

National 5 Physics



Study Guide

Name: _____

Introduction

This study guide should be used to help National 5 Physics students prepare for their exam. When studying, you should use this booklet to help answer questions and track your progress. To be successful in physics you need to study **regularly** following the guidance in this booklet.

Final exam date – 25th of April 2024, 13:00 – 15:30 (2hrs 30mins).

Exam Format:

Section 1 – 25 marks of multiple-choice questions.

Section 2 – 110 marks of extended answer questions.

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National 5 Physics Topics

Unit 1 – Waves and Radiation

	Revised?	Revised?	Revised?
Wave Parameters and Behaviours			
Electromagnetic Spectrum			
Refraction of Light			
Types of Radiation			
Dosimetry and Safety			
Activity and Half-Life			
Nuclear Power			

Unit 2 – Dynamics and Space

	Revised?	Revised?	Revised?
Scalars and Vectors			
Velocity-time Graphs			
Acceleration			
Newton's Laws			
Energy			
Projectile Motion			
Space Exploration			
Cosmology			

Unit 3 – Electricity and Properties of Matter

	Revised?	Revised?	Revised?
Electrical Charge Carriers			
Potential Difference/Voltage			
Series and Parallel Circuits			
Practical Electronic Circuits (Transistors)			
Electrical Power			
Specific Heat Capacity			
Specific Latent Heat			
Gas Laws			

How to study for Physics

Pick a topic and follow these steps to effectively study Physics!

1. Review course material

Simply reading through your notes is **not enough** to help you learn the content. You need to **do something** with the material to help you understand it.

For example, you could:

- Create a Summary of your own notes highlighting the key points.
- Make flashcards – either physical cards or digital ones using tools like Anki and Brainscape.
- Complete a mind-map (templates on your Teams page).
- Write questions that you can swap with classmates to answer.

2. Problem Practice

Problem practice is key to success in physics. Regular practice helps reinforce your understanding of the concepts learned.

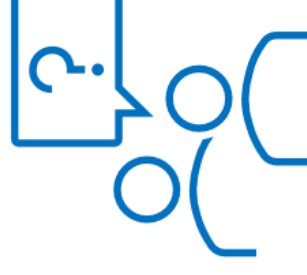
This should be done in two main ways:

- Tutorial Questions – Work through your tutorial questions on your chosen topic.
- Past paper questions – using the “Mr= Davie” past paper document on teams work your way through all the questions on your chosen topic. Make sure you check your answers using the marking scheme.

3. Ask for Help


If there are any concepts or questions you are still struggling with you can seek further help in several ways including:

- Asking your teacher – bring the specific question or concept you are struggling with!
- Look at the summary notes or textbooks for a different perspective. There are a range of resources on Teams that can be useful for this.
- Work with your classmates to try and understand the concept better.
- Take a break and revisit the material another time – sometimes a rest is all that is needed!



Calculator Help Sheet



Button/	How to get there	What is does
$\times 10^x$		Puts your answer to the power of 10, use for m, μ , k etc
ENG		Puts your answer to the power of 10 to a value that can be converted to a prefix, keep clicking the Eng to move up powers of 3 or shift Eng to move down
$S \leftrightarrow D$		Toggles between leaving your answer as a fraction or decimal
DEG		WHAT YOUR CALCULATOR MUST BE IN WHEN DOING PHYSICS USED FOR TRIG
RAD/Grad		DON'T LET YOUR CALCULATOR BE IN EITHER OF THESE
calculate		To work out a sum rather than statistics, the default setting
Input/output	Shift / set up 1	This decides if you want to use the MathIO (recommended Math decimal) which allows for the fraction button to be used or put in equations in a line format
Angle unit	Shift/set up 2	For checking your calculator is set to DEGREES
Number format	Shift/ set up 3	
Fix	Shift/ set up 3 / 1	This fixes the number of decimal places you want to display so will round up. Use this for individual questions only
Sci	Shift/ set up 3 / 2	Displays your answer in scientific notation, good when your answer requires this (lots of decimal places or a big number of sig fig etc)
Norm	Shift/ set up 3 / 3	Cancels the Fix and Sci but you then select the type of input you want (see above)
Norm 1~2		Selects between maths or line
Ab/c or d/c	Shift/ set up 4	Do you want vulgar fractions or full numbers and fractions
Recurring decimal	Shift / set up /down. 3	I RECOMMEND THIS BEING OFF, IT GIVES YOU THE DOT WHICH YOU MIGHT NOT NOTICE
Decimal mark	Shift/ set up / down 4	Should be set to dot, some countries use a comma instead of a dot in a number
pol	Shift +	Shift + number comma number bracket = FOR USE WITH VECTORS RIGHT ANGLED TRIANGLES, CONVERTS A VECTOR AND ANGLE TO X,Y
Rec	Shift -	Shift - number comma number bracket = FOR USE WITH VECTORS RIGHT ANGLED TRIANGLES, Converts an X and Y to resultant and angle (but not a bearing)
ANS		This stores the answer so you can use this for additional parts of the calculation
x^{-1}		Puts your number/answer over 1 (e.g. in Resistance in parallel)
Sin, cos, tan		Only needs for the angle in vector questions
$\circ \prime \prime$		Converts between hours, mins and second
		Fraction button RECOMMENDED to avoid problems of BODMAS

W.A.G.O.L.L

Solving Problems in Physics

When solving problems in physics follow the five steps below as shown in the example.

Step 1: Data List - Write the information given in the question in symbol form down the left-hand side to create a data list.

Step 2: Conversion - Convert your data list values into standard units. This may involve changing time into seconds or replacing prefixes where required.

Step 3: Formula - Write down the correct formula from the formula sheet. Look at your data list to help you here.

Step 4: Substitute - Substitute the values from your data list into the formula.

Step 5: Rearrange and Solve - Rearrange your equation if required (change side, change sign) and solve using your calculator. Remember to include units with your final answer.

Example: A school bus takes 20 minutes to travel 15km. What is the buses average speed for this journey?

1	2		
$t = 20\text{mins} = 1200\text{s} (20 \times 60)$		$d = vt$	3
$d = 15\text{km} = 15 \times 10^3\text{m}$		$15 \times 10^3 = v \times 1200$	4
$v = ?$		$v = \frac{15 \times 10^3}{1200}$	5
		<u>$v = 12.5 \text{ ms}^{-1}$</u>	

Other Useful Information

Prefixes

Prefix	Symbol	Multiple	Scientific Not.
Giga	G	X 1,000,000,000	X10 ⁹
Mega	M	X 1,000,000	X10 ⁶
Kilo	k	X 1,000	X10 ³
Milli	m	÷ 1,000	X10 ⁻³
Micro	μ	÷ 1,000,000	X10 ⁻⁶
Nano	n	÷ 1,000,000,000	X10 ⁻⁹

Greek Alphabet

Αα ALPHA [a] ἄλφα	Ββ BETA [b] βῆτα	Γγ GAMMA [g] γάμμα	Δδ DELTA [d] δέλτα	Εε EPSILON [e] ἑ ψιλόν	Ζζ ZETA [dʒ] ζῆτα
Ηη ETA [ɛ] ἦτα	Θθ THETA [tʰ] θήτα	Ιι IOTA [i] ἰῶτα	Κκ KAPPA [k] κάππα	Λλ LAMBDA [l] λάμβδα	Μμ MU [m] μῦ
Νν NU [n] νῦ	Ξξ XI [ks] ξεί	Οο OMICRON [o] ὀ μικρόν	Ππ PI [p] πί	Ρρ RHO [r] ῥῶ	Σσς SIGMA [s] σίγμα
Ττ TAU [t] ταῦ	Υυ UPSILON [u] ὀ ψιλόν	Φφ PHI [pʰ] φεῖ	Χχ CHI [kʰ] χεῖ	Ψψ PSI [ps] ψεί	Ωω OMEGA [ɔː] ὦ μέγα

Command Words

Command	How to answer
Describe	You must provide a statement or structure of characteristics/features.
Determine or Calculate	You must determine a number from given facts, figures or information. You should use numbers given in the question to work out the answer. You should always show your working.
Estimate	You must determine an approximate value for something.
Explain	You must relate cause and effect and/or make relationships between things clear. You should make something clear or state the reasons for something happening. This means that points in the answer must be linked coherently and logically. The answer should not be a simple list of reasons.
Identify, Name, State or Give	You need only name or present in brief form. Only a short answer is required, not an explanation or a description. Often it can be answered with a single word, phrase or sentence.
Justify	You must give reasons to support their suggestions or conclusions. For example, this might be by identifying an appropriate relationship and the effect of changing variables.
Predict	You must suggest what may happen based on available information.
Show that	You must use the appropriate formula to prove something (e.g. a given value) All steps, including the stated answer and units, must be shown.
Suggest	You must apply your knowledge and understanding of physics to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of physics.
Use your knowledge of physics	You must apply your skills, knowledge and understanding to respond appropriately to the problem/situation presented.
Use the information...	The answer must be based on the information given in the question. Unless the information given in the question is used, no marks can be given.
Compare	This requires you to describe the similarities and/or differences between things, not just write about one. If you are asked to 'compare x with y', you need to write down something about x compared to y, using comparative words such as 'better', 'more than', 'less than', 'quicker', 'more expensive', 'on the other hand.'

DATA SHEET

Speed of light in materials

Material	Speed in m s^{-1}
Air	3.0×10^8
Carbon dioxide	3.0×10^8
Diamond	1.2×10^8
Glass	2.0×10^8
Glycerol	2.1×10^8
Water	2.3×10^8

Gravitational field strengths

	Gravitational field strength on the surface in N kg^{-1}
Earth	9.8
Jupiter	23
Mars	3.7
Mercury	3.7
Moon	1.6
Neptune	11
Saturn	9.0
Sun	270
Uranus	8.7
Venus	8.9

Specific latent heat of fusion of materials

Material	Specific latent heat of fusion in J kg^{-1}
Alcohol	0.99×10^5
Aluminium	3.95×10^5
Carbon Dioxide	1.80×10^5
Copper	2.05×10^5
Iron	2.67×10^5
Lead	0.25×10^5
Water	3.34×10^5

Specific latent heat of vaporisation of materials

Material	Specific latent heat of vaporisation in J kg^{-1}
Alcohol	11.2×10^5
Carbon Dioxide	3.77×10^5
Glycerol	8.30×10^5
Turpentine	2.90×10^5
Water	22.6×10^5

Speed of sound in materials

Material	Speed in m s^{-1}
Aluminium	5200
Air	340
Bone	4100
Carbon dioxide	270
Glycerol	1900
Muscle	1600
Steel	5200
Tissue	1500
Water	1500

Specific heat capacity of materials

Material	Specific heat capacity in $\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$
Alcohol	2350
Aluminium	902
Copper	386
Glass	500
Ice	2100
Iron	480
Lead	128
Oil	2130
Water	4180

Melting and boiling points of materials

Material	Melting point in $^\circ\text{C}$	Boiling point in $^\circ\text{C}$
Alcohol	-98	65
Aluminium	660	2470
Copper	1077	2567
Glycerol	18	290
Lead	328	1737
Iron	1537	2737

Radiation weighting factors

Type of radiation	Radiation weighting factor
alpha	20
beta	1
fast neutrons	10
gamma	1
slow neutrons	3

$$d = vt$$

$$d = \bar{v}t$$

$$s = vt$$

$$s = \bar{v}t$$

$$a = \frac{v-u}{t}$$

$$F = ma$$

$$W = mg$$

$$E_w = Fd$$

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

$$Q = It$$

$$V = IR$$

$$V_2 = \left(\frac{R_2}{R_1 + R_2} \right) V_s$$

$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

$$R_T = R_1 + R_2 + \dots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$P = \frac{E}{t}$$

$$P = IV$$

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

$$E_h = cm\Delta T$$

$$E_h = ml$$

$$p = \frac{F}{A}$$

$$p_1 V_1 = p_2 V_2$$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{pV}{T} = \text{constant}$$

$$f = \frac{N}{t}$$

$$v = f\lambda$$

$$T = \frac{1}{f}$$

$$A = \frac{N}{t}$$

$$D = \frac{E}{m}$$

$$H = Dw_r$$

$$\dot{H} = \frac{H}{t}$$

National 5 Physics - Past Paper Log

Name:

Section 1					
Year	Completed	Marked	Mark (/25)	Percentage	Questions Wrong
<i>example</i>	✓	✓	14	56%	Q3,4,12,14,15,19,20,22,23,24,25
2023					
2022					
2020					
2019					
2018					
2017					
2016					
2015					
2014					
SQA Mock					

Section 2					
Year	Completed	Marked	Mark (/110)	Percentage	Questions Wrong
<i>example</i>	✓	✓	78	71%	Q2a + b, Q4, Q5, Q6b, Q9a, Q11
2023					
2022					
2020					
2019					
2018					
2017					
2016					
2015					
2014					
SQA Mock					

Notes: