**Answers to questions.**

**B01E Food tests**

**Reducing sugar test**

*What is the colour of the mixture at the start?*

Blue

*What do you observe in the tube after heating for 5 minutes?*

Colour change through green, yellow, and orange to brick red precipitate.

**Non-reducing sugar test**

*What is the colour of the mixture at the start?*

Blue

*What do you observe in the tube after heating for 5 minutes*?

Solution stays blue

*Why do you add dilute hydrochloric acid to the non-reducing sugar and heat it?*

To hydrolyse it / break the glycosidic bonds / break it down to reducing sugars.

*Why do you then add dilute sodium hydroxide or sodium bicarbonate?*

To neutralise the acid added.

*What do you observe?*

Colour change through green, yellow, and orange to brick red precipitate.

*Can you explain why the Benedict’s test was negative at first, and then positive after adding acid, heating and adding alkali?*

Benedict’s reagent only gives a brick red colour with reducing sugars. Sucrose is a non-reducing sugar and needs to be hydrolysed to its component sugars (glucose and fructose). The glucose formed is a reducing sugar and gives a brick red colour with Benedict’s reagent.

**Protein test**

*What colour is Biuret reagent at the start*?

Blue

*What colour is the solution after adding Biuret reagent?*

Lilac

**Starch test**

*What colour is iodine-potassium iodide solution at the start?*

Orange / brown.

*What colour is iodine-potassium iodide solution in the presence of starch?*

Blue / black

**Fat test**

*What do you observe where the alcohol and oil meet?*

A cloudy white line / precipitate.

**B02E Calibration of the light microscope**

*What is the width of the hair in eye piece units?*

From own slide. Answer in mm (standard form) or μm.

*Which units are the most appropriate to use?*

μm.

**B03E Preparation and scientific drawing of a slide of onion**

*What do air bubbles look like under the microscope?*

Hard-edge black circles

*What cell structures do you observe?*

Cell surface membrane, cell wall, nucleus, cytoplasm, vacuole.

*What units will you use to record the cell size?*

μm.

**B04E Determination of water potential by measuring changes in mass or length**

*Why must you make sure all the potato skin is removed?*

Potato skin will not allow water to pass through by osmosis.

*Which method gives more precise measurements – measuring length to 1mm or mass to 0.01g?*

Measuring mass to 0.1g is much more precise.

*Why must the cylinders be left in the liquid for at least 45 minutes?*

To allow time for osmosis to happen and come to a dynamic equilibrium.

*Why do you blot the cylinders and not press too hard when blotting?*

To remove excess water from the cylinder surface (which would affect the mass). Blotting must not be too rigorous or water will be expelled from the cells.

*Why is % change used?*

The cylinders will each have a different mass or length and so any change can only be accurately compared if percentage change is used.

*Which sodium chloride concentration gives no mean % change in mass or length?*

From the graph (sodium chloride concentration which gives no percentage change).

*What is the ψ of the potato tissue?*

The solute potential of the sodium chloride concentration which gave no mass change, found from the table in the lab book, is the same as the water potential of the potato tissue. At incipient plasmolysis (no % change in mass or length)

 ψP = 0

∴ ψcell = ψS + 0

∴ ψcell = ψS

**B05E Determination of the solute potential by measuring the degree of incipient plasmolysis**

*Why is the epidermis placed in de-ionised water at the start?*

So that all cells are fully turgid at the start of the experiment.

*Why do you leave the epidermis strips in the bathing solution for 30 minutes?*

To allow osmosis to happen and come to a dynamic equilibrium.

*Why do you add the same bathing solution to the epidermal strip on the slide*?

So that you can be sure that the concentration of bathing solution around the cells does not change.

*Why should you blot any excess liquid on the slide?*

To remove any surface liquid so that you can clearly view the cells under the microscope to judge the degree of plasmolysis.

*Which concentration of sodium chloride solution produces 50% plasmolysed cells?*

From the graph

*What is the solute potential of this sodium chloride solution, which is equal to the solute potential of the onion cells?*

From the table in the lab book.

**B06E Investigation into the permeability of cell membranes using beetroot**

*Where is the betalain pigment stored in the cells*?

In the vacuole.

*What happens to the colorimeter absorbance as more betalain is released?*

The absorbance increases as more betalain is released.

*What is the relationship between temperature and degree of betalain released?*

As the temperature increases more betalain is released up to a certain temperature (from their results), and from there the amount of betalain released begins to level off.

*What must happen to the membrane structure for the betalain to be released?*

The membrane structure must begin to break down and permeability begins to increase.

*Which type of molecule in the membrane structure is the most likely to be damaged by increasing temperatures?*

Proteins.

**B07E Investigation into the effect of temperature or pH on enzyme activity**

*Why is sodium carbonate solution added to the lipase solution?*

To make the solution alkaline since lipase is found in the small intestine and has an optimum pH above 7.

*What is the colour of indicator at the start?*

Pink

*Which molecules in the milk are hydrolysed by lipase?*

Lipids / fats

*Which products of this hydrolysis reaction cause the colour change of the phenolphthalein?*

Fatty acids

*What is the effect of temperature on the activity of lipase enzyme?*

The rate of reaction increases as the temperature increases up to the optimum temperature (from graph) and then decreases as the enzyme’s 3D structure starts to denature.

**B08E Investigation into the effect of enzyme or substrate concentration on enzyme activity**

*Why do you have to grind the potato cells?*

To break open the cell membranes to release the catalase enzyme.

*How would cell debris on the disc affect the rise time?*

It would increase the time taken (makes the disc heavier).

*What gas is given off by this reaction?*

Oxygen

*How does this gas affect the density of the paper disc?*

It decreases the disc density

*What effect does this density change have on the disc rise time?*

It makes the disc rise faster (decreases the disc rise time)

*How can you use this method to investigate the effect of enzyme concentration (mass of potato used) or substrate (****H2O2)*** *concentration on enzyme activity?*

Independent variable: enzyme concentration (mass of potato (g) in enzyme paste) OR H2O2 concentration (% stock solution provided)

Dependent variable: time taken for disc to sink and float to surface again in seconds

Control variables to include:

Diameter of paper disc and filter paper used

Volume of H2O2

Volume of water added to potato cylinder to make the paste

H2O2 concentration (% stock solution provided) OR enzyme concentration (mass of potato (g) in enzyme paste)

Same specimen tube to measure disc rise time

**B09E Simple extraction of DNA from living material**

*Why do you have to break up the strawberry cells?*

To break open the nucleus to release the DNA into the solution

*Which cell structure is most damaged by the detergent?*

Cell membranes e.g. plasma membrane and nuclear envelope.

*Why do you need to filter the bag contents?*

To remove the cell debris.

*Does your sample contain nucleic acids?*

From results (yes if red threads are seen)

**B10E Scientific drawing of cells from slides of root tip to show stages of mitosis**

*Which molecules are stained red with acetic-orcein stain?*

Nucleic acids, including DNA

*Why do you need to squash the root tip?*

To separate the cell layers so the individual cells are visible under microscope

*What stages of mitosis can you identify on your slide?*

From slide

*Which is the most common stage of mitosis you can see?*

Probably prophase



*What does this tell you about the relative length of time cells spend in this phase?*

This is the longest phase

**B11E Scientific drawing of cells from prepared slides of developing anthers to show stages of meiosis**

*Which stages of meiosis can you see on your slide?*

From their slide

**B12E Investigation into biodiversity in a habitat**

*Why do you use a random number generator to select the quadrat to be sampled?*

To avoid bias in the placement of the quadrats

*Which species did you identify in the quadrat?*

From results

*What was the Simpson’s index for the area?*

From results

*Why do you agitate the stream bottom?*

To dislodge organisms living amongst the stones and plants on the bottom of the stream

*What species did you collect?*

From results

*What was the Simpson’s index for the area?*

From results

**B13E Investigation into stomatal numbers in leaves**

*Why do you calculate the mean number of stomata?*

One field of view does not give a representative sample, and may be anomalous.

*What is the actual diameter of the field of view in mm?*

From results

*What is the radius of the field of view (r)?*

From results

*What is the area of the field of view in mm2 (πr2)?*

From results

*What is the mean number of stomata per mm2?*

From results

**B14E Dissection of fish head to show the gas exchange system**

*Why do the gill filaments look red?*

They have a very good blood supply (well vascularised)

*Why do the gill filaments need a large surface area?*

For maximum gas exchange and a rapid diffusion rate

*What is the function of the gill rakers?*

To remove small fragments from the water taken into the buccal cavity before they reach the gills.

*What do you notice about the structure of the gill filaments? Why is this structure important to their function?*

They have a very large surface area, for maximum exchange of gases, and are very thin and so have a very short diffusion path between the water and blood.

**B15E Scientific drawing of low power plan of a prepared slide of T.S. leaf, including calculation of actual size and magnification of drawing**

*What is the magnification of your drawing?*

From the drawing.

**B16E Investigation into transpiration using a simple photometer**

*Why must the end of the stalk be cut underwater before assembly?*

To prevent airlocks in the xylem vessels, which could prevent transpiration.

*Why is Vaseline applied to the joints of the potometer?*

To ensure there are no leaks.

*Which metabolic processes use water?*

Photosynthesis and hydrolysis of macromolecules.

**B17E Scientific drawing of low power plan of a prepared slide of T.S. artery and vein, including calculation of actual size and magnification of drawing**

*What differences do you observe between the structure of the artery and vein on your slide?*

The artery has a thicker wall. The muscle layer is much thicker in the artery. The vein lumen is much wider.

*What is the magnification of your artery drawing?*

From the drawing

*What is the magnification of your vein drawing?*

From the drawing

**B18E Dissection of a mammalian heart**

*Is there any fat on the outside of the heart? What is its function?*

There is white fat around the outside of the heart. It’s function is to protect the heart from impact.

*Can you identify any large blood vessels?*

Depends on how the heart has been butchered. Aortic arch and pulmonary veins may be visible.

*What is the function of the coronary arteries?*

To supply the heart muscle with blood containing respiratory substrates for contraction, and to remove waste products of metabolism.

**B19E Investigation of dehydrogenase activity in yeast**

*Which molecules act as a hydrogen acceptors during aerobic respiration?*

NAD and FAD

*How will you adapt this method to investigate dehydrogenase activity in yeast?*

Use the same method but vary temperature or pH, or another variable, and time how long methylene blue takes to change from blue to colourless.

**B20E Investigation into the separation of chloroplast pigments by chromatography**

*Why do you grind the leaves with sand?*

To break open the cells and the chloroplasts to release the pigments.

*Why must you use a pencil and not a pen for the line?*

The pen ink will also be separated by the chromatography solvent and will confuse the result.

*Why do you need to concentrate the pigment?*

So that the bands are visible after chromatography.

*Why must the chromatography paper touch the solvent?*

So the solvent is drawn up the chromatography paper.

*Why must the pigment spot be above the solvent surface?*

So that it is not dissolved into the solvent and removed from the paper.

*Which pigments can you identify?*

From results

**B21E Investigation into the effect of light on the rate of photosynthesis**

*What is the colour change of the indicator if photosynthesis is occurring (faster than respiration)?*

From red to purple

*Why must the balls be restored to room temperature before use?*

So the enzymes are at their optimum temperature.

*What colour is the indicator solution at the start?*

Red

*What colour is the indicator solution after illumination?*

Purple

*What does the colour change tell you about the rate of photosynthesis and respiration of Scenedesmus during illumination?*

The rate of photosynthesis is higher than the rate of respiration.

**B22E Investigation into the role of nitrogen and magnesium in plant growth**

*Why do you set up 5 test tubes of each solution?*

To identify anomalies and be able to calculate a mean.

*Why should you wrap foil round the tubes?*

To keep out the light and prevent the growth of algae.

*Why must all seedlings be placed in the same light and temperature conditions?*

To keep it a fair test

*Why is dry mass measured?*

Different seedlings may have different water content

*What differences do you observe between the seedlings?*

Lack of nitrate – poor growth and yellow leaves

Lack of phosphate – poor root growth and discoloured leaves

*What explanations can you give for any observed and measured differences between the seedlings?*

Nitrate needed for making amino acids and proteins, nucleotides, and chlorophyll

Phosphates needed for nucleotides and cell membranes

**B23E Investigation into factors affecting respiration in yeast**

*Why is sucrose solution added to the yeast suspension?*

As a respiratory substrate

*Why must the syringe have a weight on top?*

To keep the nozzle under the surface of the water so the bubbles can be counted

*What gas is given off?*

Carbon dioxide

*How could you improve the precision of this experiment?*

Collect the gas given off and measure its volume

**B24E Investigation into the numbers of bacteria in milk**

*Why must the fermented milk be diluted before plating?*

So that the number of bacteria and few enough to form distinguishable separate colonies when plated.

*Why is the Petri dish taped?*

To prevent microbes leaving or entering the plate.

*Why is the culture incubated at 25oC?*

To promote growth of microbes without encouraging the growth of pathogens.

*What is the assumption that is made about the number of colonies counted?*

That one colony is formed from one bacterium.

*What is the total dilution factor by which you multiply the number of colonies counted to get the number of bacteria in 1cm3 original fermented milk?*

From results, depending on which dilution plate was counted.

**B25E Investigation into the abundance and distribution of plants in a habitat**

N/A

**B26E Dissection of a mammalian kidney**

*Is the kidney covered in fat?*

Probably will be

*Are any blood vessels or the ureter attached?*

Depends on the way the kidney has been butchered. The ureter may be attached.

**B27E Investigation of the digestion of starch agar using germinating seeds**

*What is the name of the enzyme which hydrolyses starch?*

Amylase

*What colour does iodine-potassium iodide solution turn in the presence of* *starch?*

Blue / black

*Why do you place the seed cut face downwards on the starch agar?*

To allow enzymes to diffuse from the cut cells onto the starch agar.

*Why do you incubate the plate at 25oC?*

Optimum temperature for amylase, and to discourage pathogen growth

*Is there a clear zone on either plate?*

Only around the live seed

*How could you precisely measure the area of any clear zone?*

Using Vernier callipers

**B28E Dissection of wind and insect-pollinated flowers**

*How many sepals and petals does your flower have?*

Will depend on the species used. The number of petals and sepals should be the same or multiples of each other.

*What structural differences do you observe between the insect-pollinated and wind-pollinated flowers?*

Will depend on which species are used. Insect pollinated flowers should have larger, brightly coloured petals, stamens and stigma within the corolla, etc. Wind pollinated flowers should have no petals visible, large pendulous anthers, feathery stigma, etc.

**B29E Scientific drawing of cells from prepared slides of anther**

*How do you make sure your drawing is in proportion?*

Measure several distances on the slide in eye piece units and ensure that the drawing is in the same proportions.

**B30E Experiment to illustrate gene segregation**

*What Mendelian ratio is closest to the kernel colours observed?*

Will depend on which cobs are available, possibly 9:3:3:1

*Is the ratio of observed kernel phenotypes statistically significant?*

From results observed.

**B31E Investigation of continuous variation in a species**

*Are the means statistically significantly different?*

From results observed.