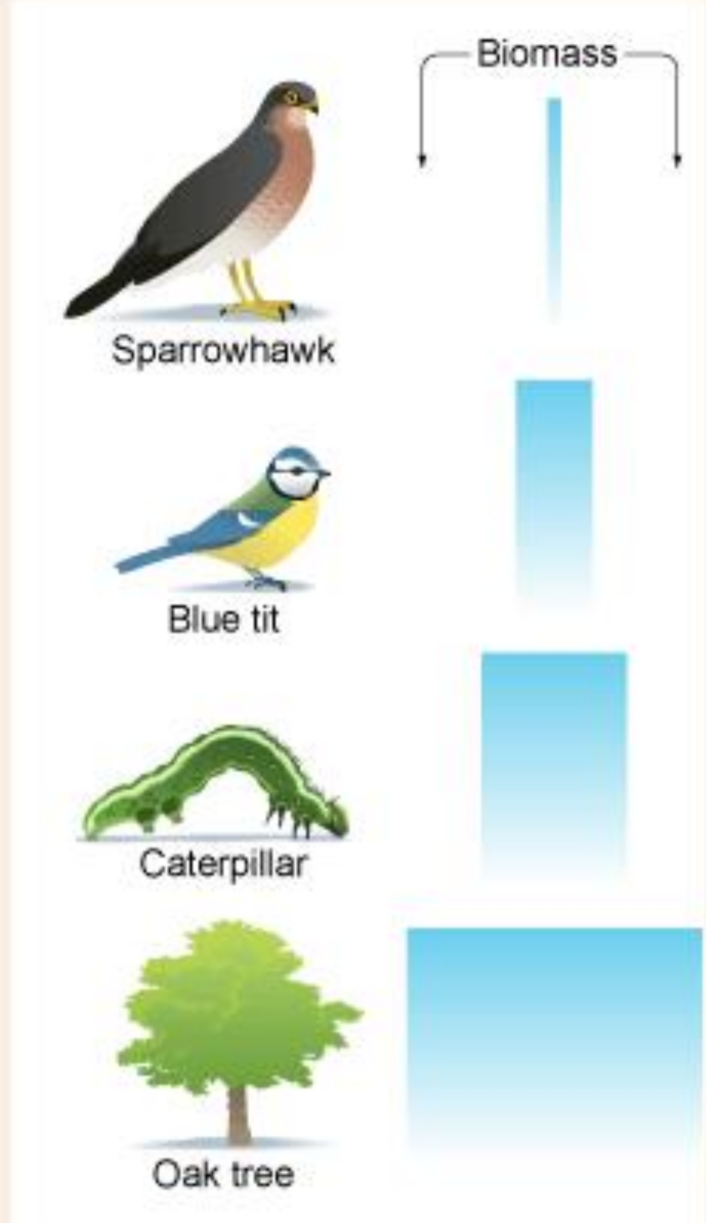
often grams per square meter ($g\ m^{-2}$)

or as energy content, (joules, J)

The biomass is found **by measuring the dry mass** of the organisms at each trophic level. This requires killing the organisms.



Pyramid of numbers



Pyramid of biomass

Use the data below to draw a Pyramid of Biomass for the hawthorne Pyramid of Numbers you drew previously.

Organism	Single hawthorne bush	Caterpillars	Dunnock
Biomass/J	75 000	7 200	680

Advantages & Disadvantages of Pyramids of Biomass

ADVANTAGES	DISADVANTAGES
Amount of energy in a trophic level more accurately represented	Organisms must be collected and killed in order to measure biomass.
	Difficult to catch/weigh all organisms
	The biomass of an individual can vary throughout the year, e.g. an oak tree will have a much greater mass in June than December

Another difficulty in producing both pyramids of number and biomass arises if organisms feed at two different trophic levels e.g. an organism that eats both plants and animals.

Question 4
Homework Booklet

http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/

Chose: food chains, energy, biomass, cycles< energy in biomass < activit

LEARNING OUTCOMES

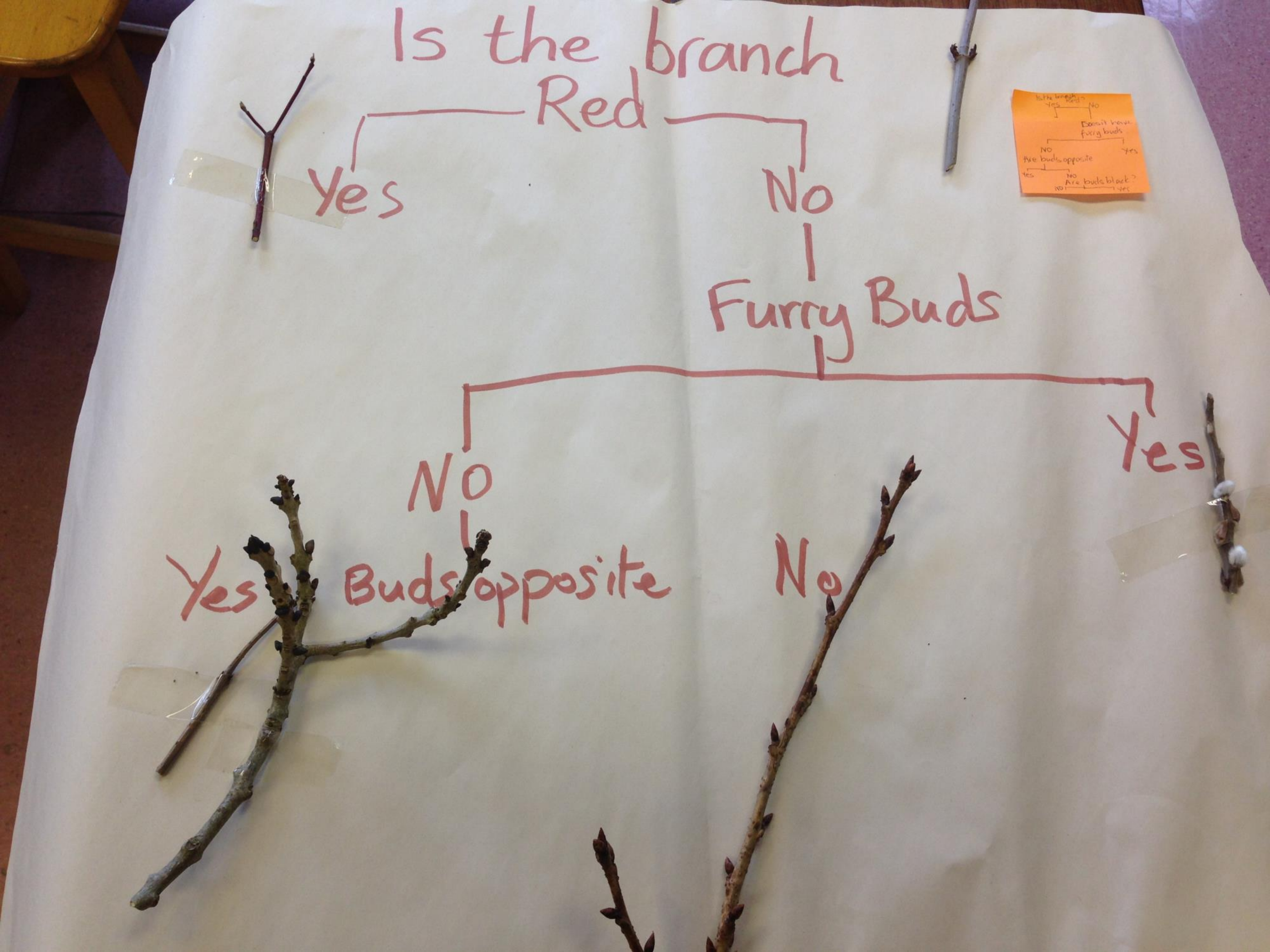
Use and construct keys to identify organisms and classify them into major groups based on the observable features.

Using and constructing keys

- Keys are used to identify unknown organisms.
- **Dichotomous keys**, used in biology, consist of a series of ***two part statements*** that describe **observable features** of organisms.
- At each step of a dichotomous key you are presented with two choices. As you make a choice about a particular feature or characteristic of an organism you are led to a new branch of the key. Eventually you will be led to the name of the organism that you are trying to identify.

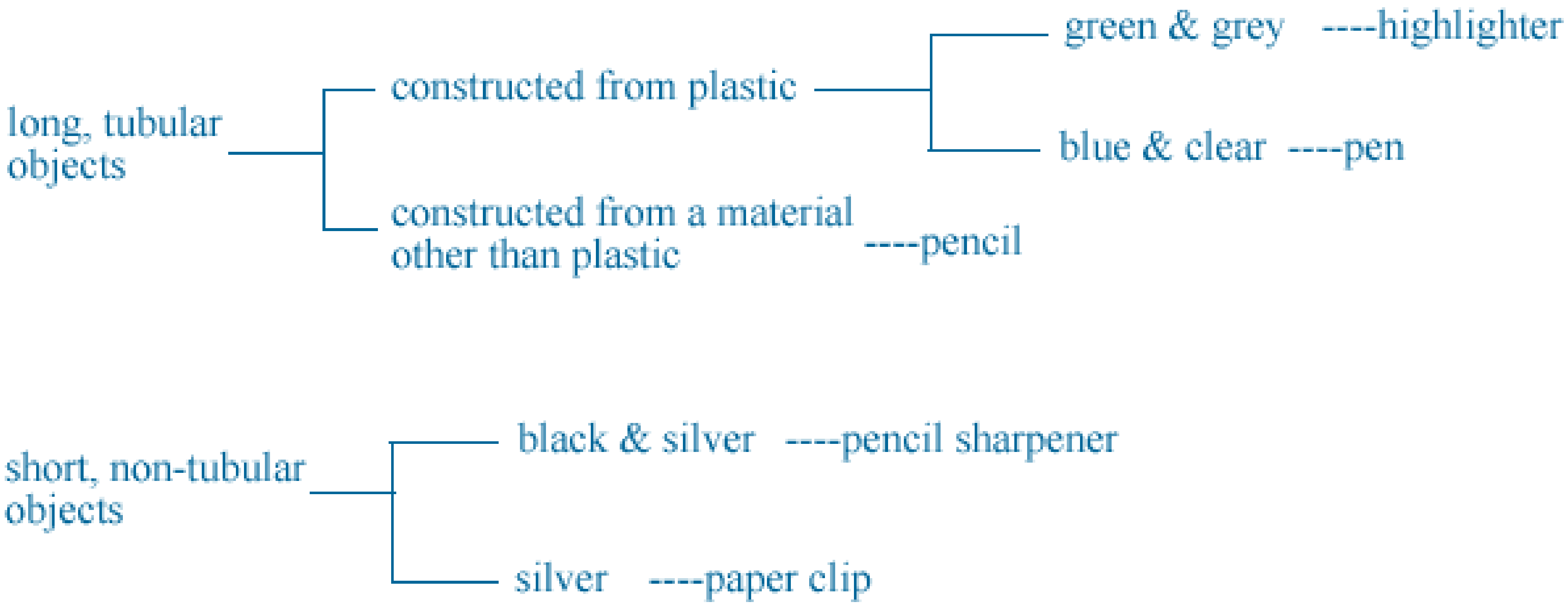
Activity: Constructing a Key

1. Give your group of items a name, e.g. leaves, branches and write this at the top of a poster page
2. Write descriptive words on the post-its for each of the items in your bag, keep them with the item they describe.
3. From your descriptions find one observable feature which you can use to divide the items into 2 groups
4. Write the feature on your poster below the name and draw to lines from it, one to the left the other to the right.
5. Write your decision on these lines, e.g. yes, no; 2, more than 2…
6. Divide your items into the 2 groups.
7. Look at each group separately and again use your descriptions to divide the items into 2 groups based on a single observable feature.
8. Repeat steps 4-6
9. Continue until each group has only one item and stick k this down on the poster



Is the branch
Red
Yes
No
Furry Buds
NO
Yes
Yes
Buds opposite
No
NO
Are buds opposite
Are buds black?

A branching key:



A numbered key:

1. a. long, tubular objects -- go to #2
   b. short, non-tubular objects ---------------------------------- go to #4

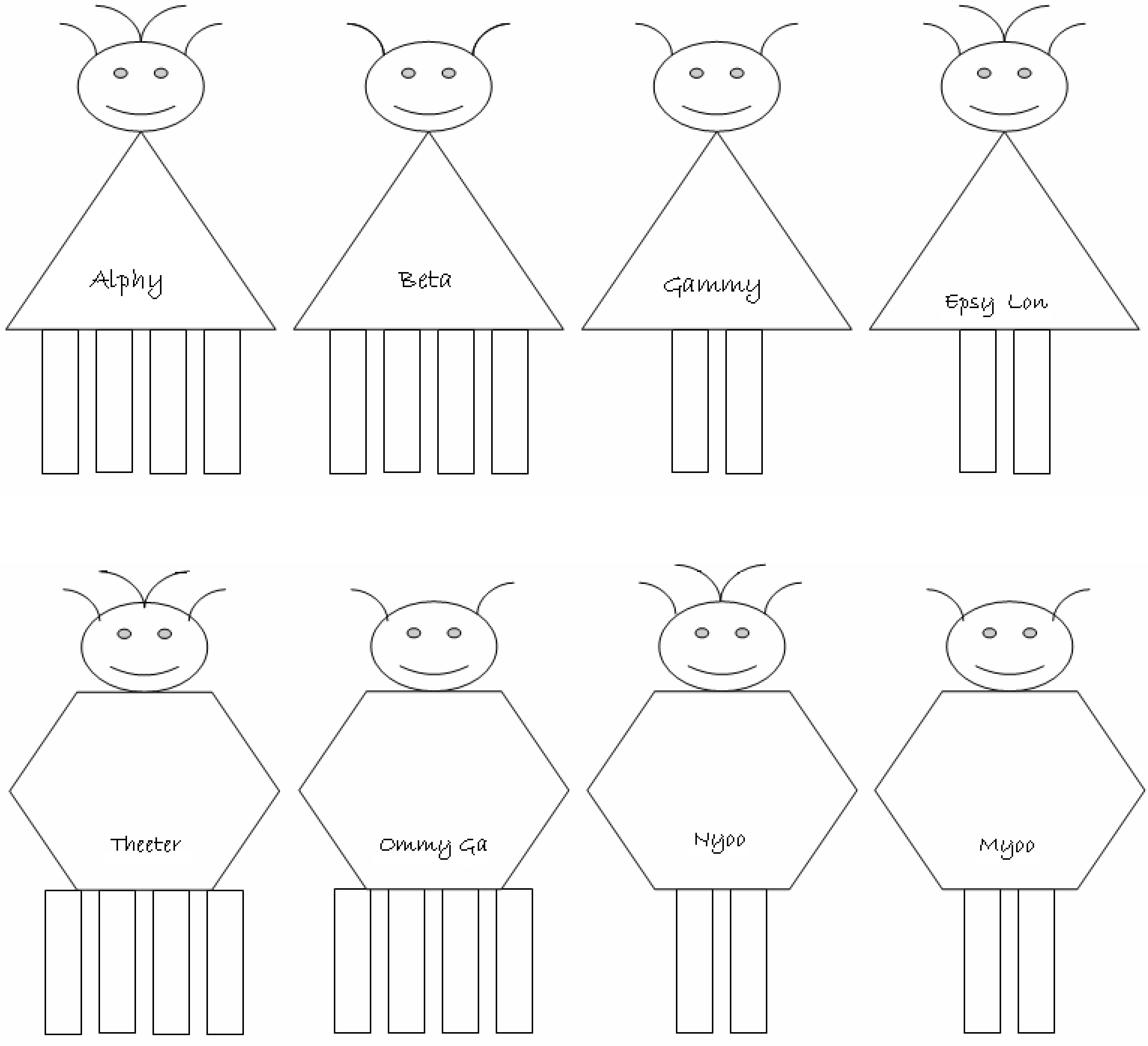
2. a. constructed from plastic ------------------------------------ go to #3
   b. constructed from material other than plastic ------------- pencil

3. a. green & grey --- highlighter
   b. blue & clear -- pen

4. a. black & silver --- pencil sharpener
   b. silver -- paper clip

alien key

- Carefully examine and think about the ***observable features*** of the 8 aliens and create a dichotomous key using some of these characteristics.


Alphy
Beta
Gammy
Epsy Lon
Theeter
Ommy Ga
Nyoo
Myoo

USING KEYS

Use the key booklet to identify the organisms described below.

Broad Leaved Trees

This trees leaves are green all over and have a hairy upper surface. They are rounded with a pointed tip and they are larger on one side of the midrib than the other. The edges of the leaves are toothed, but they have no lobes or prickles. The stalk is short and rounded and bears a single leaf.

Leaf Litter

This wingless invertebrate has a waistless segmented body with 3 pairs of legs. It uses a spring under its abdomen to move by jumping.

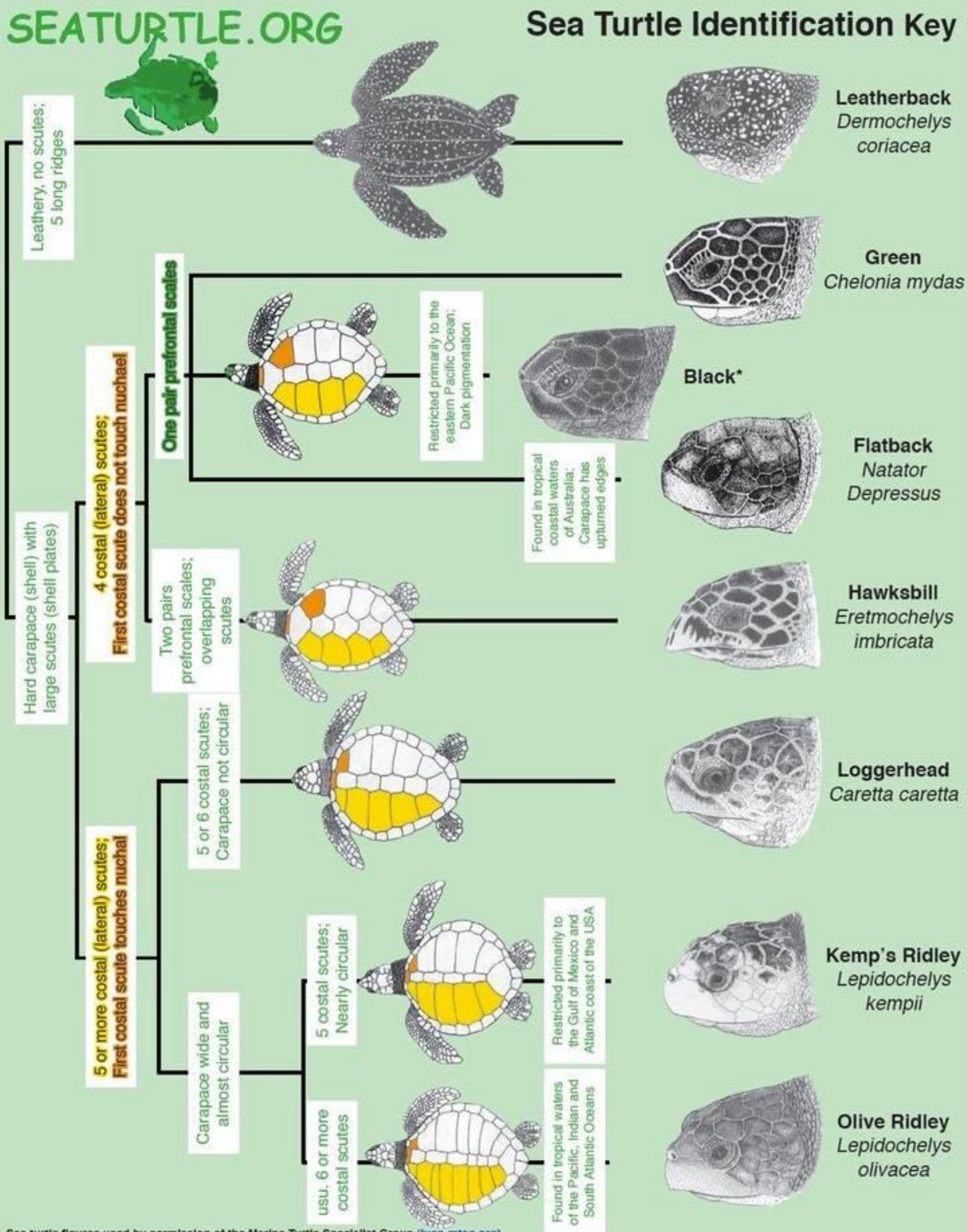
GRASSLAND

This 6 legged invertebrate has a broad body with a triangle shape on its back. It has 2 pairs of wings; one pair forms a protective case. It moves by flying or walking and has no obvious snout.

Garden Weeds

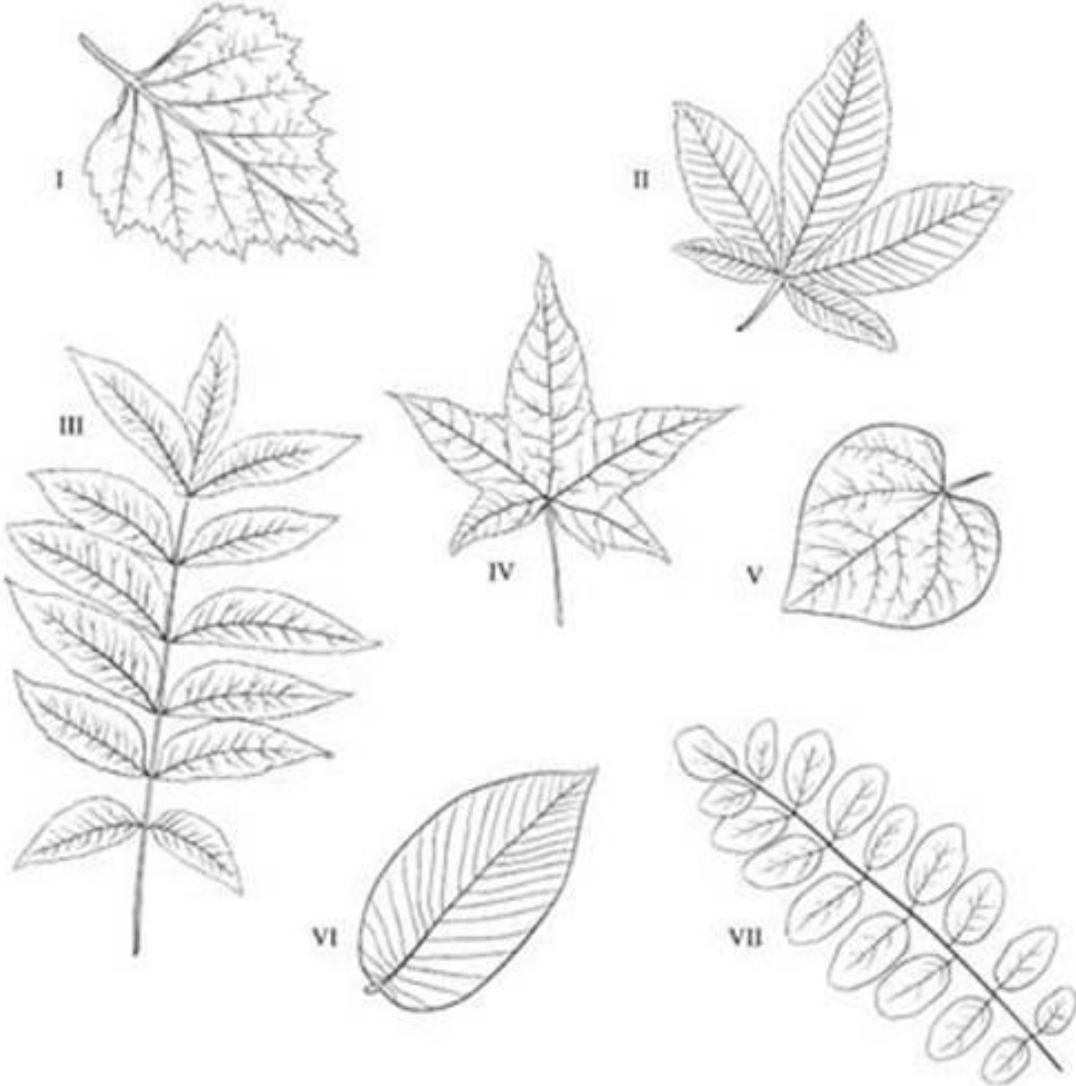
This spineless weed has smooth edged, arrow shaped leaves. The stem trails along the ground and produces pink and white trumpet shaped flowers.

Sea Turtle Identification Key



Sea turtle figures used by permission of the Marine Turtle Specialist Group (lucn-mtsg.org)

Source: Pritchard, P. C. H. and Mortimer, J. A. (1999) Taxonomy, External Morphology, and Species Identification. pp. 21-38. In: Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. (for further details see http://www.iucn-mtsg.org/publications.htm) Illustrations by Tom McFarland



Dichotomous Key for Leaves

1. Compound or simple leaf
   1a) Compound leaf (leaf divided into leaflets) ....go to step 2
   1b) Simple leaf (leaf not divided into leaflets) ....go to step 4
2. Arrangement of leaflets
   2a) Palmate arrangement of leaflets (leaflets all attached at one central point) ....*Aesculus* (buckeye)
   2b) Pinnate arrangement of leaflets (leaflets attached at several points) ....go to step 3
3. Leaflet shape
   3a) Leaflets taper to pointed tips ....*Carya* (pecan)
   3b) Oval leaflets with rounded tips ....*Robinia* (locust)
4. Arrangement of leaf veins
   4a) Veins branch out from one central point ....go to step 5
   4b) Veins branch off main vein in the middle of the leaf..............................go to step 6
5. Overall shape of leaf
   5a) Leaf is heart-shaped........*Cercis* (redbud)
   5b) Leaf is star-shaped ....*Liquidambar* (sweet gum)
6. Appearance of leaf edge
   6a) Leaf has toothed (jagged) edge ....*Betula* (birch)
   6b) Leaf has untoothed (smooth) edge ....*Magnolia* (magnolia)

LEARNING OUTCOMES

Understand why classification is needed for:

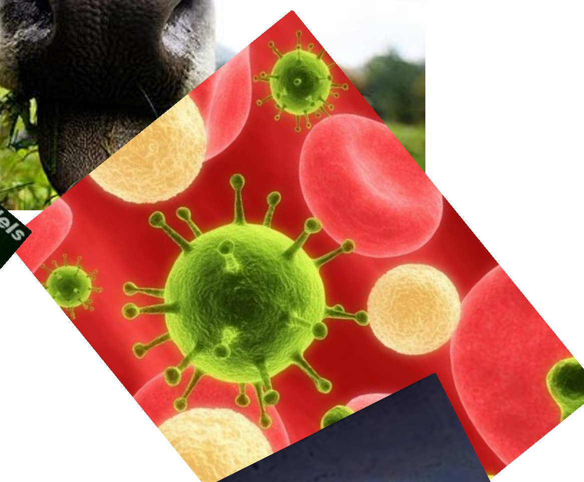
1. Identification
2. the study of how organisms have changed through time
3. the comparison of biodiversity
4. conservation of species

LEARNING OUTCOMES

Use observations of organisms to help describe the main features of the five kingdoms (protoctista, bacteria, fungi, plants and animals), to include:

- mode of nutrition
- cell wall
- cellular organisation

Classification



the 5 kingdoms

All living organisms are divided into five large groups called **Kingdoms**.

The 5 kingdoms are:

Bacteria

Protoctista

Fungi

Plants

Animals

All the organisms in each kingdom have specific features in common.

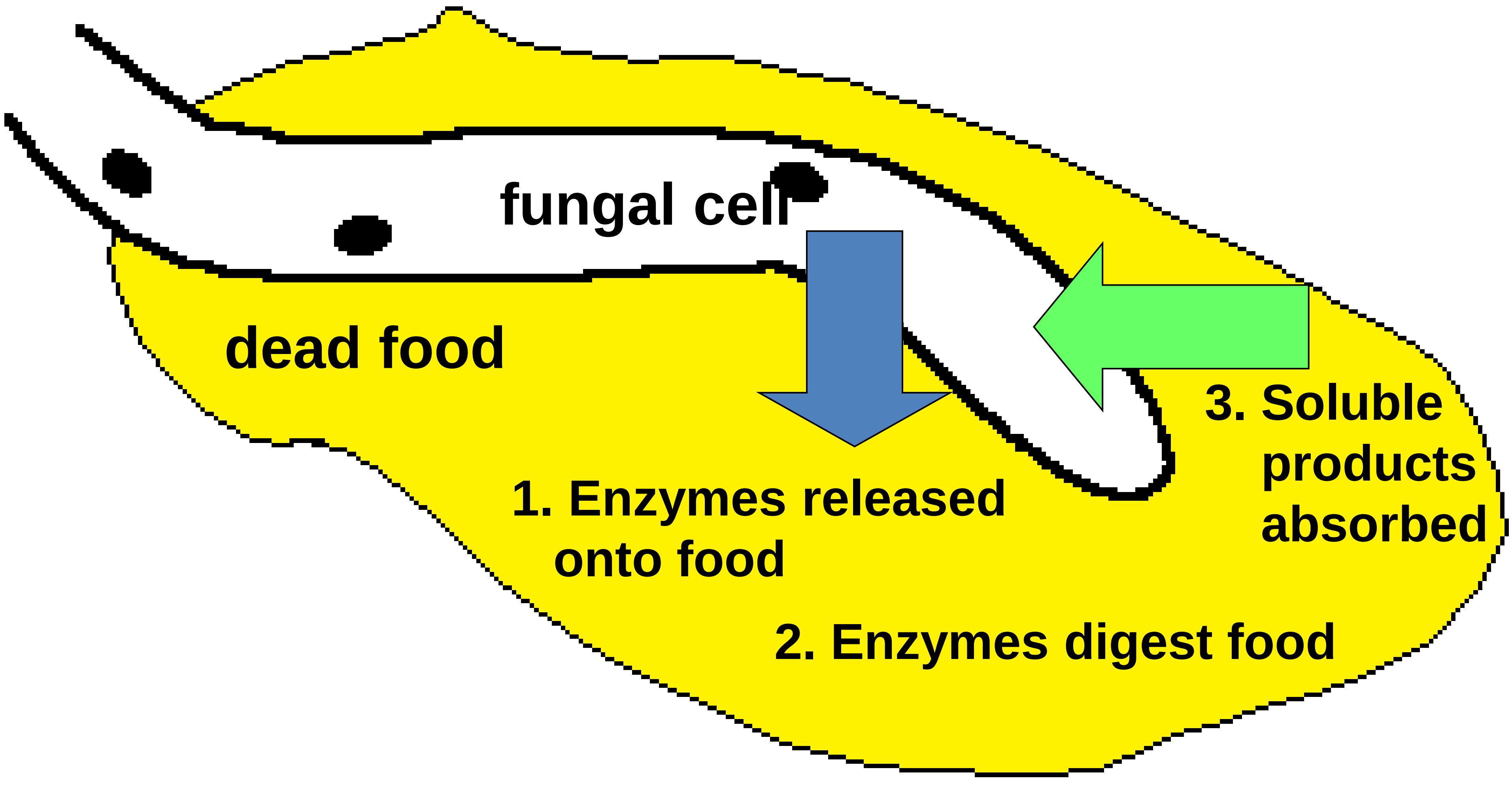
These include:

1. their mode of nutrition (**how they feed**)
2. whether they have a **cell wall**
3. **cellular organisation**;

Group	Nutrition	Cell wall	Cellular organisation
Protoctista	Saprophytic or photosynthetic	Cellulose cell wall or none	Single celled with nucleus or algae that are not truly multicellular
Bacteria	Saprophytic or photosynthetic	Non-cellulose	Single celled with no nucleus
Fungi	Saprophytic or parasitic	Non-cellulose	Single or multicellular – can be ‘acellular’ with it being difficult to distinguish individual cells and nuclei scattered throughout the organism
Plants	Photosynthesis	Cellulose	Multicellular – ‘typical’ cell arrangement with a nucleus
Animals	Eating organic food	None	Multicellular – ‘typical’ cell arrangement with a nucleus

Use the table to complete the classification poster in your booklet

how fungi feed

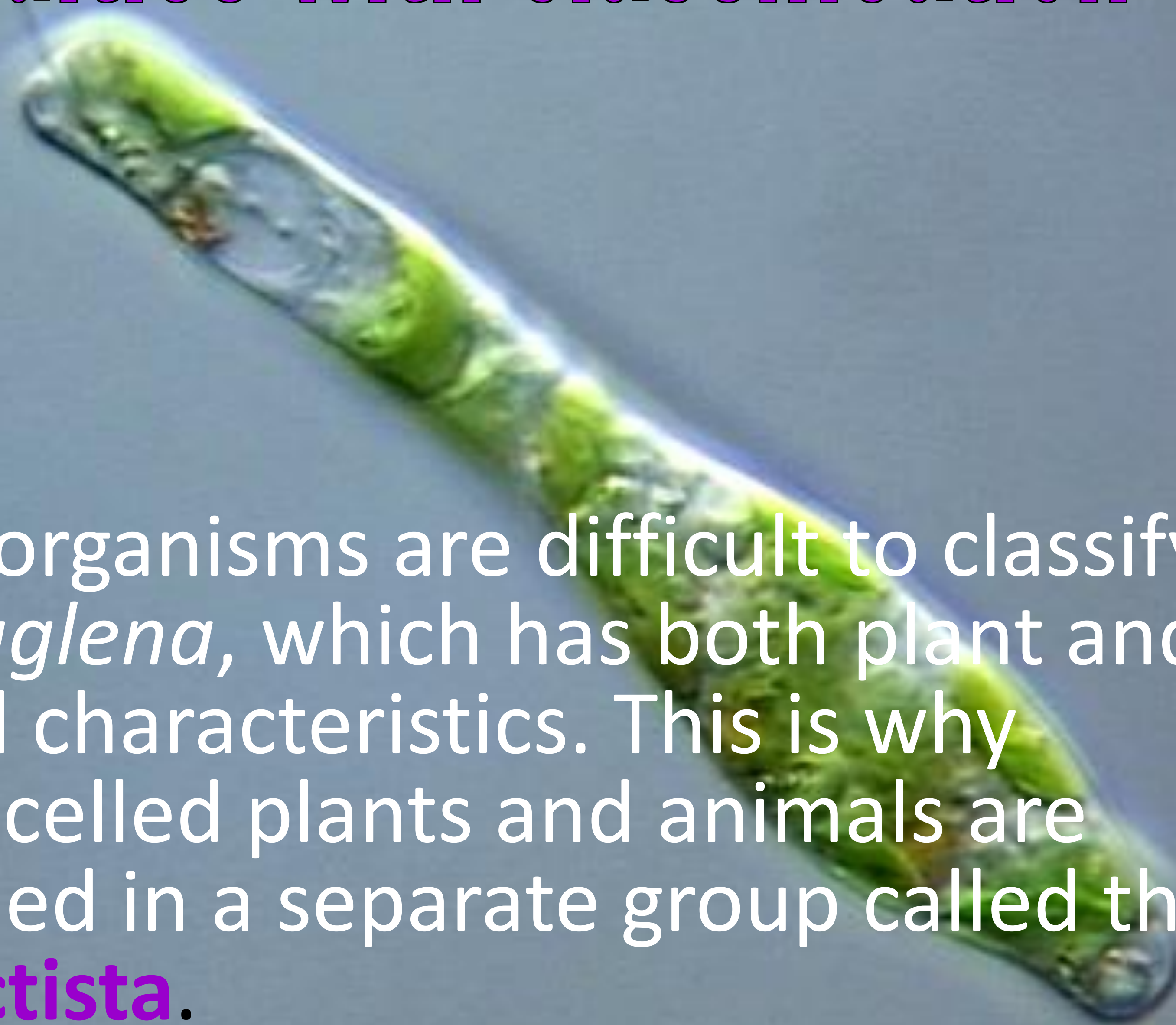


LEARNING OUTCOMES

Understand the difficulties in classifying:

- species as a group of organisms, with shared features, which can breed together to produce fertile offspring
- viruses, which lack cellular organisation and are therefore considered by many biologists as non-living,
- and understand that classification systems change over time;

difficulties With Classification



1. Some organisms are difficult to classify e.g. *Euglena*, which has both plant and animal characteristics. This is why single-celled plants and animals are classified in a separate group called the **Protoctista**.

2. Sometimes it is difficult to identify which species an organism belongs to or where one species merges into another.

Definition – **a species is a group of organisms, with shared features, which can breed together to form fertile offspring**.

is the colour due to variation or are they different species?

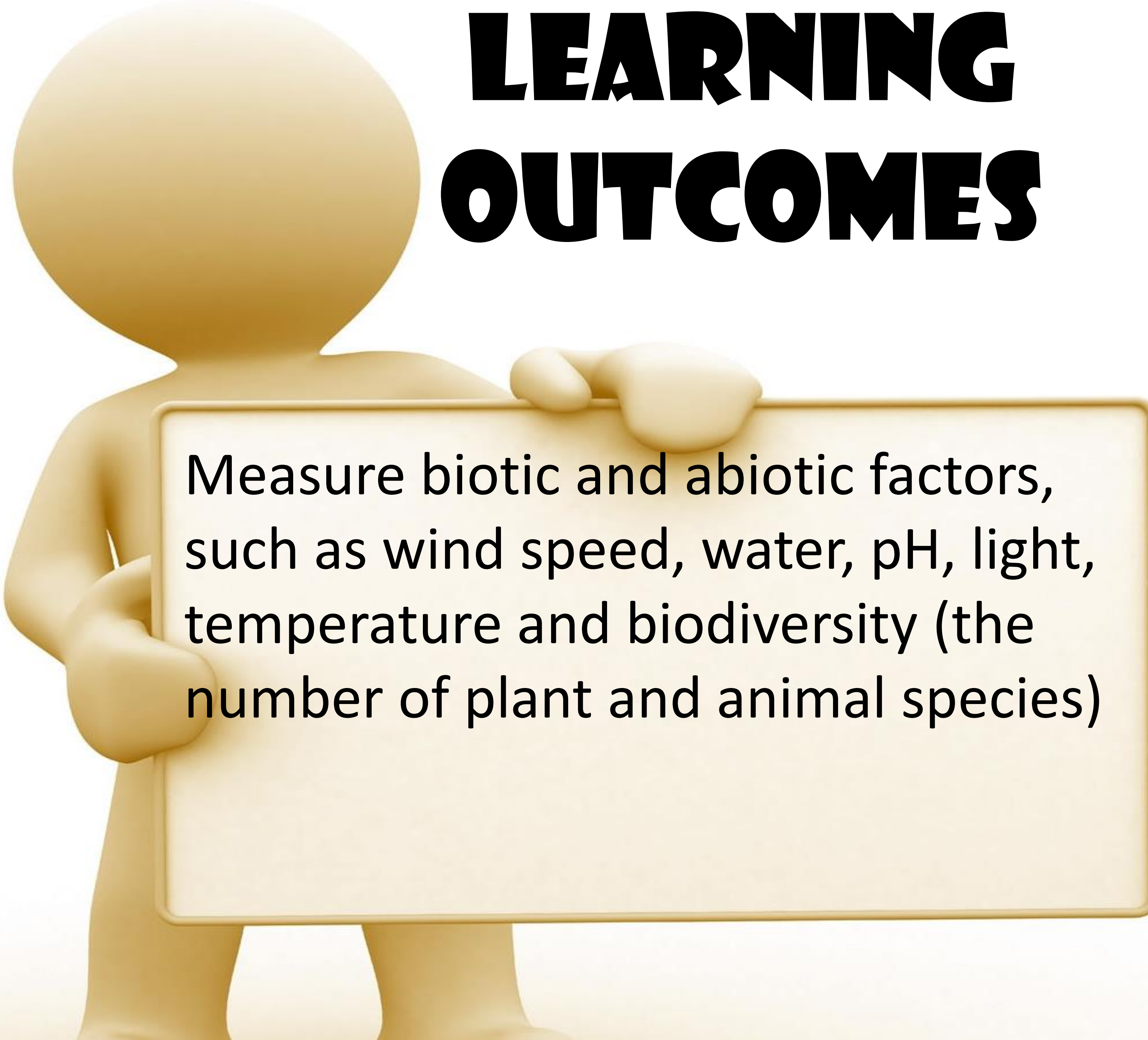
3. **Viruses** are a complex group and are very difficult to classify. All viruses, e.g. the HIV virus that causes AIDS, lack proper cellular organisation. They have a DNA/RNA core (DNA and RNA are nucleic acids – the building blocks of chromosomes) and an outer protein coat without the typical cytoplasm of other cells. They can only live if they gain access to other cells and many biologists therefore regard them as **non-living**.

QUESTION 3
HOMEWORK BOOKLET

LEARNING OUTCOMES

Use appropriate sampling techniques
to investigate changes in the
distribution of organisms within a
sample area, limited to quadrats,
pitfall traps, pooters and nets

LEARNING OUTCOMES



Measure biotic and abiotic factors, such as wind speed, water, pH, light, temperature and biodiversity (the number of plant and animal species)

FINDING OUT ABOUT POPULATIONS IN A HABITAT

Fieldwork provides information about what plants and animals live in a particular habitat and their numbers. This can be used to measure biodiversity.

It is therefore necessary

- to be able to **identify** organisms, using **keys**
- and understand the different **sampling techniques** used to count them.

We cannot actually count every plant or animal in a particular place, so

we count a sample of the population to calculate an estimated population size.

SAMPLING POPULATIONS

You should understand the importance of **random sampling**.

This is essential to **avoid observer bias**.

WHAT DOES THIS MEAN?

This means that the person collecting the data does not affect the result deliberately, **e.g. by only counting in one part.**

QUADRATS

Quadrats are usually used to count plants, but can also be used to count slow moving animals such as snails.

1. Lay out two tapes at right-angles in the area you want to sample.
2. Use random number tables to pick co-ordinates:
   - quadrats should be placed randomly so that a **representative** sample is taken.
3. Place a quadrat (of suitable size) at that point and count the organisms within it.
4. Repeat using using at least 20 quadrats, at other random coordinates across the grid:
   - repeating increases the reliability.
   - collecting across the whole grid area **reduces the effect of an unusual distribution**
5. Calculate the **average** number of organisms in each quadrat
6. Use the average to calculate an **estimated total number of organisms** in the grid area.

Quadrats can be used to estimate a population in an area which is **fairly uniform**. Examples include lawns, woods and open ground.

There are three ways to count organisms to estimate population size:

- 1. **Density**

  (calculating the number of organisms per m^2);
- 2. **Frequency**

  (number of number of quadrats that contain the organism)
- 3. **Percentage cover**

  (estimating the percentage of the grid area that contains the organism)

Percentage cover – do you agree with the estimates?

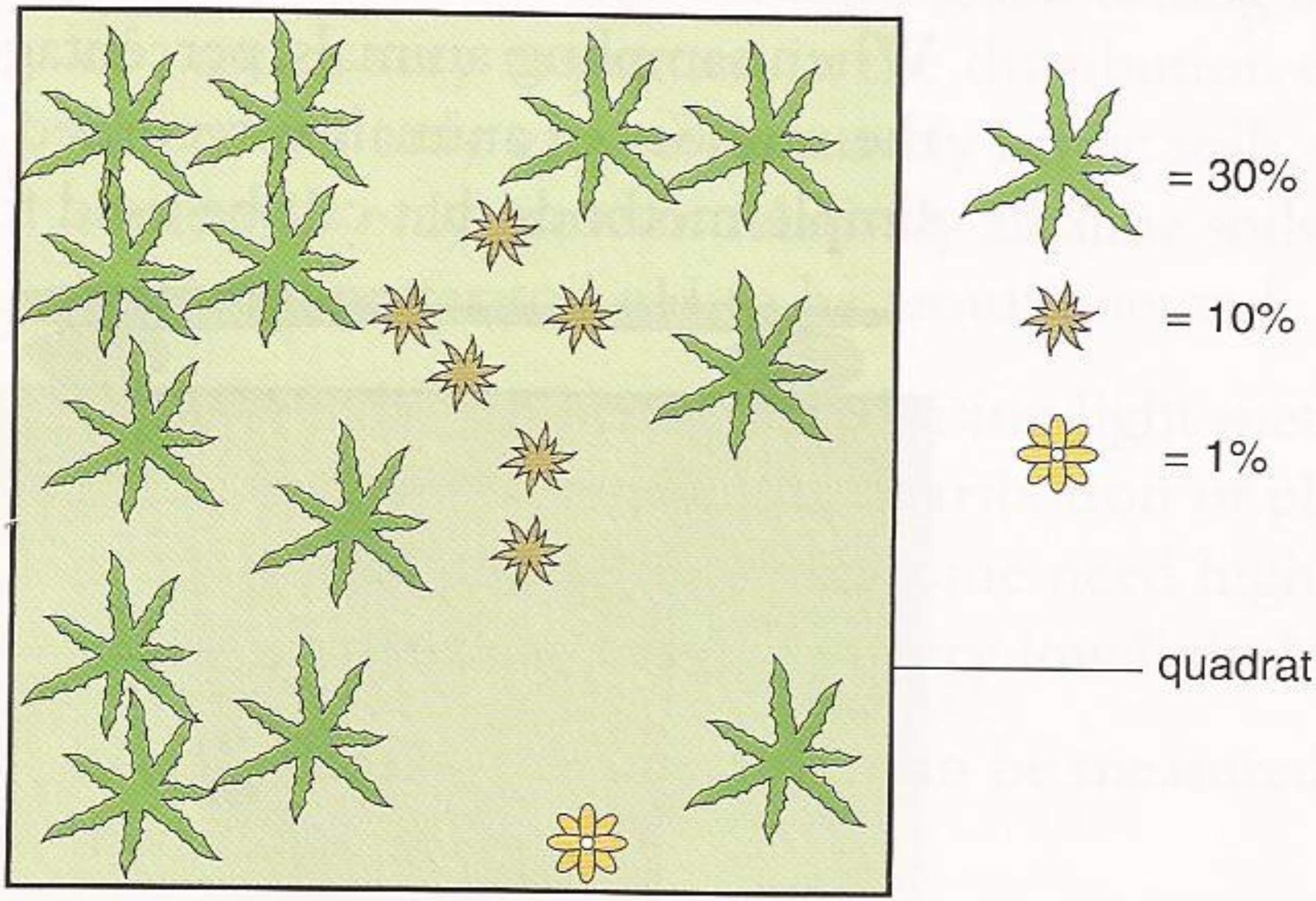


Figure 7.1 Using a quadrat to measure percentage plant cover

- Percentage cover is an easy way to estimate population size.
- However, a **disadvantage** is that it is difficult to estimate exactly what percentage of the quadrat is actually covered by a particular type of plant, so it is normal to round up to the nearest 10%. An exception is if there are any plants with a percentage cover of 1 -5% - this is recorded as 1 and not 0.
- This makes the results **less reliable** than estimating the density.

Field Work

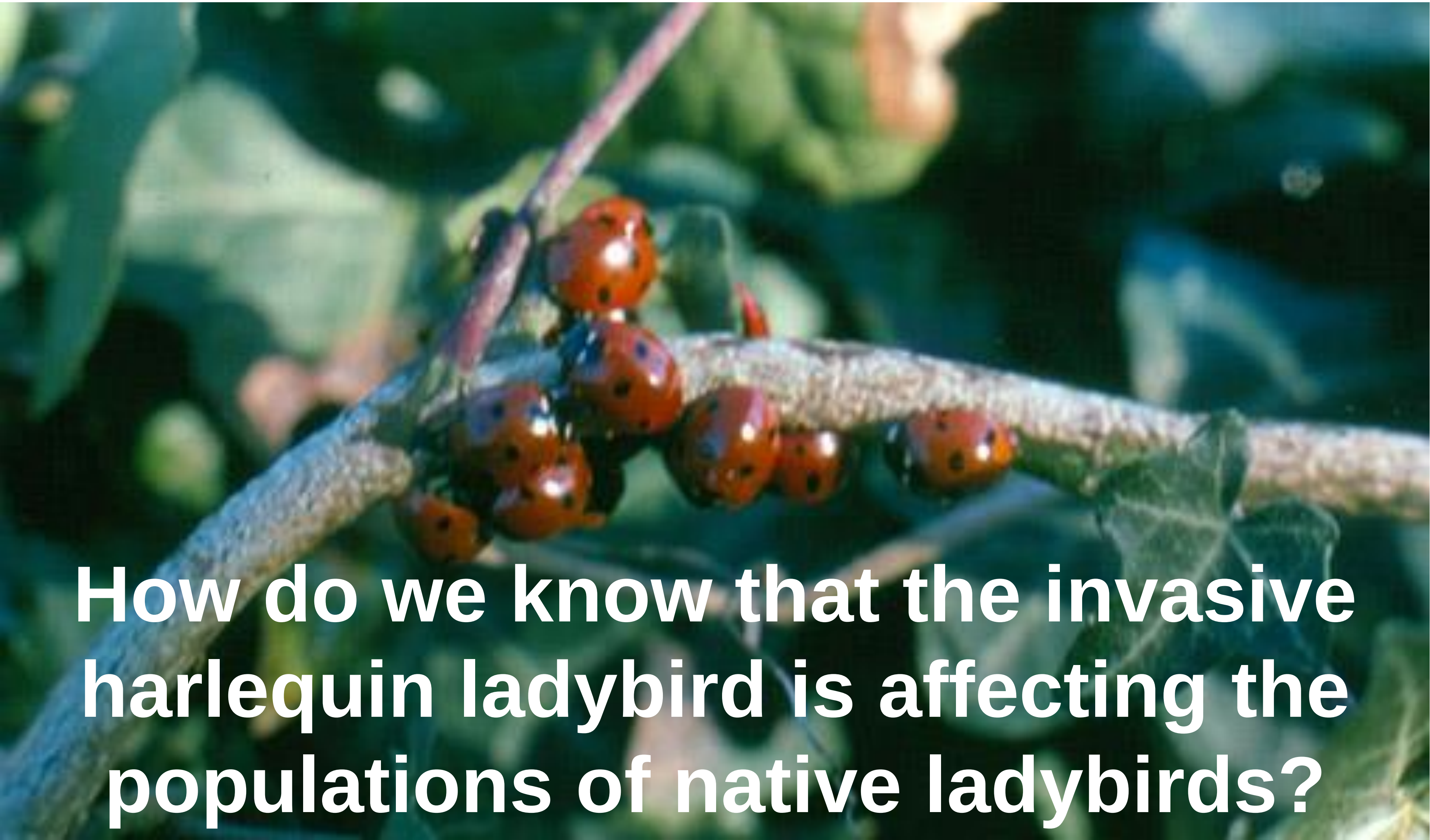
BELT TRANSECTS

Belt transects can be used to investigate **changes in the distribution** of organisms along a particular habitat, e.g. due to changing abiotic factors such as light intensity

On the seashore a belt transect can be used to investigate the effect drying out, due to tidal changes, has on the different species found as you move inshore.

draw on where you would lay a tape measure for a belt transect

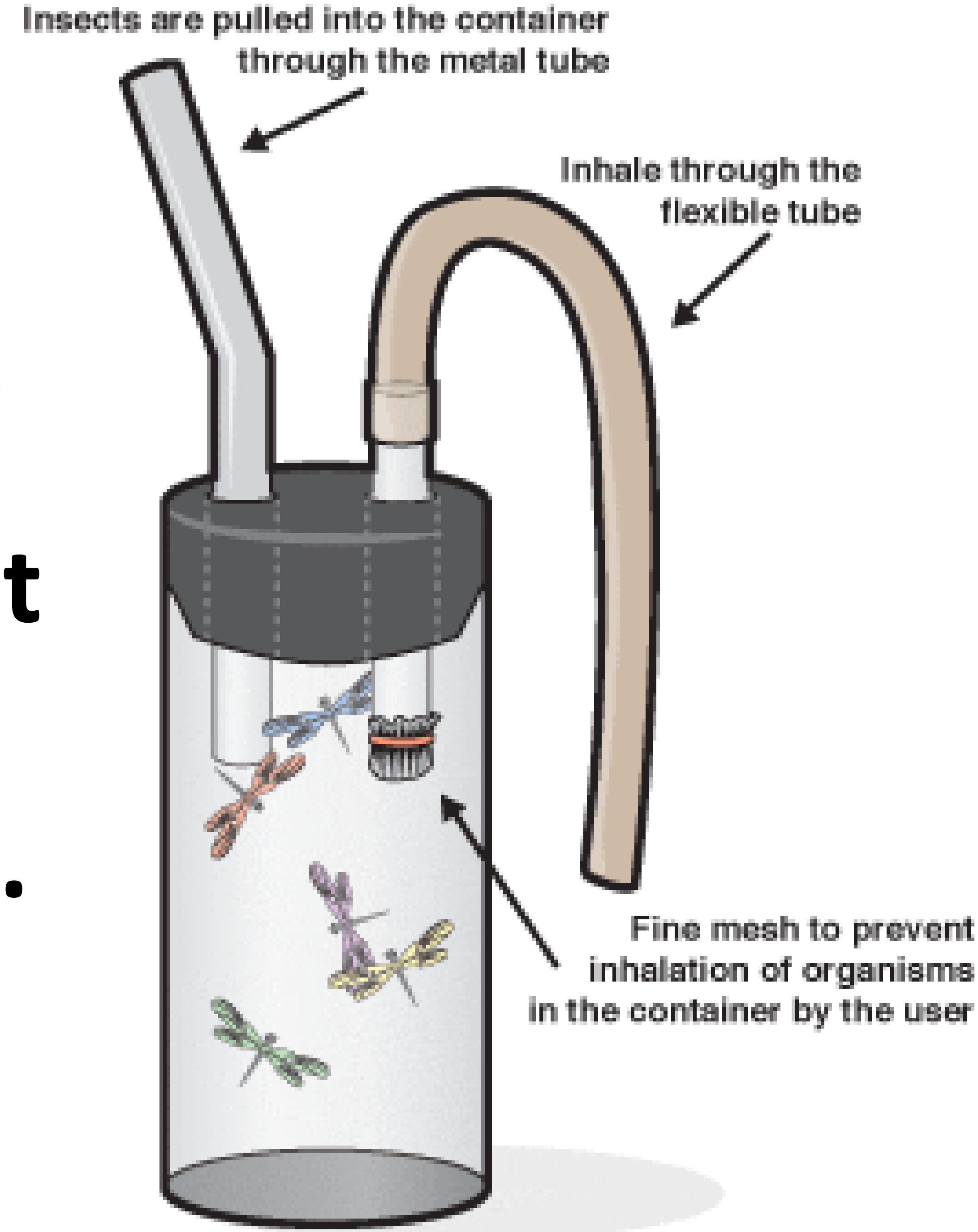
SAMPLING ANIMAL POPULATIONS



How do we know that the invasive harlequin ladybird is affecting the populations of native ladybirds?

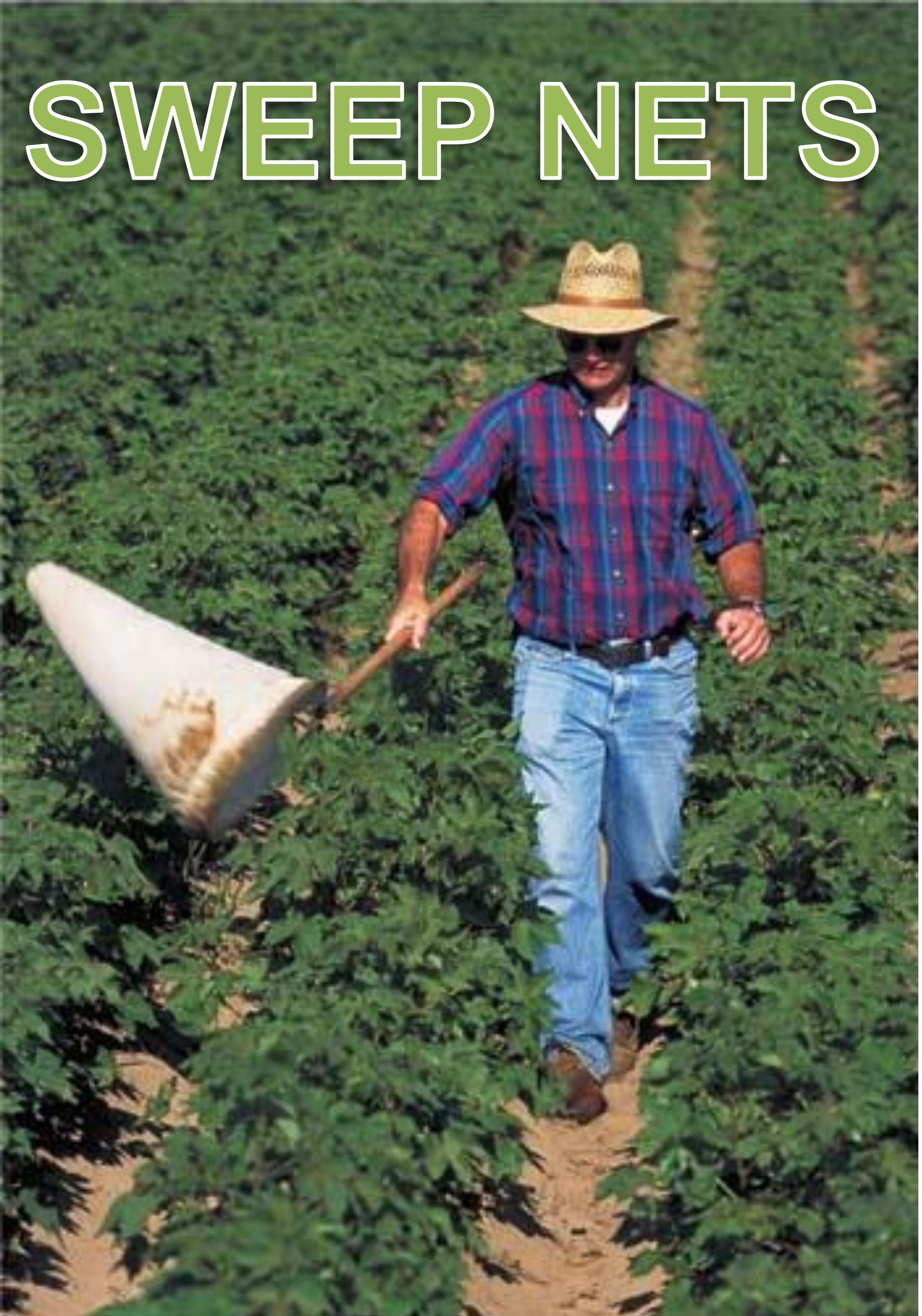
POOTERS

used to collect small invertebrates.




19. Heterocerus flexuosus Stephens ×5
5. Cebrionidae
20. Cebrio gigas Fabr. male ×1.25

SWEEP NETS



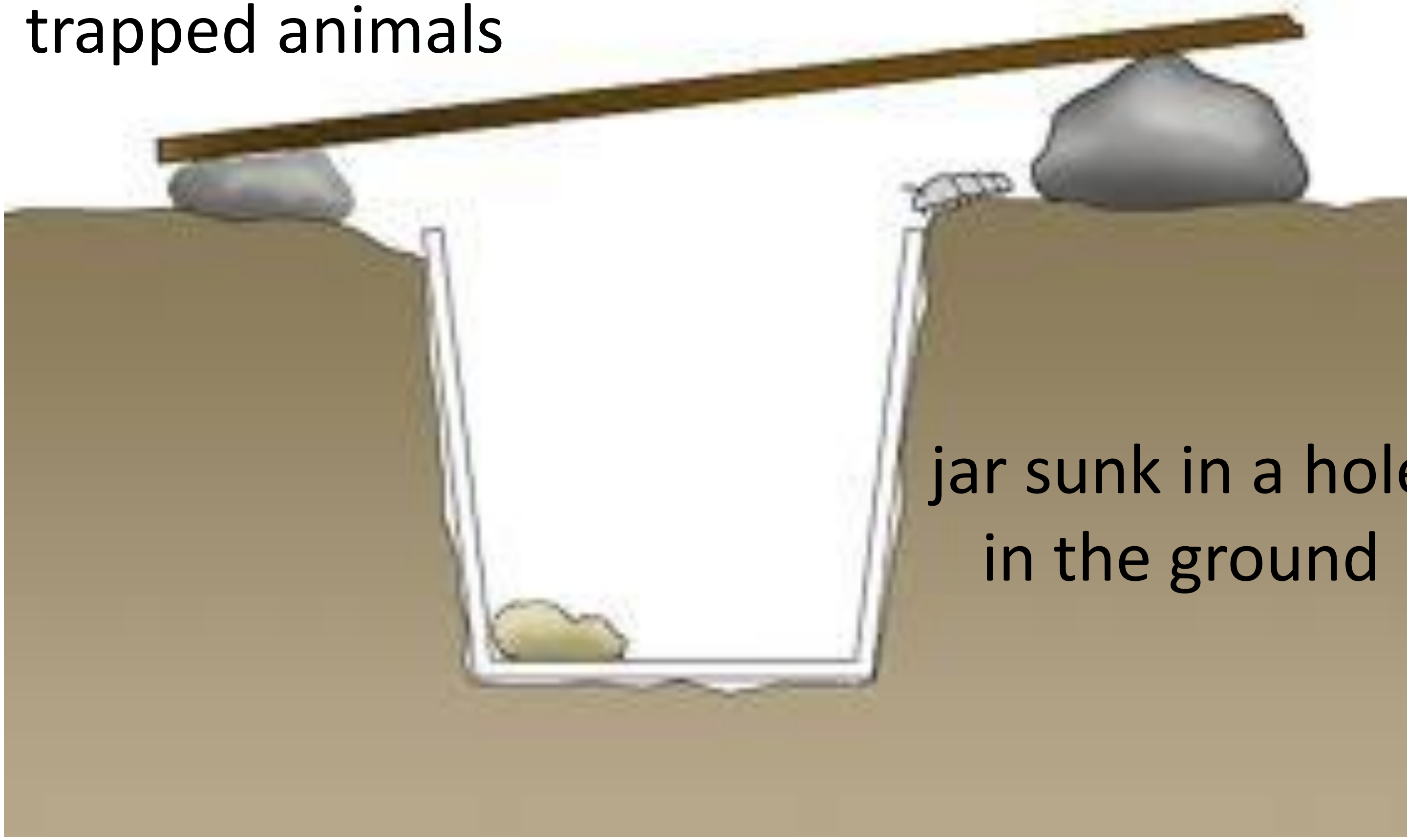
- Sweep nets allow you to collect **large numbers of invertebrates that live in low vegetation (stems, tall grasses, flowers etc) or in rivers and ponds**
- Sweep netting involves making a large rapid sweep with a net in between large paces.
- The invertebrates can be collected in a tray and counted

PITFALL TRAPS

Pitfall traps must be properly set up:

- the top of the jar should be **level with the soil surface**
- cover the trap with a stone or piece of wood to keep out the rain, **to make it dark and to stop birds eating your catch**
- the traps must be checked often to **avoid the animals escaping or being eaten before they are counted**
- as with most methods a **large number** of traps makes results more **reliable** and minimises the effects of unusual results

PITFALL TRAPS

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pooter exam question

- http://www.bbc.co.uk/scotland/learning/bitesize/standard/biology/biosphere/investigating_an_ecosystem_rev5.shtml

Learning Outcomes

Use data collected (primary or secondary) as evidence to account for the distribution of organisms

Account for this distribution in terms of the adaptations of the organisms found to their environment and competition for resources, which can affect population growth, (water, light, space and minerals in plants and water, food, territory and mates in animals

LEARNING OUTCOMES

Evaluate the validity and reliability of data collected during fieldwork when drawing conclusions about the methods of data collection and environment;

Case Study
plant distribution in a sand dune system

See worksheet (pages 54 -55 textbook)

Each organism is **adapted** (suited) to the environment in which it lives.

This case study tries to explain why specific plants live at different distances from the seashore.


problems?
adaptations?
marram grass


problems?
adaptations?
heather


problems?
adaptations?
gorse

1. Describe the area that was being studied.
   - 1km sand dune, divided into 3 sections.
   - Section 1 from the start of the first sand dune inshore.
   - Section 2 half way between 1 and 3.
   - Section 3 from the end of the last dune to to the start of the woodland.
2. What sampling method was used to study the distribution of plants along the sand dunes?
   - 3 interrupted belt transects
3. How many samples were taken?
   - 20 at each site

4. Name the biotic data collected.

- the average percentage cover
- of marram grass, common heather and gorse
- along each transect

5. Name the abiotic data collected

- Average light intensity reaching the ground
- Average soil moisture
- Average pH

6. Describe the conditions in which each of the plants prefers to grow.

- Marram grass: can grow in very unstable conditions such as those found near the shore, where the sand is constantly moving in the wind.
- Heather: small shrub, prefers stable moist soil
- Gorse: large shrub, prefers very stable soil with lots of moisture and nutrients

7. Describe the trends shown by the graphs.

- Marram grass is only common in transect 1
- Heather is not found in transect 1 but is found in transect 2
- Gorse is most common in transect 3, but uncommon or absent at transects 1 and 2.

8. Use the biological knowledge about the 3 plants and the abiotic data to explain the trends.

- Marram grass can grow at the beginning of the dunes where there is not much water available in the sand, 20%.
- It needs high light intensity to grow, 95%.
- Further inland, where the conditions are more stable, there is less light and there is more moisture, so the other plants out-compete the marram grass.

- Heather cannot grow in transect 1 because there is not enough moisture.

- Gorse grows best in transect 3 where there is most water, 60%.
- Gorse is a large shrub and creates shade, preventing the marram grass and heather from growing.

9. What features of this investigation make the results reliable?
    - The plants were counted in 20 quadrats at each transect and an average was calculated.

11. Explain why you think this a fair test?

- Only one thing was being changed.

12. State the following:

the independent variable

- The position of the transect along the dune.

the dependent variable

- Percentage plant cover in each quadrat

the controlled variables

- Size of the quadrat
- Time of the year the measurements were taken.

It was not possible to keep the wind, light intensity, soil moisture or pH controlled. However these factors were measured and helped to explain the presence or absence of the plants at the different transects.

QUESTIONS 1&2
HOMEWORK BOOKLET

LEARNING OUTCOMES

Use mathematical models to explain changes in populations

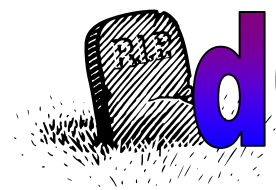
Explain the consequences of changes in population density on the environment, to include birth and death rates, emigration and immigration

Population Changes

Population numbers change over time.

Many factors can contribute to population change but they can be summarised by:

birth rate



death rate

emigration

immigration

This can be written as an equation:

POPULATION GROWTH =

(birth rate + immigration) –

(death rate + emigration)

in a decreasing population

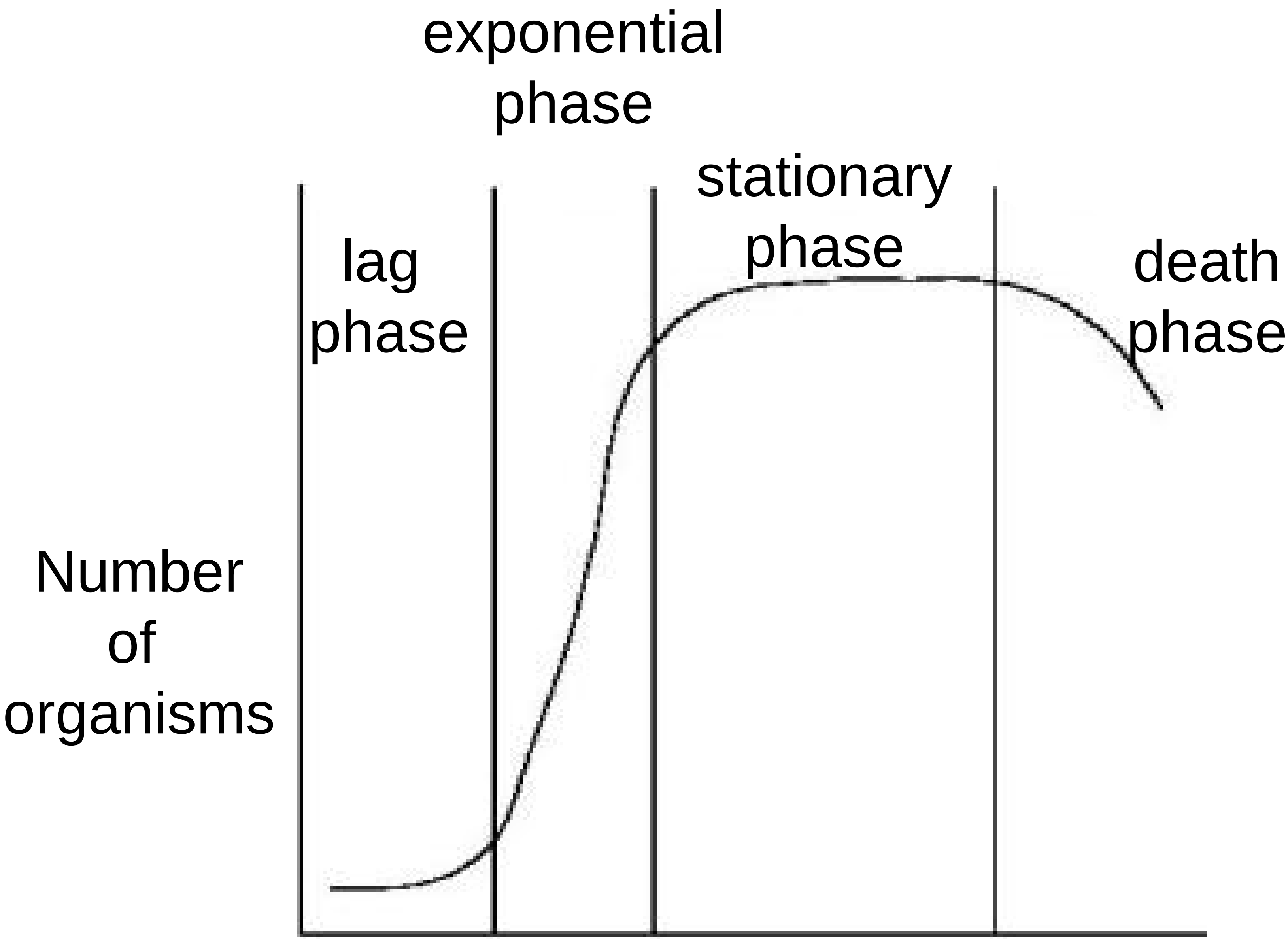
birth rate < death rate

emigration > immigration

in an increasing population

birth rate > death rate

emigration < immigration



A population growth curve shows the numbers of organisms in a closed population over time.

Describe and explain what is happening to the population in each area of the graph:

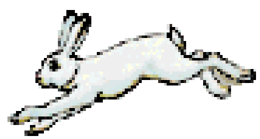
Think about:

Is the population increasing, decreasing or staying constant?

What abiotic and biotic factors might affect the organisms to cause any change in population size?

Population numbers will also be affected by:

food supply



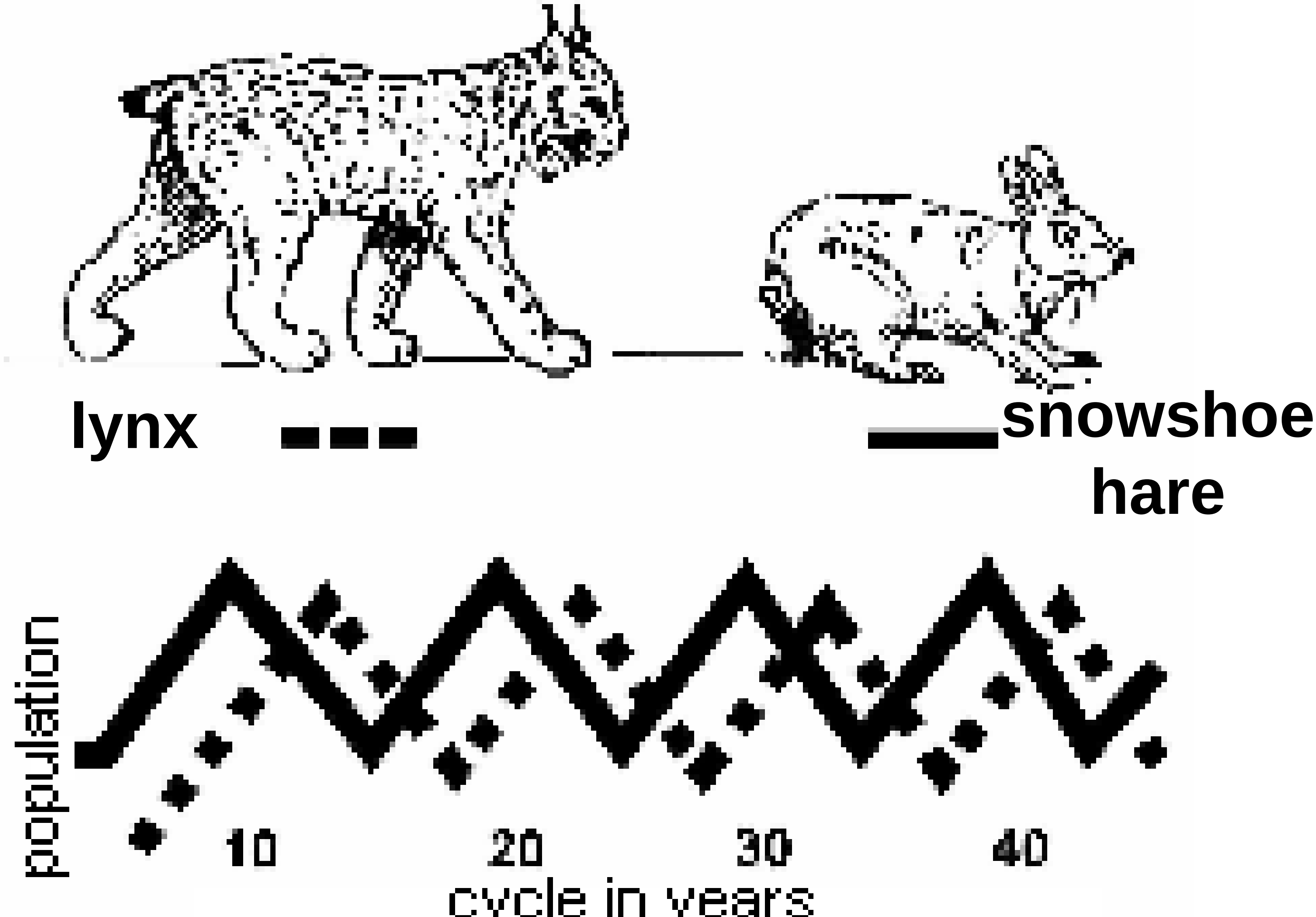
predation

disease

predator prey populations

- Some animals are **prey** to others, eg rabbits are the prey of foxes. The fox is a predator. The predator must kill the prey for food. This increases the population of predator but will decrease the population of prey.

- The populations of a predator and its prey can be measured over many years.
- The following graph shows the changes in populations of hares and lynxes over 40 years.



in pairs, use the whiteboards to describe the trend/s in the graph above

Spot the Mistakes

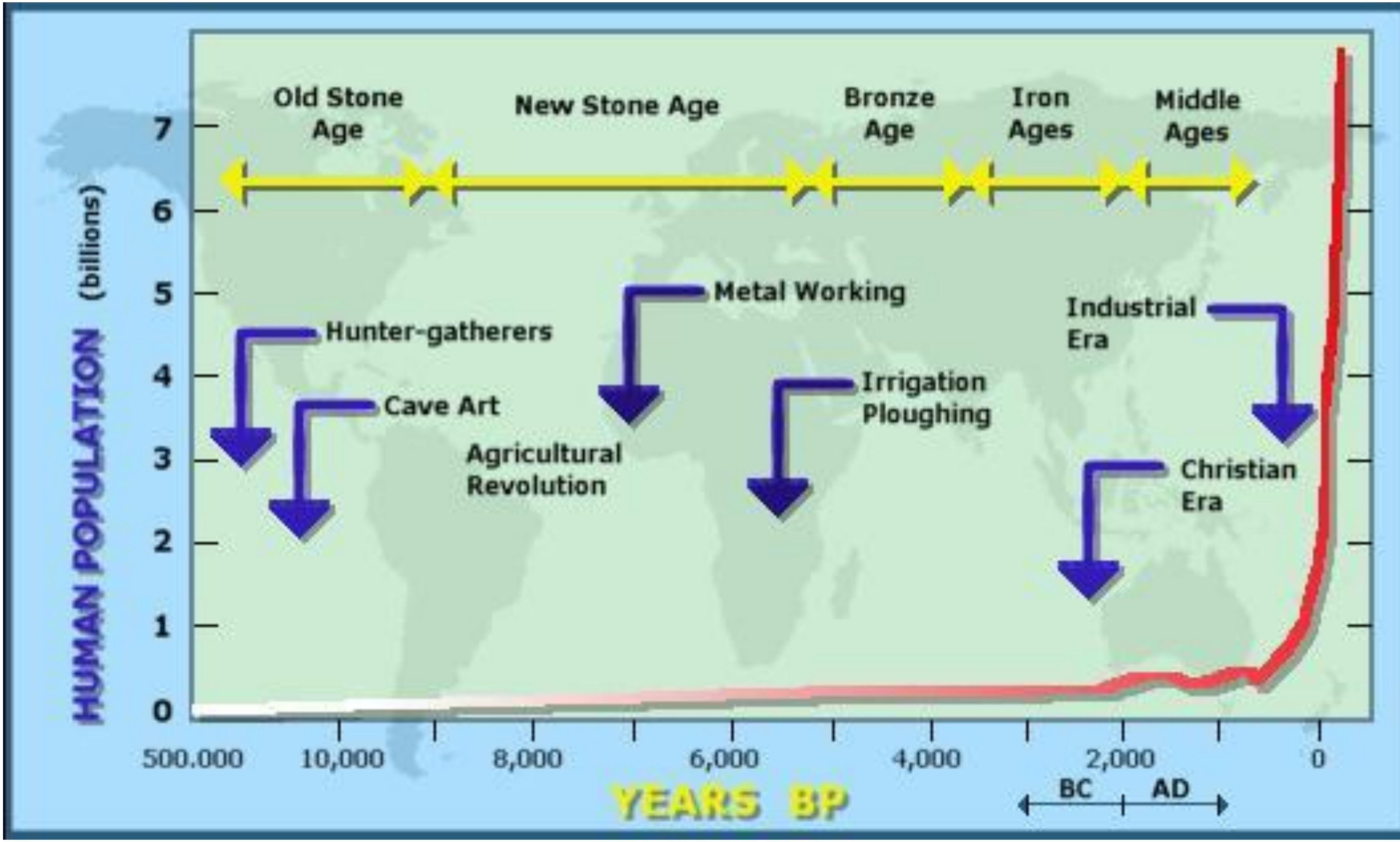
There are 2 main patterns:

- The populations of each animal remains steady over the 10 years, increasing and decreasing between certain limits.
- Changes in the population of one organism affects the population of the other organism.
  - When the lynx population increases, the hare population increases. This is because there are fewer hares being eaten.
  - When the hare population decreases the lynx population increases as there is more food to eat.
  - When the lynx population decreases the hare population decreases as there are more being eaten.

Answers

There are 2 main patterns:

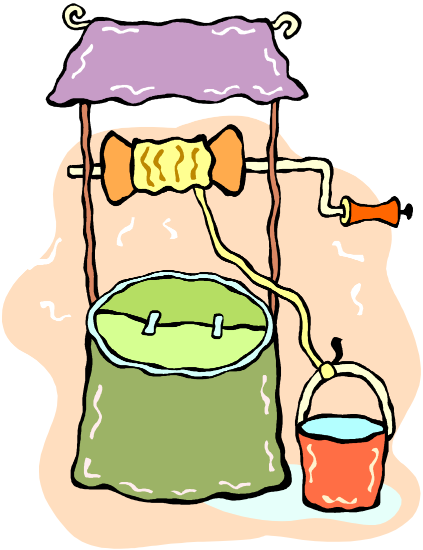
- The populations of each animal remains steady over the **40 years**, increasing and decreasing between certain limits.
- Changes in the population of one organism affects the population of the other organism.
  - When the lynx population increases, the hare population **decreases**. This is because there are **more** hares being eaten.
  - When the hare population decreases the lynx population **decreases** as there is **less** food to eat.
  - When the lynx population decreases the hare population **increases** as there are **fewer** being eaten.



HUMAN POPULATION GROWTH

REASONS FOR INCREASING HUMAN POPULATION GROWTH

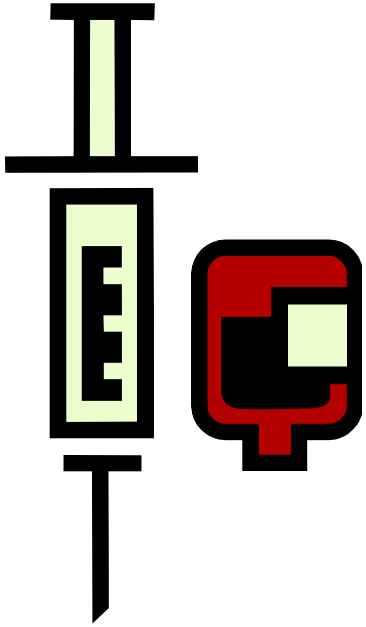
improved diet



improved hygiene

especially cleaner water

improved health care



improvements in agriculture

Review

Read through your notes on classification before answering question 3 (p71) in the GCSE Biology textbook.