Task 1: Key words

We are going to explore the varied and exciting world of freshwater pond ecosystems. As we investigate these environments there are a number of key words we will come across.

As you work through the resources or even during the live lesson you can fill in your own definition for these keywords… you might even know a few now!

Key term	Definition
Carnivore	
Herbivore	
Detritivore	
Consumer	
Producer	
Predator	
Algae	
Decompose	

Table continues on next page

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Photosynthesis	
Respiration	
Vertebrate	
Adaptation	
Eutrophication	
Prey	
Invertebrate	
Nutrients	

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Plants as primary producers

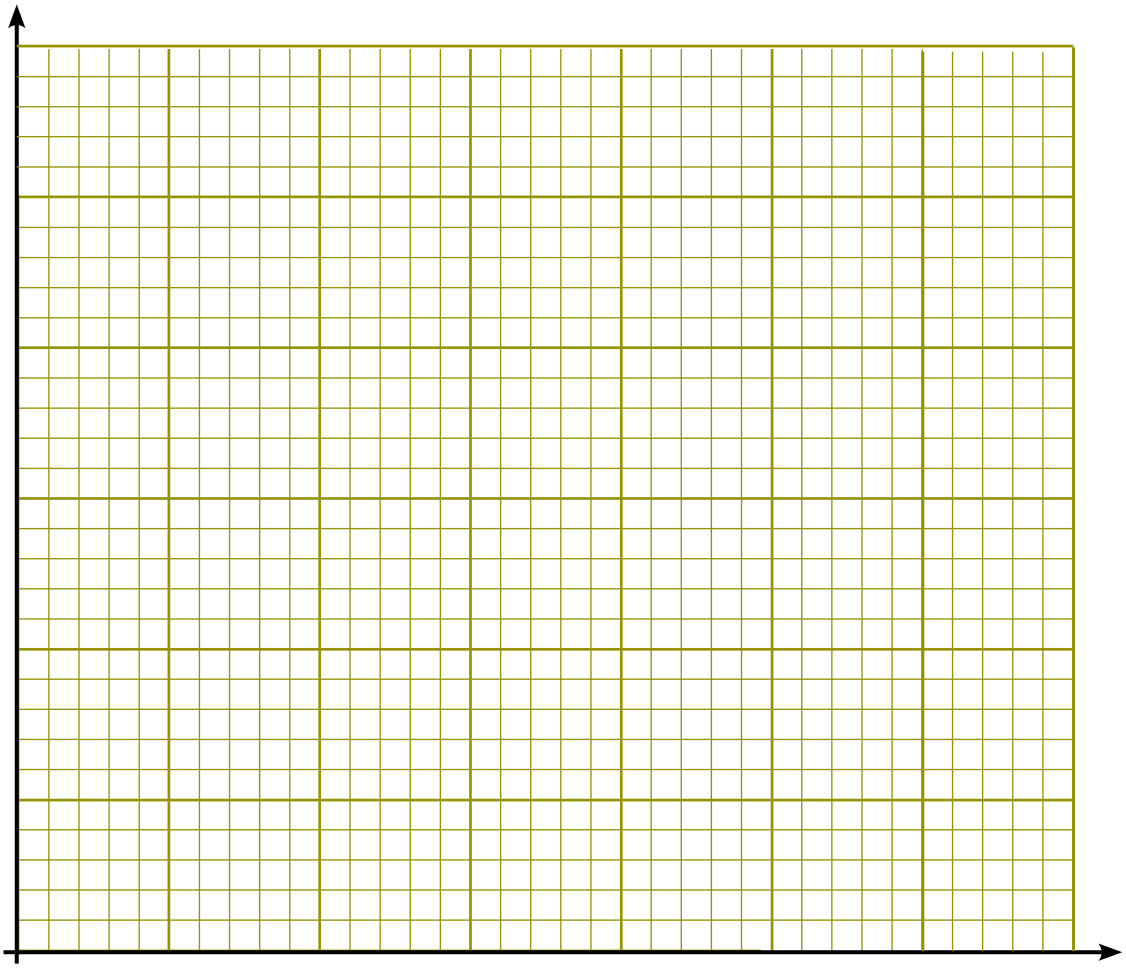
Plants are the primary producers at the start of most food chains. They convert the sun's energy into food by the process of photosynthesis. Plants require carbon dioxide for this process.

Task 2: How is photosynthesis affected by temperature?

A student investigated the effect of temperature on the rate of photosynthesis in a water plant by measuring the amount of oxygen produced as a by-product. The results are shown in the table (right).

Temperature (°C)	Volume of oxygen released (cm^3 per 5 minutes)
5	2
15	4
25	7
35	10
45	12

Plot this data using a line graph on the graph paper below. Using the graph you have drawn answer the questions below.



Ensure your graph has an appropriate title and both axes are labelled

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Answer the questions about your results.

- Describe the effect of temperature on the volume of oxygen produced.

- Explain what this tells us about the effect of temperature on the rate of photosynthesis.

- Name two other main factors which influence the rate of photosynthesis.

- What resource (s) do plants provide to the pond ecosystem?

- How could the rate of photosynthesis affect the number of herbivores (plant eating animals) living in a pond?

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Task 3: Eutrophication experiment

Eutrophication is the effect of too many nutrients entering a water system. This then influences the plant and animal life within the habitat.

Create your own eutrophication experiment or watch youtu.be/M39bZD9kESM to see the step by step process.

You will need...

- Clear container (narrower is better so you use less food resources) - POND
- Torch - SUNLIGHT
- Felt pens – DRAW FISH & PLANTS
- Herb - NUTRIENTS
- Water – POND WATER
- Oil – ALGAE
- To wash up afterwards...

STEP ONE: Pond Ecosystem

What three things to plants need to survive? .....

Plants produce oxygen through photosynthesis which animals need for respiration, plants also provide food for any herbivores in the pond.

STEP TWO: Fertiliser runoff

Agriculture for growing food for humans, often uses fertilisers, which are full of nutrients, to help crops grow. The fertilisers then get washed into riverbeds and ponds.

STEP THREE: Algal bloom (OIL)

Plants, such as algae, over grow due to the increase in nutrients, creating a 'carpet' on top of the water, this blocks out sunlight to the life below.

STEP FOUR: No light

If no light can reach the plants below the water, photosynthesis cannot happen. Plants die and start to decompose, producing carbon-dioxide. The water becomes low in oxygen and animals start to die too. The ecosystem collapses.

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KS3 Relationships in ecosystems

PRE-LESSON PREPARATION

When doing scientific experiments you need to write a method of how you did it. You can do this below.

1.

2.

3.

4.

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Task 4: Species adaptations

Freshwater ponds can be full of many different living organisms from fish, insects and plants to algae. In the next activity we will look at a few common pond invertebrates (animals without a backbone) and plants.

Create your own Top Trump Pack

Read the Fact File information about 7 common invertebrates and 1 plant that we are likely to find in UK ponds. Use the fact file information to create your own Pond Life Top Trump pack. Four have already been done for you.
Extension: you could use the additional resources section to research invertebrates or plants that aren't included here.

Category information

- Trophic Level: Producer (Lowest), Detritivore, Herbivore, Omnivore, Carnivore, Top Carnivore (Highest).
- Trent Biotic Index: A system used to rate water quality based on the presence of particular invertebrates (Higher numbers = cleaner water).
- Super Power: Make up a score from 1 to 1000 based on a special adaptation of that species (Do some research and choose your own).

1. How to Play Top Trumps:

Print out your cards, or use a digital device.

1. Shuffle and deal the cards face down.
2. From the top card only select and read out a category and its score to the other player(s) and they must also read out their score.
3. The player with the highest score in that category wins the cards and places them (including their own) at the bottom of their pile.
4. The winner is the first person to collect all the cards.

2. Build your own food web:

Place all your cards face down on a flat surface. Place cards that represent 'producers' at the lowest trophic level of your food web. This information can be found on the fact file cards. Place the 'consumers' above this and so on.

Can you draw any links between species? Who might eat who? Draw arrows to represent the links between each card (e.g. Duckweed ➔ Pond snail). The arrow represents the flow of energy. Do this until you have used as many cards as possible and created a whole web.

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Dragonfly Nymph

Dragonfly nymphs are large predators that rest quietly on the floor and then release their extendable jaw to feed on anything that passes by.

Can live up to 5 years underwater as a nymph before it turns into an adult.

They breathe by drawing water in and out of their rear end. By quickly expelling this, they can move quickly through the water.

https://www.youtube.com/watch?v=-Hc5BYGQrP8 (Dragonfly feeding)

Greater Boatmen

Water boatmen are none predaceous bugs that suck juices from algae, plants and detritus.

They are streamlined swimmers that swim upside-down, using their long hind legs to propel them.

Once underwater, they use a bubble of air trapped against their body to stay under for a long period of time. They also hook their legs around plants to stop themselves floating to the surface.

Water Flea

Water fleas are filter feeders, feeding on detritus, algae and bacteria. They sweep the food with their legs into a small groove that leads to the mouth.

They swim in a jerky, hopping motion through the water using powerful strokes of the antennae to propel them.

The water flea is very small in size, usually varying from 0.2 – 3mm.

https://www.youtube.com/watch?v=3rOCjjD29SY (Water flea swimming)

Pond Snail

Pond snails have a wide diet of plants and animals, sometimes even including smaller pond snails.
Can live up to 5 years underwater as a nymph before it turns into an adult.

Snails change their behaviour throughout the year. In summer they come to the surface to breathe, but in winter when the surface freezes they move to the bottom of the pond. They breathe through their skin and the tentacles help to take in oxygen underwater.

Their shells vary in colour

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Dragonfly Nymph

Trophic level ..... Top carnivore

Energy ..... 95.2 kJ

Size 10

Trent Biotic Index 8

Super Power 820

Extendable jaw

Greater Boatmen

Trophic level ..... Top carnivore

Energy ..... 125.4 kJ

Size 6

Trent Biotic Index 5

Super Power 475

Swims upside down

Water Flea

Trophic level ..... Detritivore

Energy ..... 0.085 kJ

Size 1

Trent Biotic Index 1

Super Power 100

HUGE population!

Pond Snail

Trophic level ..... Herbivore

Energy ..... 1.2 kJ

Size 7

Trent Biotic Index 6

Super Power 150

Extendable jaw

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Leech

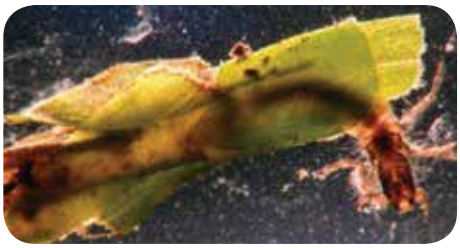
Many leeches are predatory feeding on aquatic animals and eating them whole. Some species are parasitic. Strong jaws and muscles let them to stick to bodies of other animals and feed on their blood.

They are segmented worms with flat bodies which are usually black and brown.

They are extremely flexible and can stretch greatly, moving by using a sucker at each end of their body.

https://www.youtube.com/watch?v=d2tL1AN6fcE (Leech moving)

Cased Caddis



Cased caddisflies are mainly scrapers or shredders which feed on ground algae mostly.

Their cases usually consist of pieces of plants, grains of sand or other detritus. They are created by producing silk

They use a bubble of air trapped against their body to stay underwater. They also hook their legs around plants to stop themselves floating to the surface.

https://www.youtube.com/watch?v=jID1_GwxiE0 (Caddisfly making a case)

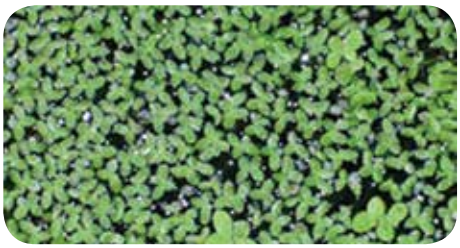
Freshwater Shrimp

Freshwater shrimp are scavengers that feed on algae and decaying plant matter.

They have a curved, flattened body and when swimming they normally do so on their side. Therefore they are sometimes known as 'sideswimmers'.

They are an important food source for birds and other large predators so spend lots of time underneath stones or vegetation to hide.

Duckweed



Duckweeds are the world's smallest aquatic plants.

A duckweed plant can produce a daughter bud daily and with the correct conditions the original plant can produce as many as 17,500 plants in 2 weeks.

This rapid reproduction can block the sunlight from entering the water which results in a decline in underwater plants and can cause oxygen depletion and therefore death of many other species.

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Leech

Trophic level .....

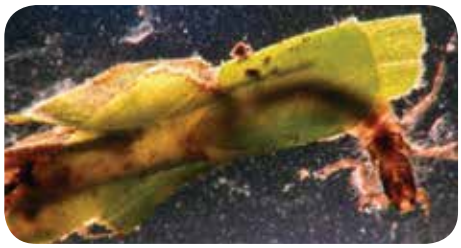
Energy .....

Size .....

Trent Biotic Index .....

Super Power .....

Cased Caddis



Trophic level .....

Energy .....

Size .....

Trent Biotic Index .....

Super Power .....

Freshwater Shrimp

Trophic level .....

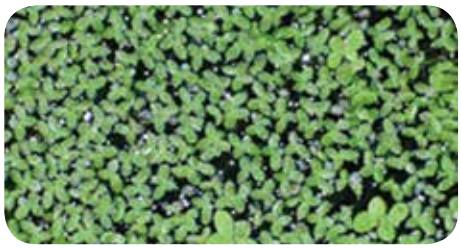
Energy .....

Size .....

Trent Biotic Index .....

Super Power .....

Duckweed



Trophic level .....

Energy .....

Size .....

Trent Biotic Index .....

Super Power .....

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Task 5: Predictions (a) for invertebrates

Now you have completed the other pre-lesson tasks have a read of the statements below. Tick the boxes to state which area will answer the question/prediction. There is a table for living factors and non-living factors that we will encounter in the pond. You will need to explain why. The final column can be filled out during the Live Lesson.

Question / prediction	Mud (bottom of pond)	Among plants (open water)	Both the same	Why?	Is this what happened in the Live Lesson?
Which microhabitat will have the most invertebrates in total?					
Where will most of the burrowing invertebrates be found?					
Where will most of the swimming invertebrates be found?					
Which microhabitat will have the most food available?					
Where will most herbivores be found?					
Where will most detritivores be found?					
Where will most carnivores be found?					

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Task 5: Predictions (b) for environmental factors (non-living)

Question / prediction	Mud (bottom of pond)	Among plants (open water)	Both the same	Why?	Is this what happened in the Live Lesson?
Which part of the pond will have moving water?					
Which microhabitat will have the slowest moving water?					
Which microhabitat will have the most hiding places?					
Which microhabitat will have the most sunlight?					
Which microhabitat will have more dissolved oxygen in the water?					
Which microhabitat will have less dissolved oxygen in the water?					
Which part of the pond will have the highest water temperature?					

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Task 6: What I would like to know?

You're going to see a live exploration of the pond in the picture below.
Label the photograph below with questions that you could ask during this live session, can you think of 3 questions? Use your key definitions to help you.

Are the creatures found in still pond water different to flowing freshwater like streams?

Additional Resources

Food chains, food webs and energy pyramids
www.youtube.com/watch?v=-oVavgmveyY

BBC Bitesize revision information
www.bbc.co.uk/bitesize/guides/zwh9j6f/revision/2

Ameba Sisters - Food chains, food webs and energy pyramids.
tinyurl.com/foodwebsameba

David Attenborough – What is Biodiversity?
tinyurl.com/DAbiodiversity

Holland Park Ecology Centre – Pond Dipping Pack
www.rbkc.gov.uk/pdf/pond_pack_2010.pdf

OPAL Freshwater Resources
www.opalexplorenature.org/water-links-resources

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