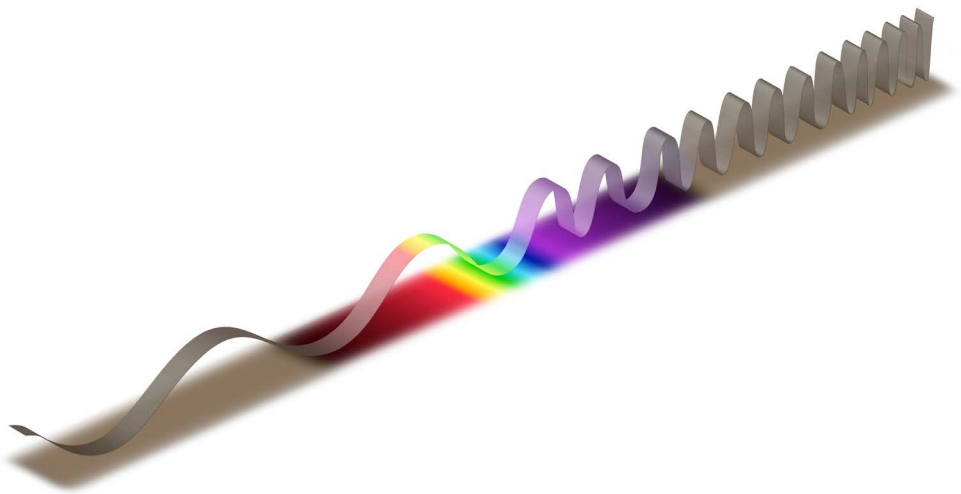
Cambridge Assessment International Education

Practice Planning Questions

Cambridge O Level

Physics 5054

To accompany the revised syllabus for examination from 2023.



Version 1

Cambridge Pathway

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Introduction

The purpose of this booklet is to provide additional practice planning questions and an associated mark scheme. Planning questions have been introduced to Cambridge O Level Physics (5054) Papers 3 and 4 for first assessment in 2023.

Practice questions have been provided to exemplify a range of types of questions which could appear in examinations.

A typical mark scheme is also provided.

Other support materials are available on the School Support Hub **www.cambridgeinternational.org/support**

Example planning questions

1 A student states that the distance a toy truck travels along a horizontal floor after rolling down a ramp depends on the mass of the truck.

Plan an experiment to determine whether or not the student is correct.

Fig. 1.1 shows an example of the set-up.

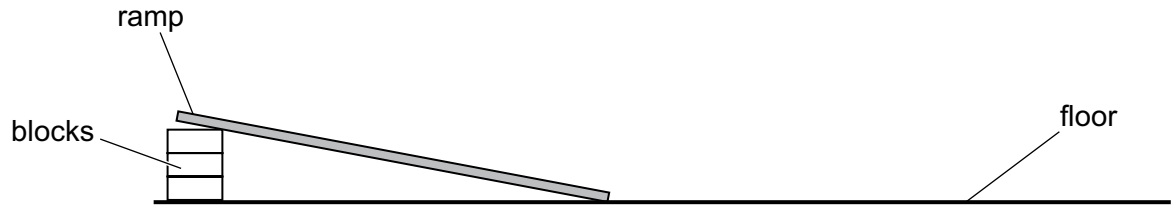

Fig. 1.1

The following apparatus is available:

a ramp
a selection of masses
a toy truck
blocks to support the masses
any other apparatus and materials usually available in a school physics laboratory.

You are **not** required to do this experiment.

In your plan, you should:

- list any additional apparatus needed
- explain briefly how you would do the experiment
- state the key variables to control
- draw a table, with column headings, to show how you would display your readings (you are **not** required to enter any readings into the table).

You may add to the diagram in Fig. 1.1 to help your description. [6]

2 A student is investigating the force needed to slide a wooden block across a surface.
He notices that some blocks need more force to start to slide than other blocks do. He suggests that the amount of force needed depends on the mass of the block.

Plan an experiment to determine whether or not the student is correct.

Fig. 2.1 shows part of the set-up.

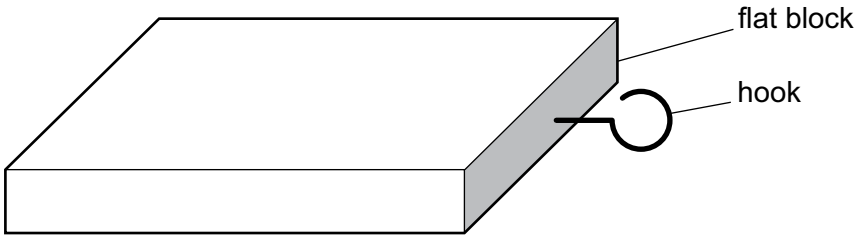

Fig. 2.1

The following apparatus is available:

one lightweight, flat wooden block with a hook fitted
a pulley which can be clamped to a bench
any other apparatus and materials that are usually available in a school physics laboratory.

You are **not** required to do this experiment.

In your plan, you should:

- list any additional apparatus needed
- draw a clearly labelled diagram of how the apparatus should be arranged
- give brief instructions for doing the experiment
- describe any precautions the student should take to ensure repeatable results
- suggest a graph which could be drawn. [6]

3 The converging (convex) lenses used in a school physics laboratory are made with a variety of thicknesses and have different focal lengths.

The focal length f of a lens can be calculated if u (the distance between the object and the lens) and v (the distance between the lens and the image on a screen) are known.

The equation is: $f = \frac{uv}{(u + v)}$

Fig. 3.1

Plan an investigation to determine the relationship between the thickness t and the focal length f of converging lenses. Fig. 3.1 shows the thickness t.

The following apparatus is available:

illuminated object
selection of lenses of different thicknesses and a lens holder
screen
metre rule
30 cm ruler
two rectangular wooden blocks with the longest side of each block longer than the diameter of the lens.

You are **not** required to do this investigation.

In your plan, you should:

- draw a diagram to show the arrangement of the apparatus, labelling u and v
- explain briefly how you would do the investigation, including the measurements you would take
- explain briefly how you would determine the thickness t of each lens (you may draw a diagram if it helps your explanation)
- draw a table, with column headings, to show how you would display your readings (you do **not** need to use the equation to calculate focal lengths).

You may add to the diagram in Fig. 3.1 to help your description. [6]

4 A student is investigating the factors that affect the height to which a ball bounces when it is dropped.

Plan an experiment to investigate in detail how the height from which a ball is dropped affects how high it bounces.

The following apparatus is available:

balls of different materials and sizes
sheets of different types of floor coverings
any other apparatus and materials that are usually available in a school physics laboratory.

You are **not** required to do this experiment.

In your plan, you should:

- list any additional apparatus needed
- give brief instructions for doing the experiment
- describe a precaution the student should take to ensure that measurements of the height of bounce are repeatable
- state the key variables to control
- draw a table, with column headings, to show how to display the readings (you are **not** required to enter any readings into the table)
- explain how to analyse the readings to reach a conclusion.

You may draw a diagram if it helps to explain your plan. [6]

5 A student uses an electrical heater to heat a beaker of water.
She notices that the time taken to heat the beaker of water changes when the voltage across the heater is changed. Fig. 5.1 shows part of her set-up.

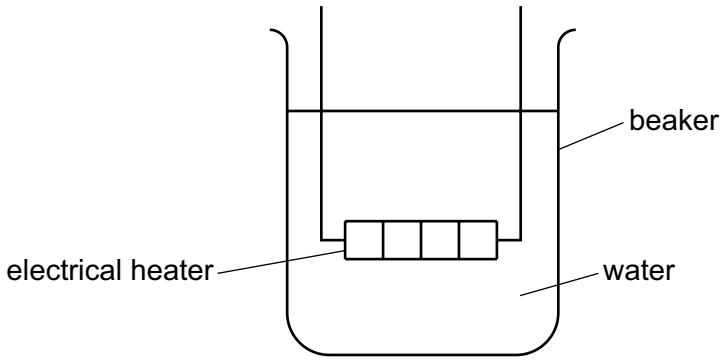

Fig. 5.1

The power P of the heater is given by the equation $P = VI$, where V is the potential difference (p.d.) across the heater and I is the current in the heater.

Plan an investigation to determine the relationship between the power produced by an electrical heater and the time taken to heat a beaker of water.

The following apparatus is available:

ammeter
voltmeter
0–12 V variable power supply
250 cm^3 beaker
heater
thermometer
stopwatch
any other apparatus and materials that are usually available in a school physics laboratory.

You are **not** required to do this investigation.

In your plan, you should:

- complete the diagram in Fig. 5.1 to show the circuit that you would use
- explain briefly how you would do the investigation
- state the key variables to control
- draw a table, with column headings, to show how you would display the readings (you are **not** required to enter any readings into the table)
- explain how you would use the results to reach a conclusion. [6]

6 A teacher tells her class that the resistance of a wire depends on the length of the wire, the type of metal from which the wire is made and the diameter of the wire.

The resistance R can be calculated by the equation $R = \frac{V}{I}$ where V is the potential difference (p.d.) across the wire and I is the current through the wire.

Plan an investigation for a student to determine how the resistance of a wire depends on the length of the wire. The student will plot a suitable graph.

The following apparatus is available:

ammeter
voltmeter
power supply
variable resistor
switch
connecting leads
resistance wires of different lengths
metre rule.

You are **not** required to do this investigation.

In your plan, you should:

- draw a diagram of the circuit to be used to determine the resistance of each wire
- give brief instructions for doing the investigation
- suggest suitable lengths of wire
- state the key variables to control
- draw a table (or tables), with column headings, to show how to display the readings to enable a suitable graph to be drawn (you are **not** required to enter any readings into the table). [6]

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	<u>'List rule' guidance</u> For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6	Calculation specific guidance Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values. For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme. Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.
7	Guidance for chemical equations Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme. State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Abbreviations and guidance

;	Separates marking points.
/	Alternative answers for the same marking point.
underline	Actual word underlined must be used by candidate (grammatical variants accepted).
(brackets)	The word or phrase in brackets is not required but sets the context.
AND / and	Statements on both sides of the **AND** are needed for that mark.
OR / or	Indicates alternative answers, any one of which is satisfactory for scoring the marks.
NOT / not	Indicates that an incorrect answer is not to be disregarded but cancels another otherwise correct alternative offered by the candidate for this mark.
Accept / A	A less than ideal answer which should be marked correct.
Ignore / Ig	Indicates that something which is not correct or irrelevant is to be disregarded.
e.c.f.	'error carried forward'
o.w.t.t.e.	'or words to that effect'
s.f.	'significant figures' – answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme.
Arithmetic errors	If the **only** error in arriving at a final answer is clearly an arithmetic one, all but the final **A** mark can be awarded. Regard a power of ten error as an arithmetic error.
Transcription errors	If the **only** error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly, all but the final **A** mark can be awarded.
Fractions	Only accept these where specified in the mark scheme.
Crossed-out work	Work which has been crossed out and not replaced but can easily be read, should be marked as if it had not been crossed out.

Example planning questions mark scheme

Question	Answer	Marks
1	**Method** (3 marks) • place truck on ramp (and release) • measure distance (travelled) from bottom of ramp • repeat with different masses (loaded on the same truck) **Apparatus** (1 mark) (metre) rule(r) / measuring tape **Control variables** (1 mark) Any **one** from: • height / angle of ramp / number of supporting bricks • release position / height above bench **Table** (1 mark) table with clear columns for mass and for distance travelled, with appropriate units in the headings of the table	**6**

Question	Answer	Marks
2	**Apparatus** (1 mark) forcemeter, (10 g and 100 g) masses / masses only (if clear they are used to change the mass of the block and as weights to the block via the pulley) **Diagram** (1 mark) block, workable means of pulling and measuring force **Method** (2 marks) • measure force required to make block slide / find mass (on pulley) required to make block slide • repeat for different values of mass **Precaution** (1 mark) Any **one** from: • same surface to slide on • repeat each measurement and take average • same angle of pulling force **Graph** (1 mark) mass on block vs force (needed to slide)	**6**

Question	Answer	Marks
3	**Diagram** (1 mark) diagram showing object, lens, screen / image in correct order with *u* and *v* labelled **Method** (3 marks) • measure / record / calculate *u* and *v* and lens thickness *t* • repeat with a different lens • method of obtaining a sharp image by moving object, lenses or screen **Measuring lens thickness** (1 mark) use of blocks either side of lens (and measure distance) **Table** (1 mark) table with columns for *u*, *v* and *t* with correct units	**6**

Question	Answer	Marks
4	**Apparatus** (1 mark) metre rule / measuring tape **Method** (1 mark) drop ball from measured heights, measure height of first bounce, repeat for different heights of release **Precaution** (1 mark) Any **one** from: • repeat (for each height of release) and average • measure to same part of ball each time • measure height of bounce at eye level • release without throwing / impeding • use of video (for height of bounce) **Control variable** (1 mark) Any **one** from: • same (diameter / mass / material) ball • same type of floor covering **Table** (1 mark) columns for release height and bounce height with units in the headings **Analysis** (1 mark) Any **one** from: • suitable analysis of readings e.g. find ratio of drop height to bounce height • draw a suitable graph of drop height against bounce height	**6**

Question	Answer	Marks
5	**Circuit diagram** (1 mark) workable, correct circuit diagram with power source and correct symbols for ammeter and voltmeter **Method** (2 marks) • measuring V, I and time for water temperature to increase by a specific amount • repeating with at least two other values of V or power and / or I **Control variable** (1 mark) Any **one** from: • same starting temperature • same temperature difference • same room temperature • same volume / mass / amount of water **Table** (1 mark) clear columns for time, V and I, with appropriate units and P (or VI) **Conclusion** (1 mark) plot a graph of power against time	**6**

Question	Answer	Marks
6	**Circuit diagram** (2 marks) • sample of wire must be clearly identifiable by a label on the diagram or by letters on the diagram with an explanation in the text • all circuit symbols correct (even if circuit is incorrect) **Method** (2 marks) • take readings of V and I • range of lengths must be between 5 cm and 2 m with the largest length at least twice the smallest **Control variable** (1 mark) Any **one** from: • material / resistivity / conductivity / type of wire • diameter / radius / thickness / cross-sectional area • temperature of wire **Table** (1 mark) drawn with headings: l / m, V / V, I / A, R / Ω	**6**

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Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
Tel: +44 (0)1223 553554 Fax: +44 (0)1223 553558
Email: info@cambridgeinternational.org www.cambridgeinternational.org