GCSE to A-level progression: Student transition activities – Environmental Science

The following tasks should be completed on to lined or plain paper (can be hand-written or typed) and handed in to either of your Environmental Science teachers in the week commencing 16th September.

Deadline for Task: First lesson in week commencing 15th September 2025

Understanding and using scientific vocabulary

Understanding and applying the correct terms are key for practical science. Much of the vocabulary you have used at GCSE for practical work will not change but some terms like working out uncertainty are dealt with in more detail at A-level so are more complex.

Activity 1 Scientific vocabulary: Designing an investigation

Link each term on the left to the correct definition on the right.

Hypothesis	The maximum and minimum values of the independent or dependent variable
Dependent variable	A variable that is kept constant during an experiment
Independent variable	The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres
Control variable	A proposal intended to explain certain facts or observations
Range	A variable that is measured as the outcome of an experiment
Interval	A variable selected by the investigator and whose values are changed during the investigation

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Activity 2 Scientific vocabulary: Making measurements

Link each term on the left to the correct definition on the right.

True value	The range within which you would expect the true value to lie
Accurate	A measurement that is close to the true value
Resolution	Repeated measurements that are very similar to the calculated mean value
Precise	The value that would be obtained in an ideal measurement where there were no errors of any kind
Uncertainty	The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

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Activity 3 Scientific vocabulary: Errors

Link each term on the left to the correct definition on the right.

Random error	Causes readings to differ from the true value by a consistent amount each time a measurement is made
Systematic error	When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero
Zero error	Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next

Understanding and using SI units

Activity 4 SI units and prefixes

What would be the most appropriate unit to use for the following measurements?

1. The length of a leaf
2. The distance that a migratory bird travels each year
3. The diameter of a smoke particle
4. The mass of a woodlouse
5. The volume of the trunk of a large tree
6. The flow volume of a river

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Activity 5 Converting data

1. Re-write the following.

   a. 0.00122 metres in millimetres
   b. 1 042 000 micrograms in grams
   c. 1120.2 metres in kilometres
   d. 0.7 decilitres in millilitres
   e. 70 decilitres in litres

2. It is estimated that 33 000 000 000 tonnes of CO_2 was released globally in 2019 from energy-related sources. Circle the correct conversion. Use the prefix table above to help you.

   33 Tt 33 Gt 33 Mt

3. The distance between the Sun and the Earth is 149.6 Gm. In this case, Gm is not a common unit, so we can convert it to km and express it in standard form. Circle the correct conversion. Use the prefix table above to help you.

   1.496×10^6 km 1.496×10^8 km 1.496×10^{12} km

4. The estimated volume of ice stored in the Antarctic ice sheet is 0.027 billion km^3. Circle the correct conversion. Use the prefix table above to help you.

   27 million km^3 2.7 million km^3 270 million km^3

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Maths Skills

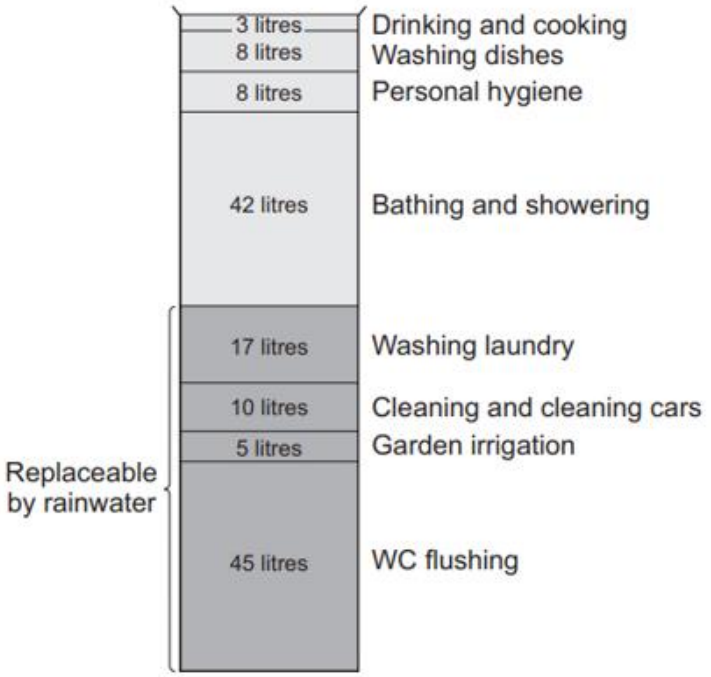
Activity 6 Maths skills

1. In East Anglia, the average annual rainfall is 0.55 m.

   A house in East Anglia has a flat roof with an area of 120 m^2.

   If 75% of the rain falling on the roof is collected, what volume of rainwater would be collected in one year?

2. The diagram shows the amount of water typically used in the home, in the UK, in one day.



Calculate the percentage (%) of water use that is potentially replaceable by using rainwater.

3. The table below shows how local authorities dealt with household waste they collected in 2009 and 2010.

	January 2009 – December 2009		January 2010 – December 2010	
Local authority collected waste	**000 tonnes**	**%**	**000 tonnes**	**%**
Recycled, composted or reused	10 275	38.7		39.7

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Not recycled, composted or reused	16 266	61.3	15 628	60.3

Calculate the mass of waste that was recycled, composted, or reused in 2010.

4. A water company estimates that the 1.9 million people living in the area produce approximately 500 000 tonnes of sewage sludge a year.

   Estimate the mass of sewage sludge produced by the UK in 1 year if it has a population of 67 million.

   Give your answer in standard form.

5. In 2017, the city of Manchester began a 'City of Trees' project. The project plans to plant 3 million trees over the next 25 years.

   It was suggested that the council plant 3.6×10^5 trees in the first year. The rest of the trees would be planted in equal numbers over the remaining years.

   Calculate how many trees would need to be planted in each of the remaining years.

   Give your answer in standard form.

6. A sample of river water contains 125 **mg per dm^3** of dissolved solids.

   Calculate the mass of dissolved solids in grams in 250 **cm^3** of this sample of river water. (Remember about your unit conversions dm^3 to cm^3.)

   Give your answer in grams to 2 significant figures.

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Activity 6 Key concepts from GCSE Biology

Factors affecting the rate of photosynthesis

1. Name **three** limiting factors of photosynthesis.

2. CO_2 can be added to the air in a greenhouse where tomatoes are growing. This increases the rate of photosynthesis.

   Suggest why increasing CO_2 levels to very high concentrations will no longer increase the rate photosynthesis.

3. Describe how global warming may affect the rate of photosynthesis and how this in turn by affect the greenhouse effect.

Factors affecting the rate of transpiration

4. Why do plants transpire?

5. Explain how the abiotic factors temperature, humidity and air flow affect the rate of transpiration in plants.

Selective breeding

6. State **two** characteristics that may be useful to select when breeding plants or animals for agriculture.

7. Selective breeding can reduce the gene pool. Describe **two** problems that may arise as a result of this reduction.

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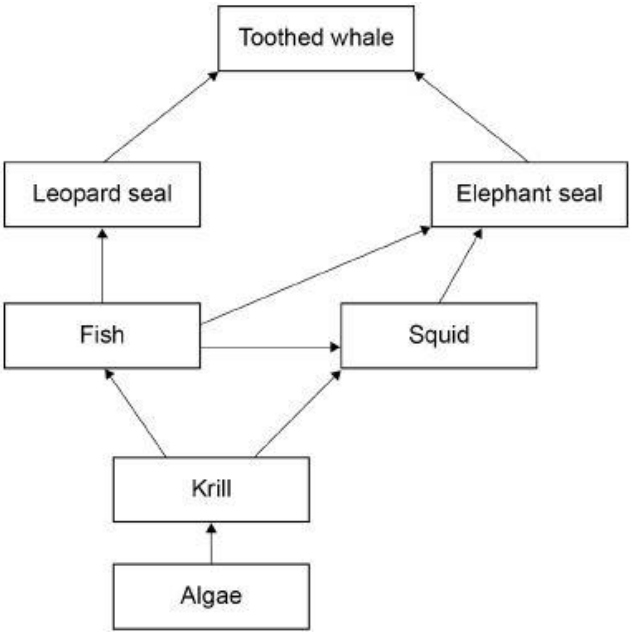
Ecosystem organisation and interactions

The diagram below shows a food web.



8. What term is used to describe all the organisms living together in an ecosystem?

9. What term is given to the place a particular species lives in?

10. What do we mean by the term population?

11. What term is used to describe the algae in this food web?

12. Toothed whales will compete with each other for food. What else might toothed whales compete for?

13. These organisms live in the ocean.

    Name **two abiotic** factors and **two biotic** factors that could affect these organisms.

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The importance of biodiversity and Human impacts on the ecosystem

14. Define the term biodiversity.

15. Tick which of the following statements are true.

    a) It is important to maintain biodiversity because:

    b) a great biodiversity ensures the stability of ecosystems.

    c) biodiversity increases the dependency of one species on another for food and shelter.

    d) biodiversity helps maintain the physical environment.

    e) biodiversity is not important in maintaining the human species.

    f) many human activities are reducing biodiversity.

16. Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on the ecosystem.

    Which of the following are examples of these kinds of programmes?

    a) Breeding programmes for endangered species.

    b) Removing hedgerows to ensure more effective Intensive farming methods.

    c) Building houses on the green belt to alleviate the housing shortage.

    d) Reduction of deforestation.

    e) Recycling resources rather than dumping waste in landfill.

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Activity 15 Key concepts from GCSE Chemistry

Acids and alkalis

1. Cross through the bold words in the sentence below that are incorrect to produce a correct statement about pH.

   The lower the pH the **lower/ higher** the content of H^+ ions and so the more **acidic / alkaline** the solution is.

2. For every decrease of 1 on the pH scale, the concentration of H^+ ions increases by a factor of 10.

   For example, an acid of pH 4 has 10 times the concentration of H^+ ions than that of an acid of pH 5.

   The pH of two soil samples was analysed.

   Soil A = pH 4
   Soil B = pH 7

   By what factor is the concentration of H^+ ions greater in soil A than soil B?

Evolution of the atmosphere

3. Complete the table below to show the Earth's atmosphere as it is today.

Gas	% volume
Nitrogen	
Oxygen	
Carbon dioxide	

   The Earth's early atmosphere had virtually no oxygen and much higher concentrations of carbon dioxide.

4. Describe **one physical** process that led to the reduction in the concentration of CO_2 in Earth's early atmosphere.

5. State the name of **one biological** process that led to the reduction of CO_2 and the increase in O_2 in the Earth's atmosphere from ~2.7 billion years onwards.

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Air pollution

6. Draw lines from each air pollutant to the environmental problems it causes. Each environmental problem can be used more than once.

Air pollutant	Environmental problem
CO_2	Respiratory problems
NOx	
SO_2	Climate change
CH_4	
Particulates	Acid rain

7. Give one common human activity that leads to the release of each of the air pollutants in question 8.

Resources and sustainability

8. Life cycle assessments (LCAs) assess the environmental impact of the entire lifetime of a product. State the four stages of a product's life cycle that can be assessed.

9. Suggest three factors that can be assessed as part of a LCA in order to quantify environmental impacts.

10. Explain why using recycled materials in the manufacture of new products results in a better LCA outcome.

11. Using the LCA model, compare the environmental impacts of wooden and plastic furniture.

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The Earth's water resources and obtaining potable water

12. Potable water is water that is safe to drink. It is not pure water in the chemical sense because it contains dissolved substances.

    Name three important water quality features of potable water.

13. Urban lifestyle and industrial processes produce large amounts of waste water that require treatment before being released into the environment.

    State the different stages involved in the treatment of sewage.

Activity 16 Key concepts from GCSE Physics

Energy stores and transfers

Thermal insulation can be used to reduce rate of energy transfer.

Students investigated how effective three different thermal insulating materials were in keeping a container of water hot.

The students:
- wrapped the three different insulating materials around three containers
- added hot water to each container
- measured the temperature of the water in each container
- left the containers for 5 minutes and then measured the temperature again.

1. Identify the independent and dependent variable in this experiment.

2. Suggest three variables that should have been controlled.

3. Suggest how the experiment could be improved.

Energy efficiency

4. The more energy efficient something is, the less energy is wasted.

   What is the equation to calculate energy efficiency?

5. Energy efficiency is important in environmental science. For example, improvements in efficiency means less energy is wasted and so less fossil fuel needs to be combusted, meaning fewer greenhouse emissions.

   An electric fan is supplied with 1500 kJ of energy. 500 kJ is wasted as thermal energy.

   Calculate the % energy efficiency of the electric fan.

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Energy resources

6. Tick the box to identify if the energy resources are renewable or non-renewable.

Energy resource	Renewable	Non-renewable
Coal		
Wind		
Gas		
Geothermal		
Solar		
Nuclear		
Wave		
Hydroelectric		
Oil		
Biofuel		
Tidal		

7. Describe two advantages and two disadvantages of using wind as an energy resource instead of coal.

Specific heat capacity

8. What unit is energy measured in?

9. A substance's specific heat capacity is the amount of energy needed to raise the temperature of 1 kg by 1 °C. Water has a specific heat capacity of 4200 J/ kg °C.

   How much energy is needed to heat 2.00 kg of water from 10 °C to 80 °C?

   Use the equation

$$\text{Change in thermal energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

Power

10. What is power?

11. What unit is power measured in?

12. What unit is energy transfer measured in?

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13. A wind turbine transfers 180 MJ of wind energy into electricity in 1 minute.

Find its power in MW.

Use the equation

$$\text{power} = \frac{\text{energy transferred}}{\text{time}}$$

Radioactive materials and half lives

14. Radioactive substances give out radiation from the nuclei of their atoms. Half-life is the time taken for the number of nuclei of a radioactive isotope in a sample to halve.

The half-life of radioactive carbon-14 is 5730 years. If a sample contains 40 g of radioactive carbon after 5730 years it will contain 20 g, after another 5730 years that will have halved again to 10 g.

Calculate the total amount of time for a 40 g sample to reduce to 2.5 g.

Electromagnetic spectrum

15. Write out the seven types of electromagnetic radiation in order of increasing wavelength.

16. Match the electromagnetic radiation to its environmental significance.

Electromagnetic radiation	Environmental significance
UV	Used in photosynthesis
Visible	Absorbed by greenhouse gases
Infrared	Absorbed by ozone

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