

PiXL Independence:

Biology – Student Booklet

KS5

Biodiversity and ecosystems

Contents:

- I. Level 1- Multiple Choice Quiz – 20 credits
- II. Level 2 - 5 questions, 5 sentences, 5 words – 10 credits each
- III. Level 3 - Science in The News – 100 credits
- IV. Level 4 - Scientific Poster – 100 credits
- V. Level 5 - Video summaries – 50 credits each

PiXL Independence – Level 1
Multiple Choice Questions
A-level Biology – Biodiversity & Ecology

INSTRUCTIONS

Score: /20

- Read the question carefully.
- Circle the correct letter.
- Answer all questions

Part 1 – Ecology & Biodiversity

1. The following statements concern biodiversity. Which statements are correct?

Statement 1 – Biodiversity is a measure of the number of species in a given area.

Statement 2 – Biodiversity is a measure of the number of genes belonging to a species in a given area.

Statement 3 – Biodiversity is a measure of the number of habitats in a given area.

- a. 1,2 & 3
 - b. 1 & 2
 - c. 1
 - d. 1 & 3
 - e. 2 & 3
2. A student sampled a local grassland and obtained the following results

Species	Number of individuals in sample area
<i>Festuca ovina</i>	15
White Clover	22
Red Clover	17
<i>Lotus corniculatus</i>	5

Calculate the biodiversity index using the following formula:

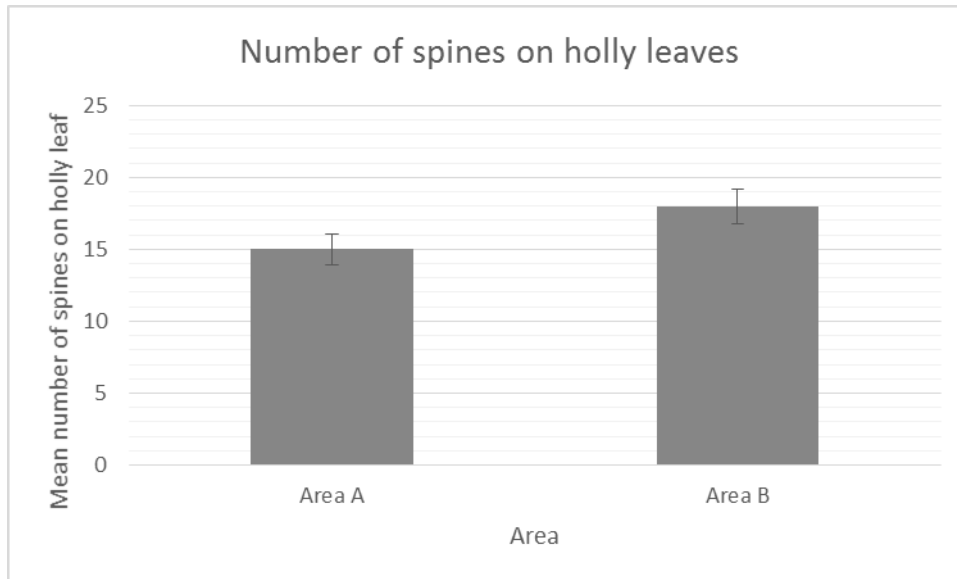
$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

n = number of individuals of a species

N = Total number of individuals of all species

- a. 0.2817
- b. -2.550
- c. 0.999
- d. 0.7183

3. A student investigated the variation of spine number on Holly leaves in two locations. The following chart shows their results. The bars show the standard deviation for each group.



Which of the following statements is correct?

- There is no significant difference between the two groups and therefore the presence of herbivores do not have an effect on the number of spines on the leaves
 - There is a significant statistical difference between the two groups and therefore Area A would have a greater herbivore presence which would lead to a decreased number of spines
 - There is a significant statistical difference between the two groups and therefore Area B would have a greater herbivore presence which would lead to an increased number of spines
 - It is not possible to say if there is a significant difference or not
4. A team of scientists measured the gross production of a meadow. Goats within the area absorb $15,000 \text{ KJ m}^{-2} \text{ yr}^{-1}$ from the plant biomass they take in. The grassland produces $70 \text{ g m}^{-2} \text{ year}^{-1}$. The respiration loss by the plants in the meadow is $18.2 \text{ g m}^{-2} \text{ year}^{-1}$ which equates to $8500 \text{ KJ m}^{-2} \text{ yr}^{-1}$.

What is the Net Biomass Production per day?

- 6500 KJ m^{-2}
- 51.8 g m^{-2}
- $1.4 \times 10^{-1} \text{ g m}^{-2}$
- 26%

5. Which line in the table gives the correct definition of the terms

a.

Niche	Abiotic	Community	Sere
An organism's role in the community	e.g. Ratio of sand : loam : clay in soil	The number of species in an area	A stage in succession

b.

Niche	Abiotic	Community	Sere
The habitat an organism lives in	e.g. light intensity	The number of species in an area & the abiotic factors	A stage in a food chain

c.

Niche	Abiotic	Community	Sere
An organism's role in the community	e.g. Oxygen saturation in a lake	The number of individuals in an area	A stage in succession

d.

Niche	Abiotic	Community	Sere
The habitat an organism lives in	e.g. The presence of a viral disease	The number of species in an area & the abiotic factors	A stage in succession

6. A heathland is undergoing succession. A farmer was informed that he would receive a grant for introducing a few cattle to the area which will graze the area and promote conservation of rarer species.

Which of the following statements are correct?

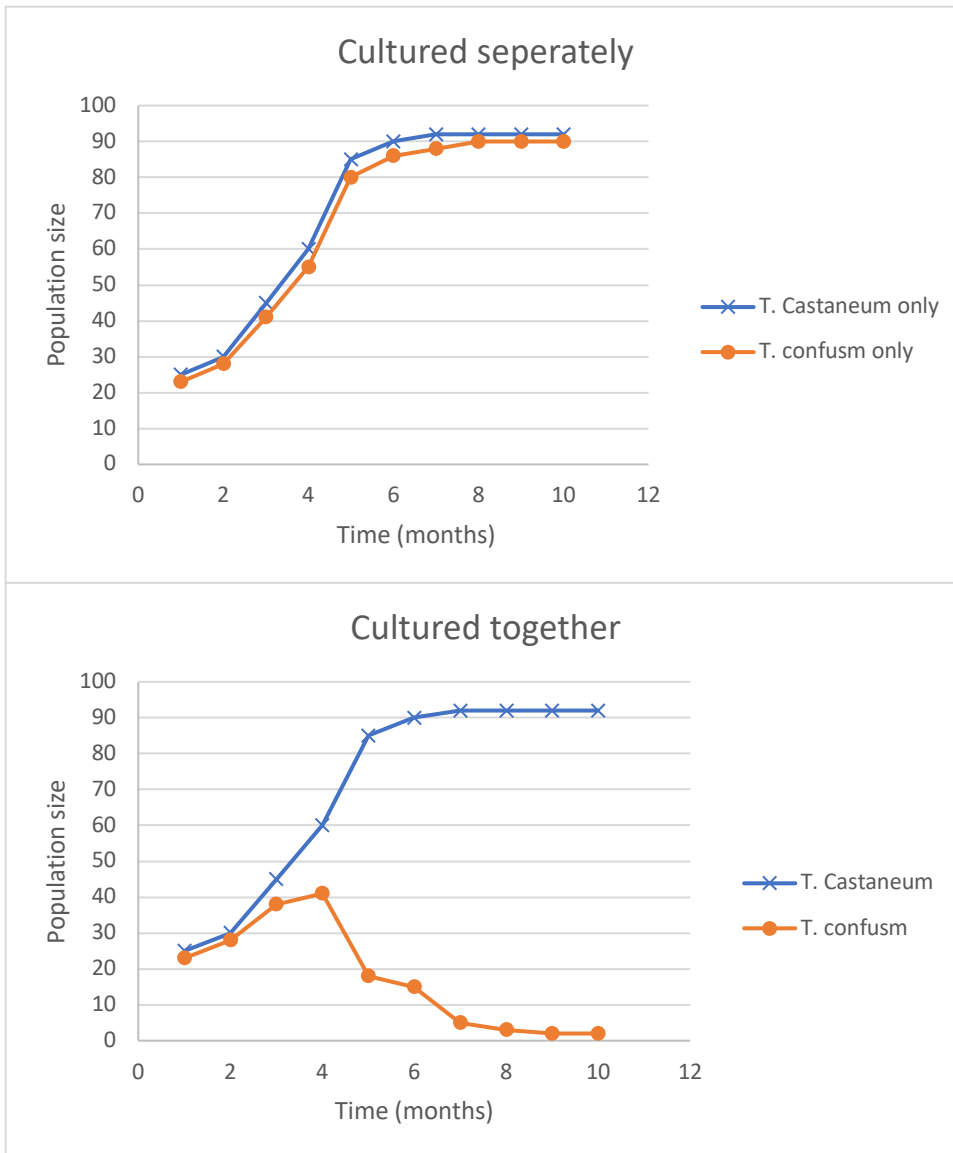
- a. This is an example of primary succession
- b. This is an example of secondary succession
- c. This is an example of deflected succession
- d. The habitat has now reached its climax state due to the presence of the cattle

7. A range of biotic and abiotic factors can affect the size of the population. These may be density dependent or density independent. Which of the following are density dependent?

Tick all that apply.

- a. Disease
- b. Territory size
- c. Light intensity
- d. Parasitism

8. Two species of flour weevil were grown in closed environments with a limited amount of food. Three trials were set up, *T. confusum* only, *T. castaneum* only and both species together. The graph below shows the population sizes for each species when kept together or alone.



Which of the following statements about the graphs is correct?

- Statement A: *T. castaneum* is the stronger competitor
 Statement B: Two species cannot occupy the same niche
 Statement C: This effect is rarely seen in nature
- A,B,C
 - A & B
 - A & C
 - B & C

9. A team of researchers wanted to compare the biodiversity within two SSSIs. Each area is of a similar size with a similar range of habitats, including a small lake, a woodland and grassland.

Which would be the most appropriate method of sampling to compare the biodiversity in each area?

- a. Random
 b. Opportunistic
 c. Systematic
 d. Stratified
10. Conservation of species can be carried out both *in situ* and *ex situ*. For the following methods, which line of the table shows the correct classification?

a.	Millennium Seed bank	Kew Botanic gardens	SSSI – Epping Forest	Marine reserve – Beachy Head
A	<i>ex situ</i>	<i>in situ</i>	<i>ex situ</i>	<i>in situ</i>
B	<i>in situ</i>	<i>ex situ</i>	<i>in situ</i>	<i>ex situ</i>
C	<i>in situ</i>	<i>in situ</i>	<i>ex situ</i>	<i>ex situ</i>
D	<i>ex situ</i>	<i>ex situ</i>	<i>in situ</i>	<i>in situ</i>

Part 2 – Classification

1. The following diagram show a phylogenetic tree of four common Brassica: radish, turnip, arabis and a fifth species, the papaya (pawpaw).

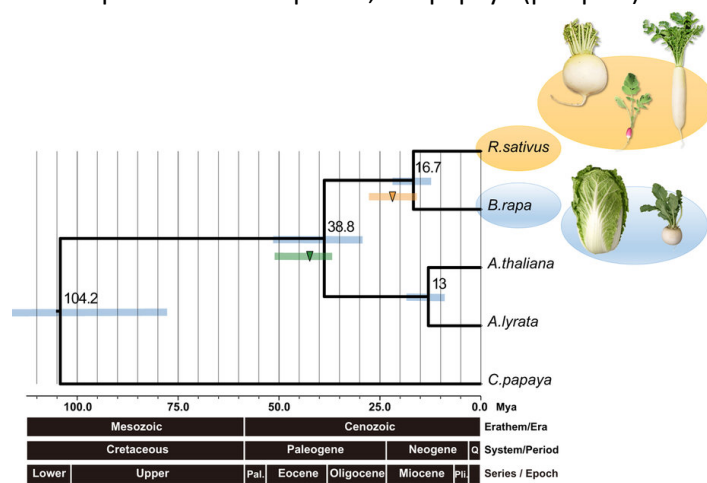


Image – Wikimedia commons – no restrictions

Which of the following statements are correct?

Statement 1: *R. sativus* & *B. Rapa* are the most closely related species

Statement 2: *A. thaliana* & *A. lyrata* form an evolutionary clade

Statement 3: A speciation event that separated the four brassica species from *C. papaya* occurred in the Cretaceous period

- a. 1,2 & 3
 b. 1 & 2
 c. 1 & 3
 d. 2 & 3
 e. 3 only

2. Phylogenetic trees show relationships between organisms. Which of the following statements is correct about their construction?
 Statement 1: Phylogenetic trees may be based on differences in ribosomal nucleotide sequences
 Statement 2: Phylogenetic trees may be based on differences in amino acid sequence of cytochrome C
 Statement 3: Phylogenetic trees may be based on morphology
- 1,2 & 3
 - 1 & 2
 - 1 & 3
 - 2 & 3
 - None of the above
3. The three-domain system was introduced in 1977 and changed the way certain groups were classified. Which of the changes below is correct?
- Mitochondrial DNA evidence was used instead of DNA sequences
 - The extremophiles (e.g. Halophiles) were placed into the Eubacteria
 - The bacteria and archaeobacteria are now grouped separately
 - Viruses were included in the Archaea
4. Which of the following molecules are components of fungi cell walls?
- Cellulose
 - Peptidoglycan
 - Chitin
 - Phospholipids
5. The Giant African Land snail is a common pet and an equally common pest of agricultural crops around the world. The following table shows its classification.

Kingdom	Animalia
	Mollusca
	Gastropoda
	Stylommatophora
	Achatinidae
	<i>Achatina</i>
Species	<i>A. Achatina</i>

Which class does the Giant African Land snail belong to?

- Mollusca
- Gastropoda
- Stylommatophora
- Achatinidae
- Achatina*

6. Both the Echidna, the hedgehog and porcupine, have spines. Their classification is shown below.

Hedgehog	Porcupine	Echidna
Animalia	Animalia	Animalia
Chordata	Chordata	Chordata
Mammalia	Mammalia	Mammalia
<i>Eulipotyphyla</i>	Rodentia	Monotremata
<i>Erinaceidae</i>	Erethizontidae	Tachyglossidae
<i>Erinaceus</i>	<i>Coendou</i>	<i>Tachyglossus</i>
<i>E. europaeus</i>	<i>C. rothschildi</i>	<i>T. aculeatus</i>

Based on the classification, what can you say about the evolution of spines?

- They are an example of divergent evolution
 - They are an example of convergent evolution
 - The most recent common ancestor to possess spines would be the Mammalia
 - This is an example of punctuated equilibria
7. Which of the following organisms do NOT have membrane bound organelles? **Tick all that apply.**
- Jelly fish
 - Protoctista, e.g. plasmodium malaria parasite
 - Slime mould
 - E. coli*
8. Which of the following statements about fungi are correct?
 Statement 1: They can be either unicellular or multicellular
 Statement 2: They have extracellular enzymes
 Statement 3: They all have hyphae
- 1,2 & 3
 - 1 & 2
 - 1 & 3
 - 2 & 3
9. The endosymbiont theory states that eukaryotic cells engulfed formerly free-living prokaryotes which became chloroplasts and mitochondria approximately 1.5 billion years ago.
 What conclusion could be drawn about the structure of mitochondria ribosomes.
- Mitochondria do not have ribosomes
 - Mitochondria will have 80s ribosomes
 - Mitochondria have ribosomes but they are not 80s
 - Mitochondria have 100s ribosomes
10. For which of these molecules would it NOT be useful to understand the molecular structure in order to produce a phylogenetic tree?
- Polysaccharide
 - Haemoglobin
 - rRNA
 - Deoxyribonucleic acid

PiXL Independence – Level 2
5 questions, 5 sentences, 5 words
A Level Biology – Biodiversity & ecology

INSTRUCTIONS

- For each statement, use either the suggested website or your own text book to write a 5-point summary. In examinations, answers frequently require more than 1 key word for the mark, so aim to include a few key words.
- It is important to stick to 5 sentences. It is the process of selecting the most relevant information and summarizing it, that will help you remember it.
- Write concisely and do not elaborate unnecessarily, it is harder to remember and revise facts from a big long paragraph.
- Finally, identify 5 key words that you may have difficulty remembering and include a brief definition. You might like to include a clip art style picture to help you remember it.

Example:

QUESTION:	Compare the 3 domain and 5 kingdom classification systems			
Sources:	1. Website – https://en.wikipedia.org/wiki/Taxonomy_(biology)#Kingdoms_and_domains 2. Interactive – https://highered.mheducation.com/sites/9834092339/student_view0/chapter26/animation_-_three_domains.html			
	1. The five kingdom system consists of Kingdom, phylum, class, order, family, genus and species, whereas the 3 domain system adds in a higher level of classification called Domain 2. In the 3 domain system, the archaea and bacteria are separated and the Eukaryote are added to the third and final domain 3. Each domain contains unique ribosomal RNA (rRNA), whereas in the 5 kingdoms, archaea and bacteria are grouped into Prokaryotes, even though they have different rRNA 4. 3 domains based on molecular evidence and DNA sequences, whilst 5 kingdoms is mostly based on physiology. 5. Both systems show the same groupings within the Eukarya/Eukaryotes			
Eukaryote – contains membrane bound organelles	Monera – former term used to describe single celled organisms	Archaea – primitive group of prokaryotes that include the extremophiles.	Protoctista – term used to describe a kingdom of organisms, which are not particularly related.	Protist – a term to be avoided, does not include multicellular organisms such as algae/ sea weeds. Use Protoctista

QUESTION 1:

Explain how a phylogenetic tree can demonstrate evolutionary relationships.

Sources:

Website – <https://www.khanacademy.org/science/biology/her/tree-of-life/a/phylogenetic-trees>
Interactive – <https://www.biointeractive.org/classroom-resources/sorting-seashells>

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QUESTION 2:

Describe how the size of a population can be measured.

Sources:

Website – <https://www.khanacademy.org/science/biology/ecology/population-ecology/a/population-size-density-and-dispersal>

Interactive – <https://virtualbiologylab.org/population-ecology/>

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QUESTION 3:

Explain why characteristics such as height show a continuous distribution of values.

Sources:

Website – <https://www.khanacademy.org/science/biology/classical-genetics/variations-on-mendelian-genetics/a/polygenic-inheritance-and-environmental-effects>

Interactive – <https://learn.genetics.utah.edu/content/evolution/criteria>

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QUESTION 4:

Discuss, with a relevant example, how an animal or plant has been protected from extinction.

Sources:

Website – www.zsl.org/conservation

Interactive – [Engaging in the Fight Against Extinction | National Geographic Society](#)

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QUESTION 5:

Discuss the factors that cause population sizes to fluctuate, stabilise or decline.

Sources:

Website – <https://www.khanacademy.org/science/biology/ecology/population-growth-and-regulation/a/mechanisms-of-population-regulation>

Interactive – <https://learn.concord.org/resources/102/african-lions-modeling-populations>

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PiXL Independence – Level 3

Science in the News

A Level Biology – Biodiversity & ecology

Fake news

Sensationalised news stories have been around for some time, but with the mass growth of social media, the problem seems to have grown in recent years.

Therefore, the ability to identify real information, track it back to the source article and make your own judgement is a very important skill. This activity will help you develop that skill.

Mexican Border Wall

News article – <https://www.washingtonpost.com/news/energy-environment/wp/2017/08/07/trumps-border-wall-would-slice-through-wildlife-refuges-and-cut-off-u-s-territory-in-texas/>

Review of US Paper political allegiance –

<https://guides.lib.umich.edu/c.php?g=637508&p=4462444>

Real articles – <https://bioone.org/journals/bioscience/volume-57/issue-1/B570116/The-Environmental-Impacts-of-a-Border-Fence/10.1641/B570116.full>

<https://onlinelibrary.wiley.com/doi/full/10.1111/reel.12169>

Task

You need to produce a 1-page essay on the Impact of a border wall on US wildlife

Essay section	Activity
Introduction	Read through the first news article. Write a brief summary of whether the Mexican – American Border wall can be carried out legally. Write a brief section on the validity of this article. Use the Review of US Paper political allegiance link to help (for this site, Trump would be considered Conservative). Do not worry about having the perfect evaluation at this stage, it is more important to show by the end of the essay you have developed your evaluation skill.
Describe	Read the journal article on “Boarder Fences and the impacts on Large Carnivores” Write a summary of the ways in which a border fence can impact wildlife. (article 1)
Explore	There are a number of international laws concerning the protection of species. Read the section on “A Global Inventory of International wildlife law obligations Vis-a-Vis Boarder fences.” (Article 2) Discuss 2-3 of the main arguments that suggest a Mexican – American boarder would breach International law.
Conclude	Put forward your own opinion based on the evidence you have read whether it is likely that the Mexican Border wall could be built legally.

PiXL Independence – Level 4

Scientific Posters

A Level Biology – Biodiversity & ecology

Scientific Posters - Scientists communicate research findings in three main ways. Primarily, they write journal articles much like an experiment write up. These are very concise, appraise the current literature on the problem and present findings. Scientists then share findings at conferences through talks and scientific posters. During a science degree, you would practice all three of these skills.

Scientific posters are a fine balance between being graphically interesting and attracting attention and sharing just the right amount of text to convey a detailed scientific message. They are more detailed than a talk and less detailed than a paper.

Use this information to help structure your poster – <https://www.wikihow.com/Make-a-Scientific-Poster>

More detailed guidance is available at: <https://guides.nyu.edu/posters>

Creating your poster

It is easiest to create a poster in PowerPoint, however you need to add custom text boxes rather than using the standard templates.



Posters need to be eye catching, but readable from a distance. If you use PowerPoint, start with a 4:3 slide (for easier printing, it can then be printed on A3) and use a 14-16 pt font. The first box could be larger to draw people in. You can use a background image, but pick a simple one that is of high quality. Select 'text box fill' and select 'change the transparency' to maintain the contrast and partially show the picture.

You can experiment with different layouts and you should include images. Avoid a chaotic layout, posters are read from top left column downwards.

Remember to include the authors and references.



Figure 1 Snow Leopard

Leopards – on the rise or on the edge of extinction?

Background

It has recently been reported that the snow leopard is no longer endangered, having its conservation status raised from endangered to vulnerable. Whilst there are still serious threats from poaching and habitat destruction, numbers have risen to over 2500 individuals and it is not experiencing a high rate of decline.

However, other subspecies of leopard, there are 9 subspecies in total, are doing less favorably. Therefore, headline news that the snow leopard is no longer at risk, could be misleading.

Snow leopard conservation frequently faces human animal conflict. Whilst poachers may hunt and sell Leopard furs, in some areas, local people live on just a few dollars a day and live their lives herding animals. If they lose their herd due to snow leopard attacks, they may carry out retaliation killings. Understanding the local situation is key to helping set up a successful conservation program.

Source article

News article – <https://www.bbc.co.uk/news/world-asia-41270646>

IUCN Redlist – <https://www.iucnredlist.org/species/15954/163991139>

Conservation programs –

1. ZSL has lots of useful information on conservation programs.
2. Lots of species have dedicated websites set up with details of their conservation programs, e.g. Snowleopard.org Altaconservation.org

Task

The snow leopard is just one example of a species that scientists are making great efforts to conserve and a number of programs are underway to protect it.

Use the source articles as a starting point and create a 3 minute presentation on the conservation of either the snow leopard or an animal that your teacher directs you to.

Describe	The current conservation status of your species
Explain	The conservation projects that have helped to protect your species
Evaluate	Evaluate the success of each program. This will be a section you will need to use evidence for, but should aim to draw your own conclusions, not use Google to find an answer.

PiXL Independence – Level 5

Video summaries

A-level Biology – Biodiversity & Ecology

Cornell Notes

At A level and University, you will make large amounts of notes, but those notes are only of use if you record them in a sensible way. One system for recording notes is known as the Cornell notes system. This method encourages you to select relevant information, rather than trying to write a transcript of everything said. More importantly, it forces you to spend a few minutes reviewing what you have written, which has been scientifically proven to aid learning and memory retention.

The ideal is to write everything on one page, but some students may prefer to type and others will to handwrite their notes. Whichever option you use, remember the aim is to summarise and condense the content with a focus on the objectives that you are trying to learn and understand.

There are three main sections to the Cornell notes

- 1 **Cue/ Objectives** – This can be done before or after the lecture. You may have been provided with the objectives or you may need to decide what they were or you may want to make the link to your learning if this is an additional task or lecture you are viewing, such as this video.
- 2 **Notes** – In this space you record concisely, simply the things you are LESS likely remember - **The NEW knowledge**.
- 3 **Summary** – The most important step that is carried out after the lecture or video. This helps to reinforce learning.

Background

The following videos present three topics that link to your learning. The first video is produced by the Smithsonian zoo and discusses the roles of zoos in conservation. The second video features Chris Packham and tours through the ecology of a forest. The final video is a short video and discusses the impact of reintroducing a top predator into Yellowstone National Park.

Source article

Video 1 – Wild Things Smithsonian Zoo

Top Documentary Films: <https://topdocumentaryfilms.com/wild-thing-smithsonian-national-zoo/>

Video 2 – Magical Forest

Top Documentary Films: <https://topdocumentaryfilms.com/magical-forest/>

Video 3 – The importance of Predators – Wolves of Yellowstone

You Tube : <https://www.nationalgeographic.org/media/wolves-yellowstone/>

Task:

**You need to produce a set of Cornell notes for one of the videos given above.
Use the following objective to guide your note taking, this links to your learning.**

1. Discuss the roles of Zoos in the conservation of endangered species.
2. Outline the interdependence of organisms within a forest using named examples.
3. Discuss the impact on an ecosystem of the reintroduction of a top predator.

Objectives
What are the main learning outcomes that have been shared with you?
This will help guide you to taking the RIGHT notes during the video.

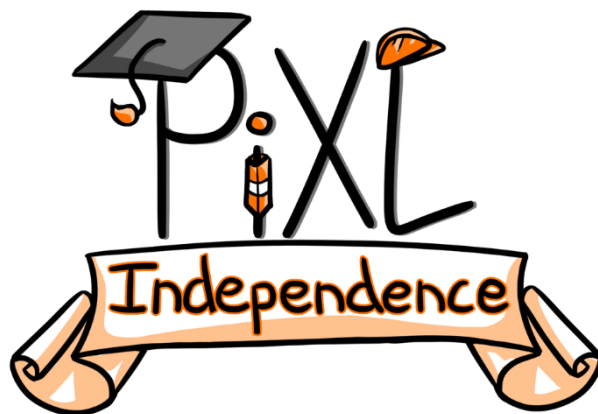
Title
Date

Sketch down note and key words
Do not write in full sentences whilst you listen, put quick sketches, single words, mind maps, short hand etc.
To help train you for university, try not to pause the video because you could not pause a live lecture (However, a lecture may give more natural pauses for you to catch up).

Summary (after the video)
What are your main points of learning from this video.
This is your chance to make sense of your notes.
Make clear connections to the things you need to know

	Title Date
Objectives	
Summary	

	Title Date
Objectives	
Summary	



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