Unit 3 Practical Exam Questions

TABLE:

Record all your experimental results in a suitable table, using the space provided. Circle any anomalous results.	**3 Marks**	**9**
Results table containing: • Suitable headings with units (1) • Measurements consistently recorded to the same precision / same number of decimal places (1) • Indication of three or more repeats and means calculated (1)		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JUN19 JAN20 JAN21

GRAPH:

Plot a graph of [independent variable] against [dependent variable] using the graph paper provided.	**3 Marks**	**9**
Graph containing: • Labels and units for axes (1) • Suitable scales (1) • All points plotted correctly and suitable line of best fit for learner's data (1) OR • All bars drawn correctly (1)		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JUN19 JAN20 JAN21
Identify, using information from your graph…	**1 Mark**	**3**
• Answer consistent with results (1)		JUN18 JAN19 JAN20
Draw an extension oft the line on the graph to cut both the x and y axes.	**1 Mark**	**1**
• Extension of line of best fit cutting x and y axes (from graph) (1)		JAN19
Estimate the value of c, where c is the value of the intercept on the y-axis.	**1 Mark**	**1**
• Answer from the graph (1)		JAN19
Calculate the value of m, where -m is the gradient of the line using the equation. m = c ÷ (x-axis intercept)	**2 Marks**	**1**
• Substitution (1) • Evaluation (1)		JAN19

RELATIONSHIP:

Use your graph to describe the relationship between [independent variable] and [dependent variable]. **(Line graph)**	**2/3 Marks**	**8**
• As the [independent variable] increases the [dependent variable] increases / decreases (1) (allow positive / negative correlation) • Comment on proportionality / gradient relationship / shape of curve (1) (Must be consistent with results and graph) • (allow there was no pattern to my results) (1) • Non-linear / not straight OR linear / straight line • Comment on plateau • Simple pattern described (1) • Relationship given (1) • Use of data (1)		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JAN20 JAN21
Describe your results using information in the graph. **(Bar chart)**	**2 Marks**	**1**
• All foods gave out heat energy (1) • {marshmallow / learners lowest result} gives out less {heat / energy} (than the rest of the foods) (1) • {popcorn / learner's highest result} gives out the most {heat / energy} than the rest of the foods (1) • (allow no pattern to results) (1)		JUN19

OBSERVATIONS:

State **one/two** other observation you made…	**1/2 Marks**	**6**
F Plants & their Environment …about the plants you measured. • Number of seeds germinating • Colour of plants / stem / leaves • Direction of plant growth • Dead plants • Size of leaves • Number of leaves G Energy content of Fuels …about the flame. • Size of flame changes • Flame fluctuates …when burning the carbohydrate foods. • Yellow flame • Different sized flames • Soot / smoke • Foods turned black		SAM1 SAM2 JUN17 JAN19 JUN19 JAN21

• Some foods {ignited quicker than others / burned for longer} than others • (water) bubbling / boiling / steam • Food melted / broke up • Food fell off the needle • {fat / grease} came away from the food / the food dripped • Flames observed moving up and around the outside of the calorimeter • Some food left over after burning <u>H Electrical Circuits</u> …as the current increased. • Wire glows • Smoke …about the brightness of the lamps. • As more lamps are added, the brightness of (all) the lamps {reduces / decreases} • Voltage decreases as the brightness decreases • (lamps in a set) are all the same (brightness) …about the lamp when the voltage output was increased. • Increased in brightness		

ANOMALY:

Explain which result is an anomaly.	**2 Marks**	**1**
• Result for [x] (1) • Does not fit pattern (1)		SAM2
Explain how you can deal with this anomaly to ensure their results are accurate.	**2 Marks**	**1**
Any two from: • Repeat result (1) • Take an average of results (1) OR • Plot a graph of results (1) • Read value from graph (1)		SAM2

CALCULATIONS:

General

Calculate the percentage errors for the equipment you used for measuring the…	**1/2/3 Mark**	**2**
Percentage error = (+/- 0.5 x 100) ÷ reading (1) …volume of water • % percentage error on (lowest) volume measurement (1) …temperature • % percentage error on (lowest) temperature measurement (1) …mass • % percentage error on (lowest) mass measurement (1) …plant height • % percentage error on (lowest) height measurement (1)		SAM1 JUN17
Calculate the percentage error in the measurement using the equation. Percentage error = (maximum error ÷ measured value) x 100.	**2 Marks**	**1**
• Substitution (1) • Evaluation (1)		JAN19
Calculate the total percentage error, using the initial and final readings.	**3 Marks**	**1**
• Uncertainty (1) • Substitution (1) • Addition (1)		JUN19
Calculate the mean.	**1 Mark**	**3**
• Mean correctly calculated (1)		JUN17 JAN18 JUN19
Calculate the standard deviation using the equation. $s = \sqrt{\frac{\sum (x - \bar{x})^2}{N - 1}}$	**5 Marks**	**2**
• For each number subtract the mean (1) and square the result (1) • Add these values (1) and divide by one less than the sample number (1) • Square root this number to get the standard deviation (1)		JUN17 JAN18
Use the table to estimate a value for the heat of combustion of hexan-1-ol.	**1 Mark**	**1**
• Answer one step above the highest value in the table.		SAM1
Use the table to estimate the current that will melt 12 copper alloy wires.	**1 Mark**	
• Answer one step above the highest value in the table.		SAM2

Estimate, using the information in the table, a value for the average rate of diffusion.	**1 Mark**	**1**
• Any number between the values in the table (1)		JAN18
Predict the value of the potential difference when the current is 1.40A.	**1 Mark**	**1**
• 3.08V		JAN21

D Enzymes in Action

State a null hypothesis for the investigation.	**2 Marks**	**1**
• No significant difference (1) • Between [things tested] (1) OR • [independent variable] will have no effect on the [dependent variable] (1) • Any difference is due to chance (1)		JUN18
Calculate, using the unpaired t-test, the value of t for the investigation using the equation. $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$	**6 Marks**	**1**
Difference in the mean • Substitution (1) • Evaluation (1) Standard error • Substitution (2) • Square root (1) • t-value (1)		JUN18
Calculate the degrees of freedom for the investigation using the equation. $(n_1 + n_2) - 2$	**2 Marks**	**1**
• Substitution (1) • Evaluation (1)		JUN18
Give the critical value of t at the p = 0.05 level using the table.	**1 Mark**	**1**
• Value correctly identified (1)		JUN18
Explain whether the null hypothesis should be accepted or rejected.	**3 Mark**	**1**
• (the null hypothesis should be) {rejected / not accepted} (1) • (because) {there is a significant difference / difference not due to chance} (1)		JUN18

• (because) t-test value is more than critical value (and is above the 95% confidence level / at the p = 0.05 significance level) (1)		

E Diffusion of Molecules

Calculate the average rate of diffusion using the equation. Average rate (s^{-1}) = 1 ÷ average time (s) Give your answer in standard form.	**2/3 Marks**	**2**
• All 5 substituted correctly (1) • 3 or 4 evaluated correctly (1) • Standard form (1)		JAN18 JAN20
Calculate the average time using the equation. Average rate (s^{-1}) = 1 ÷ average time (s)	**3 Marks**	**1**
• Rearrangement (1) • Substitution (1) • Evaluation (1)		JAN20

F Plants & their Environment

Complete the table to show the expected and observed results.	**1 Mark**	**1**
• All 3 correct (1)		JUN17
Determine, using the chi squared test, if the results are consistent with those expected using the equation. Use $X^2 = \sum \frac{(O-E)^2}{E}$	**5 Marks**	**1**
• $(O – E)^2 \div E$ for grass and no grass (2) • $X^2 = 2.86 + 1.54 = 4.40$ (1) • n = 2 – 1 = 1 degree of freedom (1) • (at n = 1 critical value is at 5% value is 3.841) 4.40 > 3.841 so there is a significant difference between the observed and expected results (results are not consistent) (1)		JUN17

G Energy content of Fuels

Explain why the mass of the carbohydrate food was recorded before and after burning in your investigation.	**2 Marks**	**1**
• To work out the {change / loss} in mass (1) • Some food might not have burned (1) • Measure of mass of food burned for calculation per gram (1)		JUN19
Calculate the heat energy in joules supplied to the water by the burning alcohol using the equation. Heat energy = mass of water x specific heat capacity x temperature rise	**2 Marks**	**1**

• Correct use of equation (1) • Correct answer (1)		SAM1
Calculate the molar masses.	**2 Marks**	**1**
• Correct answers (2) • Any 3 or 4 correct (1)		SAM1
Calculate the heat of combustion of the five alcohols in kJ mol^{-1} using the equation. Heat of combustion (kJ mol^{-1}) = (heat energy supplied to water x molar mass) ÷ mass of alcohol burnt	**3 Marks**	**1**
• Correct substitution and evaluation for all 5 (2) • Correct substitution and evaluation for 3 or 4 (1) • All 5 correctly converted to $kJmol^{-1}$		SAM1
Calculate the average heat energy in joules per gram supplied to the water for each of the foods that you tested using the equation. Average heat energy per gram = (25 x 4.2 x average temperature rise of water) ÷ average mass of food burned	**4 Marks**	**1**
• Correct substitution and evaluation for 3 foods (4) OR • Correct substitution and evaluation for 2 foods (3) OR • Correct substitution for 2 foods (2) OR • Correct substitution for 1 food (1)		JUN19

H Electrical Circuits

Calculate the power of the bulb in the initial circuit using the equation. Power (W) = voltage (V) x current (A)	**2/4 Marks**	**2**
• Correct substitution (1) • Correct evaluation (1)		SAM2 JAN21
Calculate how much energy would be transferred by the bulb in 1 hour using the equation. Power (W) = energy transferred (J) ÷ time (s) Give your answer in kilojoules.	**4 Marks**	**1**
• Rearrangement (1) • Conversion to seconds (1) • Evaluation (1) • Conversion to kilojoules (1)		SAM2
Calculate the power of the lamp using the equation. Power = VI (voltage x current)	**2 Marks**	**1**
• Substitution (1) • Evaluation (1)		JAN19

Calculate the time in hours that the cell would deliver current to the lamp using the equation. Power = work done ÷ time	**3/4 Marks**	**2**
• Substitution (1) • Rearrangement (1) • Evaluation (1) • Conversion (1)		JAN19 JAN21
Calculate the resistance (R) as shown in the table using the equation. R = V ÷ I	**2 Marks**	**1**
• Correct substitution (1) • Correct evaluation (1)		JAN21

ACCURACY:

State which measurement would be most likely to affect the accuracy of the results.	**1 Mark**	**1**
• Measurement which gives highest % error from their calculations (1)		SAM1
Explain why the [equipment] had the biggest effect on the accuracy of the results.	**3 Marks**	**1**
• Substitution (1) • Evaluation (1) • Measurement with highest percentage error (has highest effect on accuracy) (1)		SAM2
Explain two ways you made sure your results were accurate when carrying out the investigation.	**4 Marks**	**1**
• White {tile / paper} (1) • To see colour change / end point (1) OR • (used a) stopwatch / stop clock / timer (1) • To give results to milliseconds (1) OR • Read from bottom of meniscus (1) • To get the true / exact value of the volume of acid (1) OR • Eye level (1) • To get true / exact value of the volume of acid (1) OR • Time taken in seconds not minutes (1) • To give a true / exact value for time of diffusion (1) OR • Use {clean / washed / new} equipment for each test (1) • So there is no contamination (1)		JAN18

OR • Keep agar container / keep lid on agar (1) • To prevent {early reactions / colour change} with (carbon dioxide in air) (1)		
Give **one** reason why it was important to stir…the solution.	**3 Marks**	**1**
• To evenly distribute the substrate / enzyme (1)		JUN18
Explain why the water was stirred at regular intervals during the investigation.	**2 Marks**	**1**
• To ensure that the temperature of water was uniform throughout (1) • So that the temperature rise would be measured more accurately (1)		SAM1
Describe how you made sure that the mass of extracted apple juice was measured accurately.	**3 Marks**	**1**
• Stop filtering {on time / after five minutes / all at the same time} (1) • Ensure the balance is on a {flat / level} surface (1) • {read balance / record mass} to same number of decimal place (1) • Calibrate / re-set / tare balance (1) • Cleaning the equipment (1)		JUN18
Describe how you used the pipette to measure the 25cm^3 of water accurately.	**2 Marks**	**1**
• Draw water up to the {(graduation) mark / line} (1) • Read from bottom of meniscus (1) • Release water touching the pipetted on the side of the calorimeter to release last drops / ensure there are no air bubbles (1)		JUN19
Identify and justify **one** piece of equipment you could use to improve the accuracy of measuring volumes.	**2 Marks**	**1**
• Use a pipette / burette (1) • (because it has a) smaller {scale / percentage error / diameter tube} / lower uncertainty (1)		JAN20
Give one reason for the systematic error in the ammeter readings.	**1 Mark**	**1**
• Zero error / zero not checked (1) • Wrongly calibrated / not calibrated (1) • Faulty ammeter (1)		JAN20

HAZARDS:

E Diffusion of Molecules

Explain one risk in this investigation and how you minimised that risk.	**3 Marks**	**1**
• {irritation / burns} to skin (1)		JAN20

• From (warm) acid / agar cylinder (containing sodium hydroxide) / hot water (1) • Wear gloves / {use spatula / spoon} when handling the cylinder (1) OR • {irritation / burns} to eyes (1) • From (warm) acid / agar / (agar containing) sodium hydroxide / phenolphthalein (1) • Wear goggles (1)		
Explain which reading shows the **least** reliable set of results.	**1 Mark**	**1**
• Correct value (1) • It has the greatest standard deviation (1)		JAN20

G Energy content of Fuels

State **one** hazard in your experiment.	**1 Mark**	**1**
• Sharp needle / hot calorimeter / {hot / boiling} water / flame / burning food / Bunsen burner / food (1)		JUN19
Explain how you minimised **one** risk from the hazard.	**1 Mark**	**1**
• Cuts (from needle) (1) • Do not touch end of sharp needle (1) OR • Burns (from hot calorimeter / flame / burning food) (1) • Do not touch until cool / use tweezers or clamp to move calorimeter / mounted needle for food (1) OR • Scalding (from hot water) (1) • Wait until cool before pouring away (1) OR • Burns from hair catching fire (1) • Tie hair back (1) OR • Burns from Bunsen burner (1) • Put Bunsen burner on safety flame (when not in use) (1) OR • Allergic reaction (from allergies to food) (1) • Wear gloves / do not touch the food (1)		JUN19

SUBJECT SPECIFIC:

D Enzymes in Action

Give **one** reason why the concentration you identified is the optimum.	**1 Mark**	**1**

• (lowest percentage that) gives maximum / highest / most mass of juice produced (1)		JUN18
Explain how a temperature **below** the optimum would affect the rate of enzyme activity.	**2 Marks**	**1**
• Low enzyme activity / slow to react / takes longer (1) • Fewer {(enzyme substrate) collisions / enzyme-substrate complexes} (1) • Less energy for collisions (1)		JUN18
Explain how a temperature **above** the optimum would affect the rate of enzyme activity.	**2 Marks**	**1**
• Enzyme {activity low / has no activity / doesn't work / not active / decreased rate of reaction / can't break down puree} (1) • (a high temperature / above optimum) denatures the enzyme / breaks hydrogen bonds (1) • Active site loses shape / deforms / unravels (1) • Substrate no longer fits / cannot bind / cannot form ES complexes (1)		JUN18

E Diffusion of Molecules

Give **three** other reasons for any similarities or differences between your results and theirs.	**3 Marks**	**1**
• (same / different) shape / {size / surface area / volume} cylinder (1) • (same / different) {density / type} of agar (1) • (same / different) concentration of sodium hydroxide in cylinder (1) • (same / different) type of alkali (1) • (same / different) temperature (1) • (same / different) type of indicator (1) • Same concentrations of acid 0.1-2M (1) • Different concentration of 2.5M / wider range of concentrations used (1) • Different pH of {acid / alkali} (1)		JAN18
Explain why the agar cylinder became smaller in the 2.5M sulphuric acid.	**2 Marks**	**1**
• (2.5M sulfuric) acid is very concentration / high in concentration (1) • {dissolves / reacts / corrodes / dehydrates} the agar cylinder (1)		JAN18
Give a reason why your colleague did **not** use a temperature higher than 90°C.	**1 Mark**	**1**

• (more than 90°) is hazardous / acid would start to boil / acid could start to evaporate / agar could start to {disintegrate / melt} (1)		JAN20
Give a reason why your colleague did **not** use a temperature lower than 10°C.	**1 Mark**	**1**
• Less than 10°C would mean that diffusion would be too slow / acid could freeze / agar would freeze (1)		JAN20
State what effect using sulphuric acid instead of hydrochloric acid has on the average rate of diffusion.	**1 Mark**	**1**
• (the rate of diffusion) increases (1)		JAN20

F Plants & their Environment

Explain how rinsing the pH probe with distilled water made sure you obtained accurate pH measurements.	**3 Marks**	**1**
• (rinsing the pH probe) removes soil from other samples (1) • (distilled water) has a neutral pH (1) • No cross-contamination / no effect on pH (1)		JUN17
Give **two** reasons why the grass cover might be different in each area.	**2 Marks**	**1**
• Different pH of soil (1) • Different type of soil (1) • Different use of field (1) • Different shade / light (1) • Different level of grazing (1) • Different levels of trampling (1) • Qualified different levels of pollution (1) • Different levels of competition (1)		JUN17

G Energy content of Fuels

Write a balanced equation for the complete combustion of butan-1-ol, C_4H_9OH.	**2 Marks**	**1**
• All formulae correct (1) • Balancing of correct formulae (1) • (allow multiples)		SAM1
Give **two** reasons why there is a difference between your values for heats of combustion and the data book values.	**2 Marks**	**1**
• Thermal energy / heat is transferred to air / surroundings (1) • Thermal energy / heat is absorbed by the calorimeter (1) • Incomplete combustion (1)		SAM1
Give **one** reasons why a lid was used on the calorimeter.	**1 Mark**	**1**
• To reduce {heat loss / heat energy} escaping (1)		JUN19

H Electrical Circuits

Explain the number of strands of steel wool wire that should be used for a circuit using 1 amp of current.	**3 Marks**	**1**
• Answer consistent with result from graph or table (1) • Fuse will melt before too much current goes into circuit (1) • Prevents circuit getting damaged (1)		SAM2
The investigation used different metals. Give two other possible reasons why there is a difference between your results for steel wool wire and the results for copper alloy wire.	**2 Marks**	**1**
• Equipment was hot (1) • Wires at different diameters (1) • Wires at different lengths (1)		SAM2
Explain why the equipment was left to cool between each experiment.	**2 Marks**	**1**
• Resistance is affected by temperature (1) • Same / constant temperature so results can be compared (1)		SAM2
Explain why it was necessary to open the switch in between taking voltmeter readings.	**2 Marks**	**1**
Identification • (opening the switch) stops the current stops the circuit / stops the flow of electrons / breaks the circuit (1) Explanation • Stops cell / batteries / lamps / equipment from overheating (1) • Allows cell / batteries / lamp / equipment to cool down (1) • Gives cells time to recover (1) • Prevents battery from draining / going flat (1) • Prevents changes to the resistance of the lamp / bulb (1) • Allows consistent results to be achieved (1)		JAN19 JAN21
Add a voltmeter to the diagram to measure the potential difference (p.d.) across the fixed resistor.	**1 Marks**	**1**
• Voltmeter drawn in parallel around the fixed resistor (1)		JAN21

COMMENT ON:

Comment on [X]. Use the data to support your answer.	**3/4 Marks**	**4**
• [X] is more expensive than [Y] (1) • Correct manipulation of data (1) • Prediction does / doesn't fit the results (1)		SAM1 SAM2 JAN18 JAN19

METHOD:

Identify **two** strengths of the method.	**2 Marks**	**1**
• Repeats / multiple readings were taken (1) • Includes a diagram / image / picture (1) • Tests a good range of [independent variable] (1) • Used the same equipment throughout (1) • Same interval between readings (1)		JAN21
Identify **two** limitations of the method.	**2 Marks**	**1**
• Only gives trend / no specific values for [independent variable] (1) • Should use a small increment for [independent variable] (1) • Increase the range of [independent variable] (1)		JAN21

VARIABLES:

State the independent variable in your investigation.	**1 Mark**	**2**
• [independent variable]		JAN19 JAN21
State the dependent variable in your investigation.	**1 Mark**	**3**
• [dependent variable]		SAM2 JAN19 JAN21
Give a reason why it was difficult to measure the dependent variable.	**1 Mark**	**1**
• Relevant reason (1)		SAM2
Identify **one** other variable in this investigation and give a reason why it was difficult to control.	**2 Marks**	**1**
• Temperature rise (1) • Because it is difficult to stop at exactly 30°C temperature rise (1) OR • Distance of flame (1) • Because the flame size changes during the experiment (1)		SAM1
Explain why weather is not a factor in your investigation even though you can't control it.	**2 Marks**	**1**
• The areas are close together (1) • So will have same / similar weather conditions (1)		JUN17
Explain why the differences in ripeness did not affect your results.	**2 Marks**	**1**
• The apples were pureed / smashed / mashed / broken up / mixed together (1) • (so any differences in ripeness) were averaged out / spread throughout the puree (1)		JUN18

Give **two** variables that were controlled in the investigation.	**2 Marks**	**3**
<u>E Diffusion of Molecules</u> • Surface area of the cylinder (1) • By using same {size / shape / volume} cylinder / cut with the same size cork borer (1) OR • The concentration of the sodium hydroxide (1) • By using {clean / fresh / washed} equipment for each test (1) OR • Ensure all agar is covered by the same amount (1) • By keeping the size of {boiling tube / test tube} the same (1) OR • Same volume of acid (1) • By using 10ml / use a measuring cylinder / pipette (1) OR • Same type of agar (1) • By using same batch of agar (1) OR • Same concentration of the {phenolphthalein / indicator / sodium hydroxide} in the agar (1) • By using the same batch / bottle (1) OR • Temperature (1) • By using a water-bath (1) <u>G Energy content of Fuels</u> • The volume of water (1) • The distance the burning food was held from the bottom of the calorimeter (1) <u>H Electrical Circuits</u> • Ammeter (1) • Lamp / bulb (1) • Wires / switch / {lamp / bulb} holder (1) • Power supply (1)		JAN18 JUN19 JAN21
State how the surface area of the agar cylinder was controlled.	**1 Mark**	**1**
• Same size (shape / cylinder) (1)		JAN20
Explain how the rate of diffusion would be affected if the surface area of the agar cylinder was increased.	**2 Marks**	**1**
Identification • (overall) rate would increase (1) AND • More surface area for particles to diffuse across (1) OR • (so) more particles can diffuse at the same time (1)		JAN20

OR • More contact between agar and acid (1)		
Explain how **one/two** other variable was controlled.	**2/4 Marks**	**2**
E Diffusion of Molecules • Concentration of the acid (1) • By using 1M / {clean / fresh / washed} equipment for each test (1) OR • Ensure all agar is covered by the same amount (1) • By keeping the size of {boiling tube / test tube} the same (1) OR • Volume of acid (1) • By using $10cm^3$ / use a measuring cylinder / pipette (1) OR • Type of agar (1) • By using same batch of agar (1) OR • Concentration of the {phenolphthalein / indicator / sodium hydroxide} in the agar (1) • By using same batch / bottle (1) OR • Point at which experiment has finished (1) • E.g. same person judges when colour has disappeared / use a white tile to observe when agar cylinder is completely colourless (1) H Electrical Circuits • Using the same cell / battery (1) • To keep the (initial) voltage constant (1) OR • Use identical lamps (1) • Which have the same resistance / take the same current (1) OR • Make good (electrical) connections between all the components (1) • (so) there is little / no contact resistance (1)		JAN19 JAN20
Explain why temperature should be controlled when investigating the effect of concentration of acid on rate of diffusion.	**2 Marks**	**1**
• Higher temperature provides more energy (to acid particles) (1) • So acid particles will move faster (1) • More collision (in a given time) (1) • {diffusion / reaction} will happen faster (1)		JAN18

Identify **two** other variables in your investigation that cannot be controlled.	**2 Marks**	**2**
D Enzymes in Action • {size of chunks / lumps / surface area / consistency} of the pureed apples (1) • Juice absorbed by the filter (1) • pH / acidity of the mixture (1) • Damage to the apple before pureeing (1) • Varieties / types of apples (1) • Freshness / age of pectinase (1) • Fluctuations in water bath temperature due to other users (1) F Plants & their Environment • Type of soil (1) • Mineral content of soil (1) • Shade (1) • Grazing / trampling (1) • Viability of seeds (1) • Disease / infestation (1)		JUN17 JUN18

EXTEND / IMPROVE:

Explain **two** ways in which you could extend this investigation, to improve the reliability of your conclusions.	**4 Marks**	**9**
• Repeat the experiment more times to obtain concordant results (1) • In order to eliminate any anomalous results (1) OR • Repeat the experiment with more…(1) • In order to extend the range of results (1) OR • Repeat experiment with a bigger range of / use different types of…(1) • In order to see if these follow the same pattern (1) OR • Take / repeat more samples…(1) • To give more reliable results (1)		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JUN19 JAN20 JAN21
Explain **two** ways in which the reliability of your data could be tested.	**4 Marks**	**1**
• Repeat experiment (1) • Using the same apparatus / equipment (1) AND • Other learners carry out the (same) experiment (1) • Comparison of results (1)		JAN19
Describe how the reproducibility of the data could be tested.	**3 Marks**	**1**

• Attempted / tried by a colleague (1) • Same {method / standard procedure} used (1) • New / different set of equipment (1) • Different place / time (1) • Results compared / see if results are similar / compare with known data (1)		JAN21

PLAN:

Write a plan for an investigation into the effect of [independent variable] on [dependent variable].
Your plan should include the following details:
• A hypothesis
• Selection and justification of equipment, techniques or standard procedures
• Health and safety associated with the investigation
• Methods for data collection and analysis to test the hypothesis including:
  ○ The quantities to be measured
  ○ The number and range of measurements to be taken
  ○ How equipment may be used
  ○ Control variables
  ○ Brief method for data collection analysis
	12 Marks	**9**

		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JUN19 JAN20 JAN21

Question	Indicative content
4	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material using the indicative content and

	levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some / all of the indicative content but should be rewarded for other relevant answers. A plan, that makes reference to: • A hypothesis • Equipment, techniques and / or procedures • Risks • Control variables • Dependent variable – how it will be measured, units and the precision of measurements to be taken • Independent variable – the range of measurements / categories to be used and how they will be measured, the intervals to take measurements • Data analysis

Mark scheme (Award up to 12 marks) Refer to the general marking guidance found in this document on how to apply Levels Based Mark Schemes.		
Level	**Mark**	**Descriptor**
0	0	No rewardable material
1	1-4	• Limited attempt at a hypothesis is made • Demonstrates limited knowledge and understanding of scientific concepts, procedures, processes and techniques with a basic description of the plan to investigate the scientific scenario given • Provides a rationale for the method suggested and generic statements may be presented rather than linkages being made so that lines of scientific reasoning are unsupported or unclear • The plan will not be logically ordered with significant gaps that will not lead to reliable results being collected
2	4-6	• An explanation for the hypothesis is given which is partially supported by scientific understanding • Demonstrates adequate knowledge and understanding of scientific concepts, procedures, process and techniques with a partial description of the plan to investigate the scientific scenario given • Provides a rationale for the method which has occasional linkages present so that lines of scientific reasoning are partially supported • The plan will generally be in a logical sequence and will yield some results
3	7-9	• An explanation for the hypothesis is given which is supported by scientific understanding • Demonstrates good knowledge and understanding of scientific concepts, procedures, processes and techniques with a clear description of the plan to investigate the scientific scenario given

		• Provides a rationale for the method which has linkages present so that lines of scientific reasoning are supported • The plan will be in a logical sequence but with minor omissions of steps and will yield reliable results
4	10-12	• An explanation for the hypothesis is given which is fully supported by scientific understanding • Demonstrates comprehensive knowledge and understanding of scientific concepts, procedures, processes and techniques with a step by step description of the plan to investigate the scientific scenario given • Provides a rationale for the method which has consistent linkages present so that lines of scientific reasoning are fully supported • The plan is in a logical sequence and will lead to a reliable set of results being collected

EVALUATION:

Evaluate the learner's investigation. Your answer should include reference to: • The method of the experiment • The results collected • The conclusion made	**8 Marks**	**9**
• [independent variable] doesn't increase uniformly • Smaller intervals should be used • Range of results could be increased • Increase the number of data points • Method of measuring [dependent variable] not clear • Variables to be controlled not stated clearly • Readings not repeated so hard to tell if results are anomalous • Measurements not recorded to same degree of accuracy • Data supports / doesn't support conclusion • Use of quantitative values • Positive correlation / negative correlation • Relationship is linear / non-linear • Result [x] appears to be an anomaly • Line graph should have a line of best fit not a dot to dot		SAM1 SAM2 JUN17 JAN18 JUN18 JAN19 JUN19 JAN20 JAN21

Question	**Indicative content**
5	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material using the indicative content and level descriptors below. The indicative content that follows is not prescriptive.

	Answers may cover some / all of the indicative content but should be rewarded for other relevant answers.

Mark scheme (Award up to 8 marks) Refer to the general marking guidance found in this document on how to apply Levels Based Mark Schemes.		
Level	**Mark**	**Descriptor**
0	0	No rewardable material
1	12	• Adequate interpretation and analysis of the scientific information. • Generic evaluative comments made with little linkage to supporting evidence / reference to context. • A conclusion may be presented, but will lack focus and be superficial and underdeveloped.
2	3-5	• Good analysis and interpretation of the scientific information. • Evaluative comments with supporting evidence / reference to context and a partially developed chain of reasoning. • Conclusion will be mostly focused and developed and draw on some of the information presented before.
3	6-8	• Comprehensive analysis and interpretation of all pieces of scientific information. • Evaluative comments supported by relevant reasoning and appropriate reference to context. • Conclusion will be clear and concise and well-developed drawing upon the most relevant information presented before.