PRACTICAL NOTES

1. SKELETAL MARK-SCHEME

SKILL	BREAKDOWN
PLANNING [15]	• Defining the problem [5] • Methods [10]
ANALYSIS, CONCLUSIONS & EVALUATION [15]	• Dealing with data [8] • Evaluation [4] & Conclusions [3] (From P3)

2. PLANNING

2.1 Defining the Problem

- It can be done by stating a hypothesis which is a prediction about the relation between the independent and dependent variable. Hypothesis should be:
  - Quantifiable.
  - Testable.
  - Falsifiable.
  - Graphically representable.

2.2 Experimental Skills

- It should include description of the following in a logical sequence, along with a diagram of the apparatus arrangement.

CONCERN	PROCEDURE
INDEPENDENT VARIABLE	• Decision of range & interval. • Variation & measurement.
DEPENDENT VARIABLE	• Measurement. • Relation with observation.
CONTROL VARIABLES	• Identification. • Standardisation.
REAGENT SOLUTIONS	• Preparation by dilution. • Suitable control provision.
SELECTION OF STATISTICAL TEST	• Hypothesis. • Quality of investigation.
MISCELLANEOUS	• Risks & precautions. • Details & improvements.

3. DATA ANALYSIS

3.1 Measures of Central Tendency, Location & Dispersion

- Mean is sum of data divided by no. of data.
- Mode is most common value.
- Median is middle quartile.
- Range is spread between smallest and largest value..
- It can be divided into 4 quarters by 3 quartiles.
- Interquartile range is spread between upper and lower quartile.
- Standard deviation $(s) = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$
- Standard error $(s_m) = \frac{s}{\sqrt{n}}$
- 95% confidence intervals (represented graphically by error bars) lie within 2 standard deviations/errors of the mean

3.2 Statistical Tests & Calculations

Statistics	Criteria	Formulae		Interpretation
t-test	2 sets of normal, continuous quantitative data (>5 readings)	$t = \frac{\lvert\bar{x} - \bar{y}\rvert}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}}$	$v = n_x + n_y - 2$	$H_0 = t < \text{CV}$ $H_1 = t > \text{CV}$
χ^2-test	2 sets of discrete/nominal data	$\chi^2 = \sum \frac{(O-E)^2}{E}$	$v = (n-1)^2$	$H_0 = \chi^2 < \text{CV}$ $H_1 = \chi^2 > \text{CV}$
Pearson's linear correlation	2 sets of normal, discrete quantitative data (>5 readings)	$r = \frac{\sum xy - n(\bar{x})(\bar{y})}{n(s_x)(s_y)}$		−1: (-) relation 0: no relation +1: (+) relation
Spearman's rank correlation	2 sets of discrete/ordinal, normal data (10-30 readings)	$r_0 = 1 - \left(\frac{6 - \sum D^2}{n^3 - n}\right)$		0: no relation 1: true relation
Simpson's index of diversity	Population data	$D = 1 - \left\{\sum \left(\frac{n}{N}\right)^2\right\}$		0: not diverse 1: very diverse
Mark-release-capture	Population data	$n = \frac{n_1 \times n_2}{n\ (\text{marked})}$		$n =$ total population