Singapore Examinations and Assessment Board

Singapore–Cambridge General Certificate of Education Normal (Technical) Level (2026)

Science (Syllabus 5148)

CONTENTS

INTRODUCTION

The syllabus is organised around contexts that students can relate to their everyday experiences and the commonly observed phenomena in nature. The contexts are presented as **Machines Around Us (II)**, **Food Matters** and **Our Body and Health (II)**. These contexts have been chosen because they provide a strong link between the concepts to be learnt and their applications. The topics encompassed by each context are not to be viewed as compartmentalised blocks of knowledge, but rather as interdependent and united through that context.

AIMS

The *Aims* of the syllabus are to:

1. develop 21st century competencies in students which would enable them to

    1.1 apply critical and inventive thinking to identify and solve problems

    1.2 communicate and collaborate with others effectively

    1.3 show care and concern for people and the environment.

2. guide students in acquiring knowledge, skills and values for application in their daily lives such that they

    2.1 are motivated to learn Science through contextualised and hands-on learning

    2.2 become confident citizens who are able to make sound decisions tapping on Science and technology

    2.3 develop safe and ethical practices

    2.4 understand the use of ICT and appropriate tools for scientific inquiry and analysis of issues.

3. prepare students for future learning and work such that they

    3.1 become lifelong and motivated learners

    3.2 develop skills which are useful and relevant for them to be contributing citizens.

PRACTICES OF SCIENCE

The *Practices of Science* represent the set of established procedures and practices associated with scientific inquiry, what scientific knowledge is, how it is generated and established, and how Science is applied in society respectively. It consists of three components:

1. Demonstrating Ways of Thinking and Doing in Science (WoTD)

1.1 Posing questions and defining problems

1.2 Designing investigations

1.3 Conducting experiments and testing solutions

1.4 Analysing and interpreting data

1.5 Communicating, evaluating and defending ideas with evidence

1.6 Making informed decisions and taking responsible actions

1.7 Using and developing models

1.8 Constructing explanations and designing solutions.

2. Understanding the Nature of Scientific Knowledge (NOS)

2.1 Science is an evidence-based, model-building enterprise concerned with understanding the natural world

2.2 Science assumes there are natural causes for physical phenomena and an order and consistency in natural systems

2.3 Scientific knowledge is generated using a set of established procedures and practices, and through a process of critical debate within the scientific community

2.4 Scientific knowledge is reliable and durable, yet open to change in the light of new evidence.

3. Relating Science, Technology, Society and Environment (STSE)

3.1 There are risks and benefits associated with the application of science in society. Science and its applications have the potential to bring about both benefits and harm to society

3.2 Applications of science often have ethical, social, economic and environmental implications

3.3 Applications of new scientific discoveries often inspire technological advancements while advances in technology motivate scientists to ask new questions and/or empower scientists in their inquiry (e.g. collecting more precise data or carrying out more complex data analysis).

The *Practices of Science* serve to highlight that the discipline of Science is more than the acquisition of a *body of knowledge* (e.g. scientific facts, concepts, laws, and theories); it is also a way of *thinking and doing*. In particular, it is important to appreciate that the cognitive, epistemic and social aspects of the *Practices of Science* are intricately related. For example, observation of events can lead to the generation of scientific knowledge which is simultaneously shaped by the beliefs of scientific knowledge. In addition, scientists develop models to construct theories, based on the assumption that there is order and consistency in natural systems. The practice of theory-making, in turn, reinforces the explanatory power of scientific knowledge. The scientific endeavour is embedded in the wider ethical, social, economic and environmental contexts.

ASSESSMENT OBJECTIVES

The *Assessment Objectives* listed below reflect those parts of the *Aims* and *Practices of Science* that will be assessed.

A Knowledge with Understanding

Candidates should be able to demonstrate knowledge and understanding in relation to:

1. scientific phenomena, facts, laws, definitions, concepts, theories

2. scientific vocabulary, terminology and conventions (including symbols, quantities and units contained in '*Signs, Symbols and Systematics 16-19'*, Association for Science Education (2000) and the recommendations on terms, units and symbols in *Biological Nomenclature*, 4th Edition (2009) published by the Institute of Biology, in conjunction with the Association for Science Education)

3. scientific instruments and apparatus including techniques of operation and aspects of safety

4. scientific quantities and their determination

5. scientific and technological applications with their social, economic and environmental implications.

The subject content defines the factual knowledge that candidates may be required to recall and explain. Questions testing these objectives will often begin with one of the following words: *define, name, state, describe, explain or outline* (see the *Glossary of Terms*).

B Handling and Applying Information

Candidates should be able (in words or by using symbolic, graphical and numerical forms of presentation) to:

1. locate, select, organise and present relevant information from a variety of sources

2. transpose information from one form to another

3. process numerical and qualitative data

4. use information to identify patterns, report trends and draw inferences

5. present reasoned explanations for phenomena, patterns and relationships

6. make predictions

7. solve problems.

These *Assessment Objectives* cannot be precisely specified in the syllabus content because questions testing such skills may be based on information which is unfamiliar to the candidate. In answering such questions, candidates are required to use principles and concepts that are within the syllabus and apply them in a logical, reasoned or deductive manner to a novel situation. Questions testing these objectives will often begin with one of the following words: *predict, deduce, suggest, calculate* or *determine* (see the *Glossary of Terms*).

C Experimental Skills and Investigations

Candidates should be able to:

1. select and use techniques, apparatus and materials
2. make and record observations and measurements
3. handle experimental data and observations
4. interpret and evaluate experimental results
5. suggest improvements to experimental procedures.

Scientific subjects are, by their nature, experimental. It is therefore important that the candidates carry out appropriate practical work to facilitate the learning of this subject and to meet objectives C1–C5 above.

USE OF CALCULATORS

An approved calculator may be used in all papers.

SCHEME OF ASSESSMENT

Candidates are required to enter for Papers 1 and 2. All questions in the two papers are compulsory.

Paper	Type of paper	Duration	Marks	Weighting
1	E-Examination Multiple choice, selected response, short-answer and structured	1 h 15 min	50	50%
2	Short-answer and structured	1 h	50	50%

Paper 1: **E-Examination** (1 h 15 min, 50 marks)	Paper 1 consists of two sections: Section A will carry 40 marks and consist of 30 multiple-choice questions (30 marks) and 2 to 5 selected response questions (10 marks). Section B will carry 10 marks and consist of 2 to 3 selected-response, short-answer and/or structured questions with video, animation or interactive stimuli. Selected response questions in Paper 1 may include matching, checkbox, drag and drop, and fill-in-the blank. Candidates answer questions on a computer for Paper 1.
Paper 2: (1 h, 50 marks)	Paper 2 will carry 50 marks and consist of a variable number of short-answer and structured questions. One of the questions is a data-response question, requiring candidates to interpret, evaluate or solve problems using data and/or observations. This question will carry 8–12 marks.

Weighting of Assessment Objectives

Papers 1 and 2 (100 marks in total)

A **Knowledge with Understanding**, approximately 60% of the marks with approximately one-third allocated to recall.

B **Handling and Applying Information**, approximately 40% of the marks.

Objectives A and B may be assessed through questions which involve experimental skills and investigations. These questions, when set, are also intended to meet appropriate aspects of objectives C1–C5.

Questions on experimental skills and investigations will normally be set within the bounds of the syllabus. If questions are based on apparatus or topics beyond the syllabus, candidates will not be assessed on knowledge of the apparatus or topics. They will be assessed on knowledge or general skills (e.g. reading of scales, data handling), which are required by the syllabus. Questions may be set requiring the candidates to:

(a) select appropriate experimental techniques
(b) select and organise apparatus and materials
(c) draw, complete or label diagrams of apparatus
(d) record observations and readings from apparatus
(e) read, complete or draw tables of data
(f) take readings from or plot graphs
(g) determine a gradient, intercept or intersection on a graph
(h) interpret or draw conclusions from observations and experimental data
(i) suggest a needed modification to a step in an experiment
(j) recognise or comment on possible sources of error from experimental data
(k) comment on the safety or suggest safety procedures when using apparatus, materials and techniques.

CONTENT STRUCTURE

Section	Topics	
I. Machines Around Us (II)	1.1	Energy
	1.2	Electricity
	1.3	Wave
	1.4	Effects of Force
II. Food Matters	2.1	Sources of Food
	2.2	Food Chemistry
	2.3	Food Safety
III. Our Body and Health (II)	3.1	Staying Healthy
	3.2	Digestion
	3.3	Breathing
	3.4	Blood Circulation

SYLLABUS CONTENT

SECTION I: MACHINES AROUND US (II)

1.1 Energy

Content

- Energy conversion and conservation
- Power
- Electricity generation and transmission

Learning Outcomes

Candidates should be able to:

(a) show an understanding that electrical energy, kinetic energy, light energy, potential energy (chemical, elastic and gravitational), sound energy and thermal energy are examples of different forms of energy

(b) show an understanding that thermal energy is transferred from a region of higher temperature to a region of lower temperature until both regions reach the same temperature

(c) state the principle of conservation of energy and apply the principle to solve problems

(d) recall and apply the relationship *power* = *energy* / *time taken* to solve problems

(e) describe the generation of electricity with reference to the energy conversions that take place in fossil fuel power stations

(f) explain why electricity is transmitted from power stations through a grid of high voltage transmission lines

(g) describe the use of step-up and step-down transformers in transmission of electricity and in electrical appliances (the term *alternating current* is **not** required)

1.2 Electricity

Content

- Series and parallel circuits
- Electric power and energy

Learning Outcomes

Candidates should be able to:

(a) draw and interpret circuit diagrams, and set up circuits, with power sources (cell or battery), switches, lamps, resistors (fixed and variable), bells, fuses, ammeters and voltmeters

(b) identify series and parallel arrangements of circuit components

(c) use a multimeter to measure current, voltage and resistance

(d) state that the current is the same at every point in a series circuit

(e) state that the current through the power source is the sum of the currents in the separate branches of a parallel circuit

(f) state that the voltage across the power source is equal to the sum of voltages across the other components in a series circuit

(g) state that the voltage is the same across the separate branches of a parallel circuit

(h) state that the effective resistance increases when the number of resistors connected in series increases

(i) state that the effective resistance decreases when the number of resistors connected in parallel increases

(j) explain the advantages of connecting household appliances in parallel

(k) identify voltage rating and power rating found on a label of an electrical appliance

(l) recall and apply the relationship *power* = *current* × *voltage* to solve problems

(m) calculate the cost of using electrical appliances where the energy unit is the kWh

(n) identify electricity usage found on an electricity bill

(o) state some ways to reduce electrical energy wastage in daily lives (e.g. use energy-efficient appliances)

1.3 Wave

Content

- Describing wave generation
- Wave terms
- Applications of waves

Learning Outcomes

Candidates should be able to:

(a) describe how waves can be generated by vibrations, as illustrated by wave motion in ropes and springs (the terms *longitudinal* and *transverse* are **not** required)

(b) show an understanding that waves transfer energy

(c) show an understanding of the terms *amplitude*, *frequency* and *wavelength* used to describe wave motion

(d) state some uses of the following types of waves:

  (i) radio waves (e.g. radio and television communications)

  (ii) microwaves (e.g. microwave oven, satellite communication)

  (iii) infrared (e.g. remote-controlled devices)

  (iv) light (e.g. optical fibres for telecommunication)

  (v) ultraviolet (e.g. sterilisation, sunbeds)

  (vi) X-rays (e.g. engineering and radiological applications)

  (vii) gamma rays (e.g. medical treatment)

1.4 Effects of Force

Content

- Effects of force
- Speed and acceleration
- Distance-time graph

Learning Outcomes

Candidates should be able to:

(a) use a ruler and a measuring tape to measure length

(b) use a digital stopwatch to measure time interval

(c) show an understanding of the following effects of force:

  (i) change in shape and/or size of an object

  (ii) change the state of rest or motion of an object (including change in speed and/or direction)

  (iii) bring about turning effect of an object

(d) show an understanding of what is meant by speed and acceleration

(e) recall and apply the relationship *average speed = total distance / total time taken* to solve problems

(f) recall and apply the relationship *acceleration = change in speed / time taken* to solve problems (for motion in one direction only)

(g) plot and interpret a distance-time graph

(h) describe the moment of a force in terms of its turning effect and relate this to everyday examples (knowledge of equations is **not** required)

SECTION II: FOOD MATTERS

2.1 Sources of Food

Content

- Growing plants
- Food production

Learning Outcomes

Candidates should be able to:

(a) state that plants need air, light, water, nutrients and appropriate pH for photosynthesis and growth

(b) show an understanding that the increase in world population and the limitation in space to grow food lead to the need to improve food production

(c) describe how the following methods improve crops produced:

  (i) use of fertilisers

  (ii) use of pesticides and herbicides

  (iii) slash-and-burn

(d) describe the environmental problems associated with the following methods:

  (i) use of fertilisers (water contamination leading to increased growth of algae and water weeds)

  (ii) use of pesticides and herbicides (soil and water contamination leading to transfer of harmful substances along the food chain)

  (iii) slash-and-burn method (haze leading to breathing difficulties and deforestation leading to soil erosion)

(e) explain how the use of biological control reduces the need for pesticides (limited to control of prey by their predators)

(f) describe how food production can be improved by:

  (i) improving varieties of plants and animals

  (ii) intensive farming methods for crops and farm animals (e.g. chicken, fish)

  [details of technologies are **not** required]

(g) state that plant hormones are used as weed killers, and in regulating growth and ripening of fruits

2.2 Food Chemistry

Content

- Separation techniques
- Acids and bases

Learning Outcomes

Candidates should be able to:

(a) use a measuring cylinder to measure volume of liquid/solid

(b) explain that substances can be separated from a mixture through the following techniques:

  (i) dissolving

  (ii) filtration

  (iii) evaporation

  (iv) distillation

  (v) paper chromatography

(c) state some uses of separation techniques in homes and food industries (e.g. remove tea leaves from a cup of tea, obtain water from seawater)

(d) describe a chemical reaction as a process that leads to the formation of new products

(e) state the following everyday changes that involve chemical reactions and how they can be slowed down:

  (i) decaying of food slowed down by food preservation methods (see also LO 2.3(d))

  (ii) cooking of food and burning of fuel slowed down by reducing oxygen/fuel supply

  (iii) rusting of iron cans slowed down by tin-plating

(f) describe the properties of acids and alkalis in terms of their effects on litmus paper and universal indicator solution

(g) use universal indicator solution and a pH meter to measure pH

(h) describe acidity, neutrality and alkalinity in terms of the pH scale

(i) describe the characteristic properties of acids in terms of their reactions with metals, bases and carbonates that are found in daily lives:

  (i) metals (e.g. cooking utensil)

  (ii) bases (e.g. toothpaste, antacid)

  (iii) carbonates (e.g. baking soda, effervescent vitamin C tablet)

  [knowledge of general products is required; chemical names of salts and equations are **not** required]

(j) state that neutralisation takes place when an acid reacts with a base and the products can be salt and water only

2.3 Food Safety

Content

- Food preservation
- Food additives

Learning Outcomes

Candidates should be able to:

(a) state what microbes are

(b) describe the action of microbes on food (e.g. bacteria on milk, mould on bread)

(c) state that stopping or reducing microbial activity may prevent food spoilage

(d) describe the following methods of preventing food spoilage and give example(s) for each of them:

  (i) lowering pH (pickling)

  (ii) reducing oxygen supply (bottling and vacuum packaging)

  (iii) reducing water content (freeze-drying, dehydration and use of chemical preservatives)

  (iv) using high temperature (sterilisation, pasteurisation and canning)

  (v) using low temperature (freezing)

(e) explain the use of the following food additives and give examples for each of them:

  (i) preservatives (e.g. salt, sugar, sulfur dioxide, vinegar)

  (ii) nutritional supplements (e.g. minerals, vitamins)

  (iii) texture and appearance modifiers (e.g. food colourings, starch)

SECTION III: OUR BODY AND HEALTH (II)

3.1 Staying Healthy

Content

- Maintaining good physical health
- Problems related to bones and joints

Learning Outcomes

Candidates should be able to:

(a) state the following ways in maintaining good physical health:

  (i) adopting an active lifestyle

  (ii) eating a balanced diet

  (iii) having sufficient rest

  (iv) practising good hygiene

(b) show an understanding of what is meant by a balanced diet

(c) state the dietary importance of carbohydrates, dietary fibre, fats, proteins, minerals (calcium), vitamins (vitamin D) and water

(d) recall and determine the body mass index, $BMI = mass\ (kg)/[height\ (m) \times height\ (m)]$ to deduce whether an individual's mass is in the healthy range

(e) describe the health risks of undereating and over-exercising to lose weight

(f) describe the following problems related to bones: fracture and osteoporosis

(g) state the following parts associated with common joints and their functions: cartilage and ligament

(h) describe the following problems related to parts associated with joints: arthritis, dislocation and sprain

(i) state how diet and level of physical activity can affect the risk of developing problems related to bones and joints

(j) state that diseases can be caused by bacteria or viruses (structures of bacteria and viruses are **not** required)

(k) describe the effects of antimicrobial agents (e.g. antiseptics, disinfectants) on the population growth of microbes (e.g. bacteria, fungi)

(l) explain the importance of completing a prescribed course of antibiotics for diseases caused by bacteria

(m) state that diseases caused by bacteria and viruses may be prevented by vaccinations

(n) state that some diseases/conditions are hereditary by nature (e.g. sickle cell disease, thalassemia, colour deficiency)

(o) state some limitations of the use of technology in replacing or supporting malfunctioning organs (e.g. tissue rejection after organ transplant, lifelong dependence on kidney dialysis)

3.2 Digestion

Content

- Digestive system
- Problems related to digestive system

Learning Outcomes

Candidates should be able to:

(a) explain the importance of digestion

(b) identify the following main organs and associated organs of the digestive system, and state their functions: mouth, gullet, stomach, small intestine, large intestine, rectum, anus, salivary glands, pancreas, liver and gall bladder

(c) show an understanding that enzymes speed up the rate of digestion and require an optimum temperature and pH to work efficiently (names of enzymes and substrates are **not** required)

(d) interpret data on the effect of pH and temperature on the rate of digestion by enzymes

(e) explain why constipation occurs and state possible preventive measures

(f) state the effects of excessive alcohol consumption on the liver (e.g. damaged liver, liver cancer)

(g) state how diet and level of physical activity can affect the risk of developing diabetes

3.3 Breathing

Content

- Respiratory system
- Effects of smoking

Learning Outcomes

Candidates should be able to:

(a) describe the roles of breathing and respiration in keeping humans alive

(b) identify the following parts of the respiratory system and state their functions: windpipe, bronchi, lungs, diaphragm and ribcage

(c) explain the differences in the composition of inhaled and exhaled air

(d) use simple tests for:

  (i) carbon dioxide (limewater test)

  (ii) water vapour (cobalt chloride paper test)

  [knowledge of detailed procedures of tests is **not** required]

(e) explain how choking affects breathing

(f) state the effects of smoking and passive smoking on the respiratory system (e.g. bronchitis, lung cancer)

3.4 Blood Circulation

Content

- Circulatory system
- Problems related to circulatory system

Learning Outcomes

Candidates should be able to:

(a) state the following components of blood: plasma, platelets, red blood cells and white blood cells

(b) state the role of blood and its following components in transport and defence:

  (i) plasma – transport of digested food substances and waste substances (carbon dioxide)

  (ii) platelets – clotting of blood

  (iii) red blood cells – transport of oxygen

  (iv) white blood cells – antibody formation, destruction of bacteria and viruses, and tissue rejection

(c) outline the pathway of blood through the heart and the lungs in relation to the transport of oxygen and carbon dioxide

(d) state the structure of arteries, veins and capillaries, and relate it to their functions

(e) state that blood pressure, heart rate and pulse rate can be used to monitor the condition of the circulatory system

(f) explain why breathing rate, heart rate and pulse rate increase during physical activities

(g) describe how the formation of plaque leads to heart attack and stroke

(h) state how diet, level of physical activity and smoking can affect the risk of developing heart diseases, high blood pressure and stroke

SUMMARY OF KEY QUANTITIES, SYMBOLS AND UNITS

Candidates should show familiarity with the following physical quantities and their symbols. They should be able to state the units in which these quantities are measured.

Quantity	Symbol	Unit
length	*l, h . . .*	km, m, cm, mm
area	*A*	m^2, cm^2
volume	*V*	m^3, dm^3, cm^3
		l, L, m*l*, mL
		($1l = 1000\ cm^3 = 1\ dm^3$)
weight	*W*	N
mass	*m, M*	kg, g, mg
		tonne ($1t = 1000$ kg)
time	*t*	h, min, s, ms
concentration	*c*	g/ dm^3
speed	*u, v*	km/h, m/s, cm/s
acceleration	*a*	m/s^2
force	*F, f*	N
moment of force		Nm
energy	*E*	J, kJ, kWh
power	*P*	W, kW
temperature	θ, *T*	°C, K
speed of rotation		rev/min, rev/s
frequency	*f*	Hz, kHz, MHz
wavelength	λ	m, cm
potential difference / voltage	*V*	V, mV
current	*I*	A, mA
resistance	*R*	Ω, kΩ

CHEMICAL NAMES, SYMBOLS AND FORMULAE

The list below is a guide to some of the chemical names that candidates may encounter in examination papers. The chemical symbols/formulae will **not** be assessed.

Chemical Names	Chemical Symbols / Formulae
Hydrogen	H
Oxygen	O
Nitrogen	N
Carbon	C
Chlorine	C*l*
Aluminium	A*l*
Calcium	Ca
Chromium	Cr
Copper	Cu
Iron	Fe
Lead	Pb
Nickel	Ni
Tin	Sn
Hydrochloric acid	HC*l*
Nitric acid	HNO_3
Sulfuric acid	H_2SO_4
Ethanoic acid (vinegar)	CH_3CO_2H
Calcium carbonate	$CaCO_3$
Calcium hydroxide	$Ca(OH)_2$
Potassium hydroxide	KOH
Sodium hydroxide	NaOH
Water	H_2O
Ammonia	NH_3
Carbon dioxide	CO_2
Carbon monoxide	CO
Hydrogen gas	H_2
Oxygen gas	O_2
Nitrogen gas	N_2
Sulfur dioxide gas	SO_2

GLOSSARY OF TERMS USED IN SCIENCE PAPERS

It is hoped that the glossary (which is relevant only to science papers) will prove helpful to candidates as a guide, i.e. it is neither exhaustive nor definitive. The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings.

Candidates should appreciate that the meaning of a term must depend in part on its context.

1. *Calculate* is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.

2. *Classify* requires candidates to group things based on common characteristics.

3. *Comment* is intended as an open-ended instruction, inviting candidates to recall or infer points of interest relevant to the context of the question, taking account of the number of marks available.

4. *Compare* requires candidates to provide both similarities and differences between things or concepts.

5. *Define* (the term(s)…) is intended literally, only a formal statement or equivalent paraphrase being required.

6. *Describe* requires candidates to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena. In the latter instance the answer may often follow a standard pattern, e.g. Apparatus, Method, Measurement, Results and Precautions.

   In other contexts, *describe and give an account* of should be interpreted more generally, i.e. the candidate has greater discretion about the nature and the organisation of the material to be included in the answer. *Describe and explain* may be coupled in a similar way to *state and explain*.

7. *Determine* often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula.

8. *Estimate* implies a reasoned order of magnitude statement or calculation of the quantity concerned, making such simplifying assumptions as may be necessary about the points of principle and about values of quantities not otherwise included in the question.

9. *Explain* may imply reasoning or some reference to theory, depending on the context.

10. *Find* is a general term that may be variously interpreted as calculate, measure, determine, etc.

11. *List* requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified, this should not be exceeded.

12. *Measure* implies that the quantity concerned can be directly obtained from a suitable measuring instrument, e.g. length, using a rule, or angle, using a protractor.

13. *Outline* implies brevity, i.e. restricting the answer to giving essentials.

14. *Predict* or *deduce* implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted from an earlier part of the question. Predict also implies a concise answer with no supporting statement required.

15. *Sketch*, when applied to graph work, implies that the shape and/ or position of the curve need only be qualitatively correct, but candidates should be aware that, depending on the context, some quantitative aspects may be looked for, e.g. passing through the origin, having the intercept, asymptote or discontinuity at a particular value.

    In diagrams, sketch implies that a simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear exposition of important details.

16. *State* implies a concise answer with little or no supporting argument, e.g. a numerical answer that can be obtained 'by inspection'.

17. *Suggest* is used in two main contexts, i.e. either to imply that there is no unique answer, or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may be formally 'not in the syllabus'.

18. *What do you understand by*/*What is meant by* (the term(s)...) normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in light of the indicated mark value.

PRACTICAL GUIDELINES

Scientific subjects are, by their nature, experimental. It is therefore important that the candidates carry out appropriate practical work to facilitate the learning of this subject. An outline of some practical activities that support learning for N(T) Science is shown below; the details of these activities can be found in the teaching resources.

The list of practical activities is not intended to be exhaustive. Candidates should show familiarity with the techniques used in these experiments. Reference may be made to the techniques used in these experiments in the theory papers but no detailed description of the experimental procedures will be required.

- Measurements of length, mass, temperature, time interval, volume of liquids/solids and force (e.g. weight) using appropriate instruments such as ruler, measuring tape, electronic balance, laboratory thermometer, digital stopwatch, measuring cylinder and spring balance

- Determination of average speed of an object

- Measurements of current, voltage and resistance using multimeter

- Separation of mixtures by filtration, evaporation and simple paper chromatography

- Determination of pH of a substance using pH meter or universal indicator solution

- Investigation of effect of antimicrobial agents on the population growth of microbes

- Test for the presence of carbon dioxide (using limewater) and water vapour (using cobalt chloride paper) in exhaled air

- Measurements of average pulse rate when resting and after physical activity