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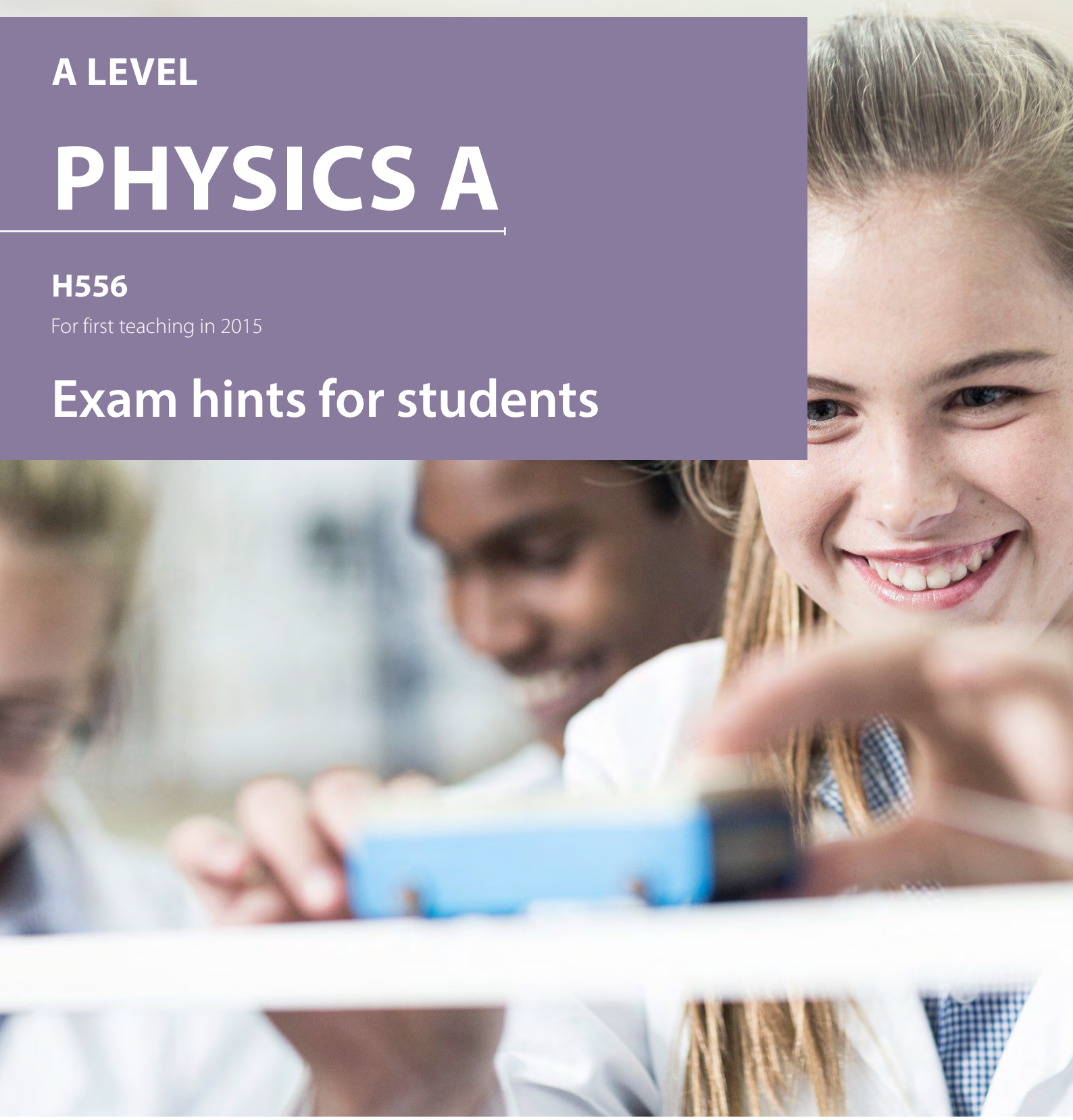
A LEVEL

PHYSICS A

H556

For first teaching in 2015

Exam hints for students



Version 2

www.ocr.org.uk/science

Exam hints for students

General exam skills

$g = 9.81\ m\ s^{-2}$

$e = 1.60 \times 10^{-19}\ C$

$v = u + at$

$s = \frac{1}{2}(u + v)t$

$s = ut + \frac{1}{2}at^2$

$v^2 = u^2 + 2as$

$\phi = BA\cos\theta$

$\mathcal{E} = -\frac{\Delta(N\phi)}{\Delta t}$

$\frac{n_s}{n_p} = \frac{V_s}{V_p} = \frac{I_p}{I_s}$

$A = \lambda N;\ \frac{\Delta N}{\Delta t} = -\lambda N$

$\lambda t_{1/2} = \ln(2)$

$A = A_0 e^{-\lambda t}$

$N = N_0 e^{-\lambda t}$

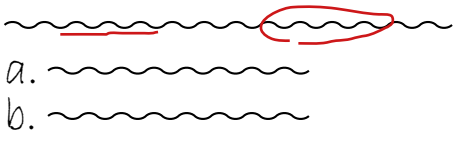
Your answer: ~~A~~ B

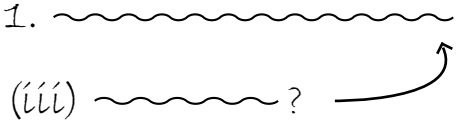
The value of many physical constants is given in the data booklet.

Don't rely too heavily on the data booklet; revise formulae in context and know the meanings of each symbol.

If changing the answer for an MCQ, completely cross out the wrong letter and write the correct one anew.

a. ✗
b. ✓
c. ✗





For MCQs, if you don't know the answer try eliminating options by annotating. Don't leave MCQ answers blank!

Underlining or circling key information in MCQs is sensible, as is jotting down ideas and equations.

Data may be presented at the start of the question and not repeated in each subsequent part.

$\frac{3.19 \times 10^{-3}}{370 \times 10^{-10}} = 86200$ ECF ✓

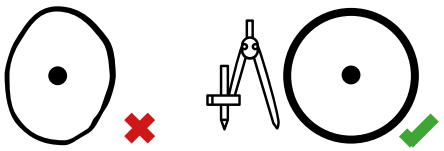
Answer: ~~1008~~ −504

1. ✓
2. ✓

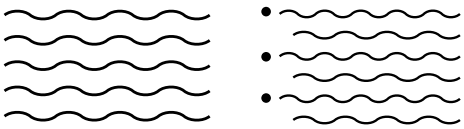
Show clear working for calculations. Error carried forward may mean a response still gains marks if a mistake is made.

Cross out answers if you need to change them. Trying to correct an answer by writing over it can make it unclear.

The command word 'show' requires a candidate response with clear and logical steps.



Calculate the speed of rotation of the drum and the absolute uncertainty in this value.



Draw diagrams accurately, using drawing instruments where needed. Some orbits were far from circular!

For the six mark level of response questions, underline the key terms and answer the question in full.

With long explanations, answers are often better written in bullet points as this gives them more structure.

* see additional answer page

Longer answers don't always lead to more marks. If correct responses are contradicted, marks can be lost.

If use of additional answer pages are necessary, it's a good idea to write a note to the marker to this effect.

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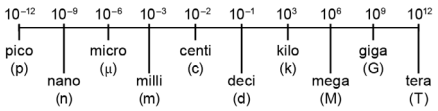
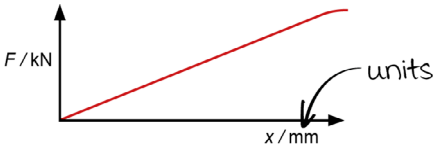
Maths skills



Learn the correct values for SI prefixes, e.g. nanometres (nm).



When reading information from graphs include the SI prefix on the axis label in your working.

Answer: 65000

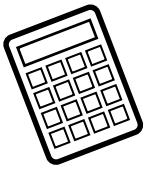
Answer: 6.5×10^4

You need to be able to convert results between decimal form and standard form (e.g. $a \times 10^n$).

0.04% ✗

0.04 × 100 = 4% ✓

When calculating a percentage, remember to multiply by 100. Check this if your answer seems very small.



0.345645245 ✓

0.346 ✗

It's always more accurate to round once, for the final answer, and work with unrounded values on the calculator.

speed = 7.26 × 10⁹ ms⁻¹ ✗

Consider whether the numerical answer you arrive at is realistic. Don't just write down whatever the calculator produces!

mass = 125 g

time = 25 ms

2 s.f.

The 'appropriate number of significant figures' is the lowest number of significant figures provided in the data.

346
0.346
0.0346
→ 3 significant figures

Make sure you give answers to the number of significant figures asked for after performing calculations.

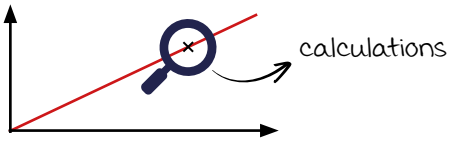
$y = ab$ $y = \frac{a}{b}$ → add % uncertainties

$y = a^2$ → double % uncertainty

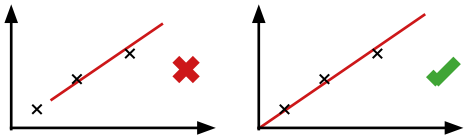
Learn the rules for combining percentage uncertainties.

$f \propto \frac{1}{\lambda}$ ✓ $f = \frac{1}{\lambda}$ ✗

Use the correct symbol "∝" when discussing relationships involving proportionality.



Read the scales on graphs carefully and check any reading is correct before using it in subsequent calculations.



Lines of best fit must cover the full range of points. They don't need to extend to the axes or the origin if not appropriate.

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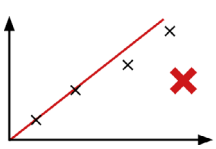
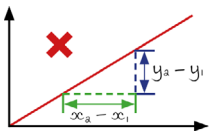
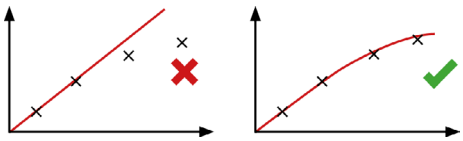


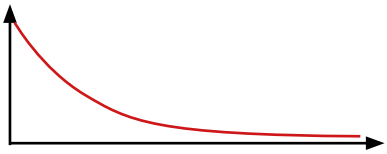
Lines of best fit should cover all points and have a fair distribution of points above and below the line.



When calculating the gradient of a line of best fit, use a large triangle and use co-ordinates from the line in the equation.



Lines of best fit can be straight or curved. They don't have to extend to the axes or origin if not appropriate.



Reserve use of the term 'exponential' for relationships such as capacitor discharge or radioactive decay.

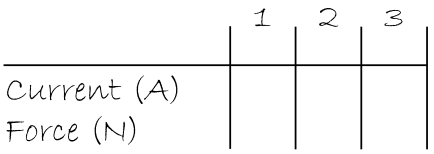
$$\lg = \log = \log_{10}$$

lg, log, and $\log_{10}$ are all equivalent expressions which may be seen in questions or on calculator buttons.

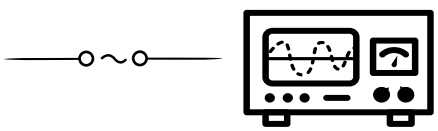
Practical skills

Remember that precision is the closeness of agreement between different results. It is not the same as accuracy.

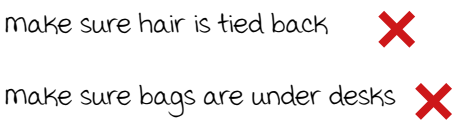
Accuracy is a measure of how close a result is to the true value.



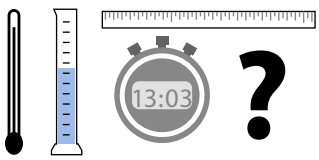
Too many candidates were content with taking a single measurement when describing an experiment.



An oscilloscope, as a voltmeter, can measure the output voltage and period of an alternating current.



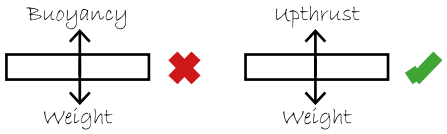
When a question asks for safety precautions, a response beyond normal safe lab practice is usually expected.



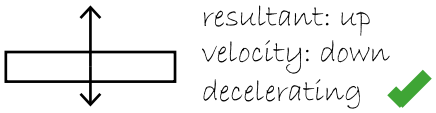
Being clear about which instrument is being used for measurements is vital.

Theory

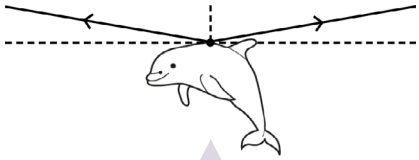
Forces and motion



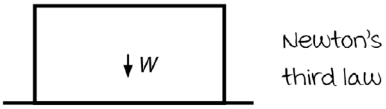
Force labels such as buoyancy, pressure, etc, were not acceptable. The specification is clear on the names of relevant forces.



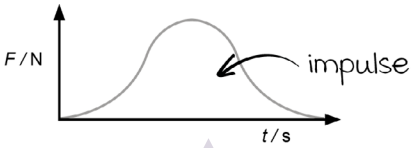
Some candidates didn't remember that the resultant can be opposite to the direction of velocity.



An object is in equilibrium if the resultant force acting on it is zero **and** the sum of moments acting on it is zero.

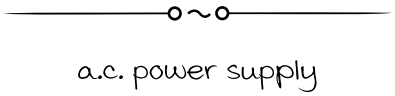


The weight of an object is equal and opposite to the gravitational force exerted on the Earth by the object.

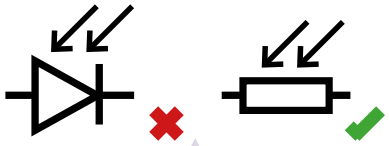


Area under a force-time graph is impulse. Impulse imparted on an object equals the object's change in momentum.

Electrons, waves and photons



Many students drew a cell or battery to represent an A.C. current supply. Make sure you use the correct symbol.

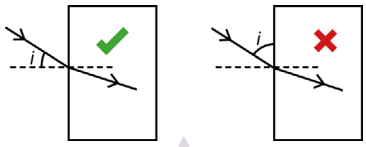


Some candidates drew a variation of an LED symbol instead of that of an LDR.

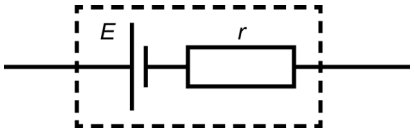
Kirchhoff's 1st law
total current entering a junction equals the total current leaving it.

Kirchhoff's 2nd law
sum of emfs around loop in circuit = sum of pds around the loop.

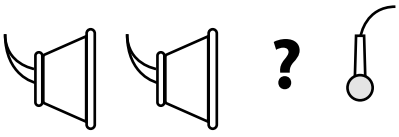
Kirchhoff's 1st law is an application of charge conservation; his 2nd law is an application of energy conservation.



The angle of incidence and the angle of refraction are measured between the normal line and the ray.



Cells have an internal resistance. Remember to include this in your calculations.



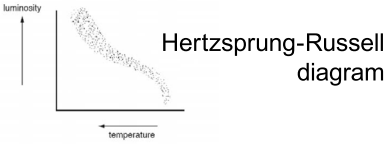
Explanations often confused path and phase difference, or referred to the detection of nodes and antinodes.

Newtonian world and astrophysics

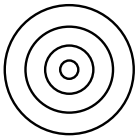
The simple harmonic motion relationship $x = A\cos(\omega t)$ requires that the value of ωt is expressed in radians.

...gas molecules on Mercury would have more energy than the escape velocity

When discussing escape velocity, it isn't acceptable to equate high energy with speed in responses.



Remember that the temperature scale on a Hertzsprung-Russell diagram increases to the left, rather than to the right.



$n = 1 \quad -13.6\ eV$
$n = 2 \quad -3.40\ eV$
$n = 3 \quad -1.51\ eV$
$n = 4 \quad -0.85\ eV$

Many candidates incorrectly stated that energy levels are negative due to the negative charge of electrons.

Many candidates muddled emission lines and absorption lines in spectra.

$\lambda_{max} \times T_{surface} = \text{constant}$

To calculate the surface temperature of a star, the idea that $\lambda_{max} \times T_{surface}$ = constant should be used.

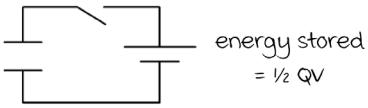
Homogenous: the same in all locations.

Isotropic: the same in all directions. Can be true even if the universe is not the same density throughout.

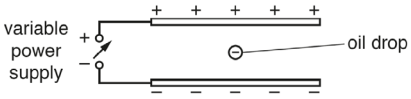
'Homogenous' and 'isotropic' were often mistaken for one another when discussing the universe.

When redshifted, emission lines all undergo the same 'fractional' wavelength increase. Longer wavelengths have a larger absolute increase.

Particles and medical physics



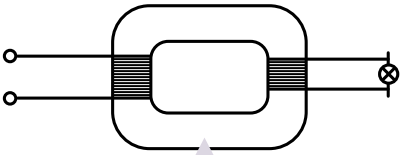
The energy stored in a capacitor is equal to $\frac{1}{2}$ QV



A charged object between two charged plates can be stationary if the electric force (upwards) is equal to its weight.

when the magnet is perpendicular to the coil the change in flux linkage is a maximum ✖

A common error was to refer to 'change in flux linkage' rather than 'rate of change of flux linkage'.



When discussing electromagnetic induction, a common misconception was that there was an alternating current within the iron core.

$p \quad n \quad e^- \quad \nu$

$\bar{p} \quad \bar{n} \quad e^+ \quad \bar{\nu}$

Make sure that the correct symbols for a variety of particles and their antiparticles are known.

$d \rightarrow u + e^-$ ✖

$d \rightarrow u + {}^{0}_{-1}e$ ✔

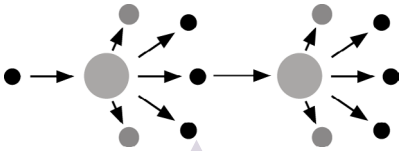
When writing decay equations electrons should be represented as ${}^{0}_{-1}e$ rather than e^-.

$${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \bar{\nu}$$

Candidates need to practise balancing nuclear equations involving beta decay.

$${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{146}_{57}La + {}^{87}_{35}Br + 3{}^{1}_{0}n$$

Many candidates' descriptions of fission were not clear enough.



In nuclear reactor descriptions, neutrons were omitted and roles of moderators and control rods were confused.

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