**Unit 1 – Cell Biology Learning Outcomes:**

**National 4 in red**

**National 5 in black**

1. **Cell Ultrastructure (National 5)**
* Describe the ultrastructure of typical plant, animal, fungi and bacteria cells.
* State the functions of organelles found in typical plant, animal, fungi and bacteria cells.
1. **Transport across cell membranes (National 5)**
* Describe the composition of the cell membrane and its permeability.
* Explain the characteristics of passive transport.
* Describe diffusion and its importance.
* Describe osmosis.
* Describe the effects of osmosis on plant and animal cells.
* Explain the characteristics of active transport.
1. **Producing New cells (National 4 and 5)**
* *Explain why cell division is important.*
* *Describe what happens during cell division in general terms.*
* *Explain the link between cell division and cancer.*
* State the meaning of the term diploid and the importance of maintaining a diploid chromosome complement after cell division.
* Describe the sequence of events of mitosis, including equator and spindle fibres.
* Describe the factors required for the production of cells by cell culture including aseptic techniques, an appropriate medium and control of other factors.
1. **DNA (National 4 and 5)**
* *Describe where genes are found in a cell.*
* *State what genes are made of*
* *Describe the information which is contained in DNA.*
* *Describe the individuality of each individual’s DNA.*
* *Describe the inheritance of genes.*
* Describe the structure of DNA.
* Explain the relationship between DNA and proteins.
* State the names of the four bases and that they make up the genetic code.
* Explain the relationship between the order of bases on DNA and the amino acids in a protein.
* Describe the role of mRNA in protein production.
* Give the simple structures proteins are made from and where they are assembled.
1. **Therapeutic Use of cells (National 4 and 5)**
* *Describe the range of products which can be made by genetic engineering.*
* *Describe some other therapeutic uses of cells to include stem cell technology or using cells to grow artificial organs.*
* Describe how genetic information can be transferred from one cell to another.
* Give details of the stages of genetic engineering.
1. **Controversial Biological Procedures (National 4)**
* *Investigate examples of controversial biological procedures.*
1. **Enzymes (National 4 and 5)**
* *State where enzymes can be found.*
* *Describe the effect of enzymes on chemical reactions.*
* *Explain what is meant by the term specific.*
* *Describe the two classes of reactions enzymes can be involved in.*
* *Give examples of some uses of enzymes in biotechnology industries.*
* Explain how the variety of protein shapes and functions arises.
* Describe the functions of some proteins.
* State what enzymes are and where they can be found.
* Give the function of an enzyme.
* Explain the relationship between the active site of an enzyme and its substrate.
* Explain the meaning of the term optimum as applied to enzymes.
* • Give the factors which affect enzymes and other proteins and describe their effect.
* Explain the meaning of the term denaturation and explain why it happens.
1. **Microorganisms in industry (National 4)**
* *Describe some properties of microorganisms.*
* *Give examples of how some cells work and are used in industrial processes.*
* *Describe the use of yeast in baking and brewing.*
* *Describe the use of bacteria in yoghurt and cheese production.*
* *Describe the use of bacteria in the production of biofuels.*
1. **Respiration (National 4 and 5)**
* *Give the meaning of the term respiration.*
* *Explain the role of oxygen in respiration.*
* *Describe respiration when oxygen is present in yeast, plant and animal cells.*
* *Describe respiration when oxygen is absent in yeast and plant cells.*
* *Describe respiration when oxygen is absent in animal cells.*
* *• Give details of the different quantities of energy released by respiration with and without oxygen.*
* *Explain why temperature affects the rate of respiration.*
* Explain what is meant by the term respiration.
* Describe the production of ATP using energy from respiration.
* State the uses of ATP within a cell.
* Describe the chemistry of respiration with reference to the number of ATP produced.
* Give examples of cells with a high energy demand and number of mitochondria.
* Describe the fermentation pathway with reference to the number of ATP produced.
* Describe anaerobic respiration in animal cells.
* Describe anaerobic respiration in plant and yeast cells.
* Give the location of fermentation reactions within the cell.
* Give the location of aerobic respiration within the cell.
* Give the summary word equations for respiration.
1. **Photosynthesis (National 4 and 5)**
* *State the limiting factors of photosynthesis.*
* *Describe the effects of limiting factors on the rate of photosynthesis when low or absent.*
* *Explain the benefits of overcoming these limitations.*
* Describe the chemistry of photosynthesis as a series of enzyme-controlled reactions in a two stage process.
* Describe what happens during the light reactions.
* Describe what happens during carbon fixation.
* Give the summary word equation for photosynthesis.
* Give details of the fate of the sugar made during photosynthesis.
* Describe the limiting factors of photosynthesis and explain their impact on photosynthesis and cell growth.