



Pearson BTEC Level 3
National Extended Certificate in
Applied Science



1. **Course Introduction**

The requirements of the qualification will mean that learners develop the transferable and higher order skills which are valued by higher education providers and employers. Learners will develop laboratory skills, including collaboration and teamwork in addition to the scientific knowledge and understanding that learners need to progress to higher education, employment, self-employment, or training.

The qualification carries UCAS points and is recognised by higher education providers as contributing to meeting admission requirements for many relevant courses if taken alongside other Level 3 qualifications as part of a programme of learning. Learners will be able to choose a wide range of degree programmes to progress to, depending on the other qualifications they have taken.

For example, taken alongside:

- A-Levels in Business, Mathematics and Economics, or Psychology to progress to business
- A-Level in Biology and a BTEC Level 3 National Foundation Diploma in Sport and Exercise

2. **Key information:**

The National Extended Certificate in Applied Science is a course that is designed for learners who are interested in learning about the sector alongside other fields of study, with a view to progressing to a wide range of higher education courses, not necessarily in applied science. To be taken as part of a programme of study that includes other appropriate BTEC Nationals or A Levels.

BTEC Nationals are demanding and will require you to take responsibility for your learning and coursework. You will be required to complete a range of units, submit consistently high-quality work and ensure that you are well prepared for your external examinations.

The course is equivalent in size to one A-Level. It consists of 4 units, of which 3 are mandatory. The mandatory content accounts for 83% of the course and external assessment will contribute 58%. In addition to external assessment, you will be required to submit several coursework assignments.

Prior to commencing this course, you should ensure that you have taken time to familiarise yourself with the specification and course requirements. This can be found here:

<https://qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/Applied->

3. Modules:

The National Extended Certificate consists of 4 modules which will be undertaken over the duration of your 2-year course. The content of each module and associated assessment requirements are set out below:

Module	Content	Assessment
Unit 1 – Principles and Application of Science (I) Unit weighting – 90hrs	Biology – Cells & Tissues Chemistry – Periodic Table Physics – Waves	External examination 3 x 40-minute exams
Unit 2 – Practical Scientific Procedures and Techniques Unit weighting – 90hrs	Learners will be introduced to quantitative laboratory techniques; calibration, chromatography, calorimetry, and laboratory safety.	Internal Coursework submission
Unit 3 – Principles and Applications of Science (II) Unit weighting – 120hrs	Learners will cover the stages involved and the skills needed in planning a scientific investigation: how to record, interpret, draw scientific conclusions, and evaluate	External examination 3 hr supervised assessment
Unit 8 – Physiology of Human Body Systems Unit weighting – 60hrs	Learners will focus on the physiological make up of three human body systems (musculoskeletal, lymphatic, and digestive), how the systems function and what occurs during dysfunction.	Internal Coursework submission

4. Transition Task:

The transition material provided will support you in completing work towards [Unit 1 – Principles and Application of Science \(I\)](#). The tasks set out within this document aim to provide you with the fundamental knowledge and understanding required in order that you can access the high-level learning that will be delivered in September.

What is a eukaryotic cell?

What is a prokaryotic?

Explain the function of the mid-piece of a human sperm cell.

What is the function of root hairs in plant cells?

What is the function of the chloroplast in plant cells?

What is the formula for magnification?

Light microscope positives:

What is gram staining?

Light microscopes negative:

Electron microscope positives:

Electron microscope negatives:

What is the function of the golgi apparatus?

Unit 1: Biology (Part 1)

What is a gamete?

How can arteriosclerosis develop?

Endothelial tissue lines the heart and blood vessels, what is its function?

Ciliated columnar epithelial tissue protects the lungs by lining the trachea, how does it do this?

What is the function of the plasmodesma?

Name the organelles found in plant cells that are not found in animal cells.

What is the job of a ribosome?

What damage can smoking cause?

What are cilia?

Explain how the ultrastructure of a bacterium capsule prevents dehydration.

Name the type of ribosome found in bacteria.

What is the function of the Sarcomere in muscle tissue?

Name the 3 type of muscle tissue.

What are slow twitch muscle fibres and how do they work?

What are fast twitch muscle fibres and how do they work?

What is the function of the myelin sheath?

What is the function of root hairs in plant cells?

Draw a labelled diagram of a nerve cell:

What are the two protein filaments found in muscle cells?

What is resting potential?

Explain the function of the sarcoplasmic reticulum in skeletal muscle tissue.

What is action potential?

What is the gap between two neurons called?

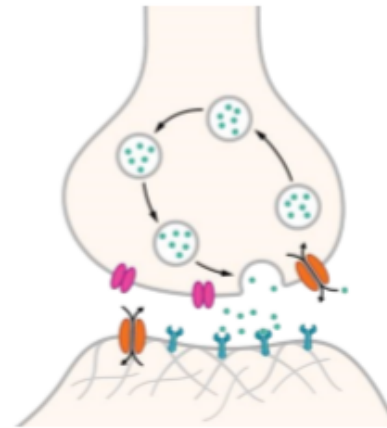
What is the end of a neuron called?

Explain how hyperpolarisation occurs in an axon cell.

Unit 1: Biology (Part 2)

What ions enter the cell at the synapse?

Label the diagram of a synapse:



Ciliated columnar epithelial tissue protects the lungs by lining the trachea, how does it do this?

What is the membrane potential while at rest?

When a neurone is at rest, describe the conditions inside and outside of the cell:

What is depolarisation?

What is happening at +40mV?

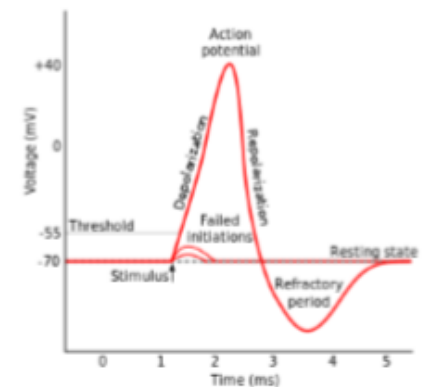
What causes Parkinson's disease?

Label where Na⁺ and K⁺ enters and leaves the cell:

Which 2 ions play a key role in transmitting an action potential?

What is the role of neurotransmitters?

How can Parkinson's disease be treated?



Draw the atomic structure of sodium:

What letters are used to represent the different orbitals?

Using dot and cross diagrams, show covalent bonding between two oxygen atoms

What is electronegativity?

What is the Aufbau principle?

Draw a diagram to show metallic bonding and explain:

Draw the spin state for lithium:

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What is the electronic structure of boron?

Draw the spin state for sodium:

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Electron microscope positives:

Electron microscope negatives:

What is electrostatic attraction?

Unit 1: Chemistry (Part 1)

Describe polar and non-polar molecules:

What is a lone pair?

What is hydrogen bonding?

The weak forces present between non-polar covalent molecules are called what?

Describe dipole-dipole forces:

Explain why the first ionisation energy of silicon (789 kJ mol^{-1}) is greater than that of germanium (762 kJ mol^{-1}).

Draw dot-and-cross diagrams to show the arrangement of the outer electrons in the calcium ion and the two chloride ions in calcium chloride, CaCl_2 .

What is a dative bond?

What are Van der Waals forces?

What are organic compounds?

Describe the structure of CH_4 :

Write the balanced equation for the reaction of aluminium in air to form aluminium oxide.

What is the formula for percentage yield?

Explain why calcium is an s block element.

List all 4 state symbols:

What is the number of moles in 20 g of sodium hydroxide, NaOH?

What is the A_r of oxygen?

Calculate the expected mass of water if 10 g of oxygen is reacted with excess hydrogen.

Explain the trends in atomic radius as you move across a period from left to right.

Outline the trends in the ionic radii of cations and anions moving across a period from left to right.

Calculate the mass of 2 moles of Li:

What is the Mr of H_2SO_4 ?

Unit 1: Chemistry (Part 2)

What does isoelectronic mean?

What are cations?

What are anions?

What is the number of moles in 136.5 g of potassium?

What is the formula for calculating moles?

$n = \frac{m}{M_r}$, explain:

What does electronegativity depend on?

3.2g of sulfur reacts with oxygen to produce 6.4g of sulfur oxide. What is the formula of the oxide?

Fluorspar is made of calcium and fluorine. If 51% is calcium, calculate the empirical formula.

What volume in cm^3 of 2M sulfuric acid solution would you need to ensure you had a sample containing 0.05 mol?

What is electron affinity?

What is the role of neurotransmitters?

Deduce the oxidation state of nitrogen in HNO_3 :

Deduce the oxidation state of chlorine in $HClO_4$:

What is an oscillation?

What is the formula for wave speed?

Light from a sodium-vapour lamp passes through the slits in a diffraction grating and creates a pattern on a screen. This pattern is called an emission spectrum. Which property of light produces the pattern on the screen?

What is a stationary wave?

Draw a labelled diagram of a transverse wave:

What is displacement?

What are the SI units for frequency?

How can a chemical element be analysed using light?

What is resonance?

How do stringed and wind instruments depend on resonance to produce their musical notes?

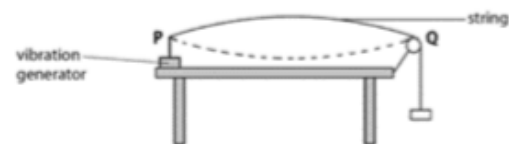
Explain compression in longitudinal waves:

Explain rarefaction in longitudinal waves:

Why are earthquakes difficult to study?

Unit 1: Physics (Part 1)

Label the node and anti-nodes on this diagram:



Outline 3 applications of stationary waves:

What type of wave is sound?

Describe the displacement in a transverse wave:

What is diffraction?

What is transmission?

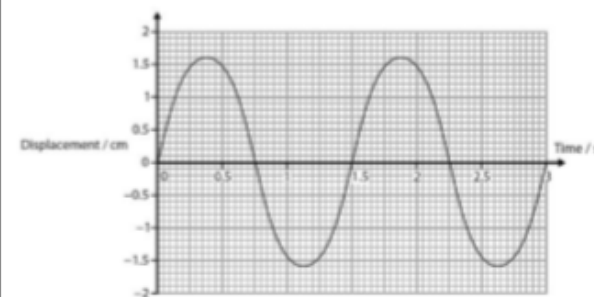
Explain how a diffraction grating produces an emission spectrum:

What is the wavelength of this wave?

Calculate the following:

Amplitude:

Wavelength:



A fibre optic cable is made from a material that has a critical angle of 43.8° . Calculate the refractive index:

What happens to light in transparent materials?

What is the formula for refractive index?

Describe how a critical angle is formed:

What is the formula to calculate the critical angle?

Describe total internal reflection:

What are the 3 main layers of fibre optic cabling and list their function:

With the aid of a diagram, explain how an endoscope can view images inside the body:

The refractive index of the optical fibre is 1.48. The speed of light in air is approximately 3×10^8 m/s. Calculate the speed of light in the optical fibre:

Draw and explain an analogue signal:

Draw and explain a digital signal:

Explain the difference between multimode and single mode fibres:

Unit 1: Physics (Part 2)

$n=c/v$, explain:

Explain how satellite communication is used:

Explain how mobile phones use EM waves:

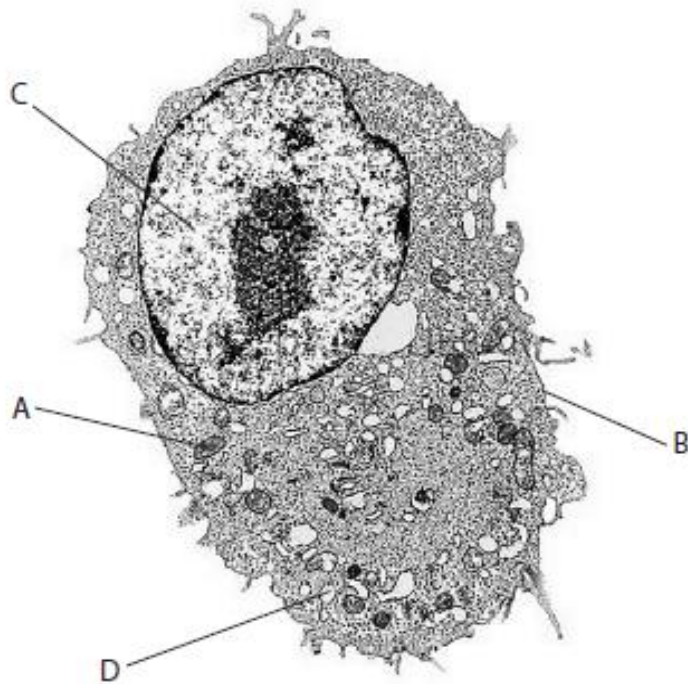
Outline how infrared waves are utilised:

Explain how Bluetooth and Wi-Fi work:

What is the formula for the inverse square law in relation to the intensity of a wave?

An electromagnetic wave has a frequency of 4.5×10^9 Hz. The speed of light is 3×10^8 m/s. Show that the wavelength of the electromagnetic wave is approximately 7.0 cm.

1 The electron micrograph shows the ultrastructure of an animal cell.



(a) (i) Identify which cell component is a lysosome.

(1)

- A
- B
- C
- D

(ii) Give **two** functions of lysosomes.

(2)

Function one

.....

Function two

.....

Outline the structure and function of ciliated columnar epithelial tissue

Describe the difference between fast-twitch and slow-twitch fibres

Outline what is meant by the London Dispersion forces

Describe the difference between oxidation and reduction in Chemistry

A free section of a stretched guitar string is 70cm long and it produces a fundamental harmonic with a frequency of 450Hz.

- a) What is the wavelength of the fundamental vibration of the string?
- b) What is the speed of the waves moving up and down the string?
- c) If the mass per unit length of the string is 0.00kg/m, what must be the tension of the string?

A microphone converts sound waves to electrical signals.
 Figure 3 shows an analogue signal from the microphone.

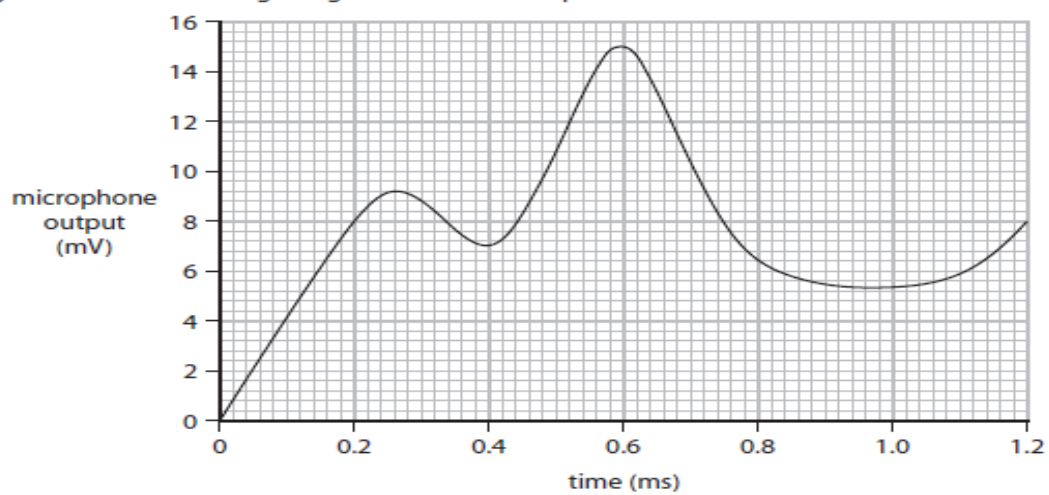


Figure 3

- (a) Give the maximum voltage of the signal in Figure 3. (1)
 maximum voltage = mV

- (b) Figure 3 shows an example of an analogue signal.
 Complete Sentence 1 for the correct definition of an analogue signal. (2)

The signal in Figure 3 is analogue because the varies
 with time.

Sentence 1

- (c) Describe how an analogue signal can be converted into a digital signal. (3)
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Learner Reflection

1. Which tasks in this transition booklet did you feel that you were able to complete easily?

2. Which tasks in this transition booklet did you find more challenging?

3. Prior to commencing the course in September, which areas of the course content/specification do you feel that you need to work on?

4. How do you intend to address this?
