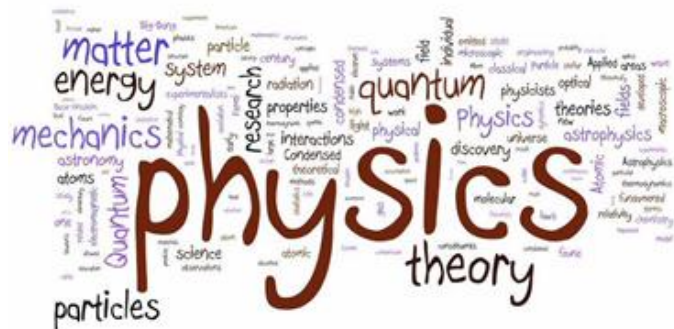


Physics Summer Work

Some Calculations



Physics is both exciting and challenging.

This work is designed to help you get off to a flying start at A level. It will help to make sure you know your GCSE work really well and it will develop your ability to handle numbers and use equations.

If you get stuck; **don't just give up. Instead try:**

- Looking at a GCSE revision book.
- Working with another student.
- Moving on to the next question and coming back later.

Information to help you

wave speed = frequency x wavelength (c = speed of light = $3 \times 10^8 \text{ ms}^{-1}$)	$v = f\lambda$ or $c = f\lambda$
voltage = current x resistance	$V = IR$
power = current x voltage	$P = IV$
kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{velocity}^2$	$KE = \frac{1}{2} mv^2$
potential energy = mass x gravity x height	$GPE = mgh$
energy = mass x (velocity of light) ²	$E = mc^2$

SI Prefixes

kilo	k	10^3
mega	M	10^6
giga	G	10^9
tera	T	10^{12}

milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

Notes

μ is a Greek letter and is pronounced mu

The ENG button on your calculator will convert numbers to one of these standard prefixes, give it a try now with the examples below. At A level m/s is written ms^{-1}

Examples

30 000 volts can be written as 30 kV or $30 \times 10^3 \text{ V}$

0.000 025m can be written 25 μm or $25 \times 10^{-6} \text{ m}$

Be warned: If your work is not laid out like this you will get it back to do again.

1. Convert values into standard units and replace SI prefixes with powers of 10.
2. Write out the equation you will use and rearrange if necessary. Using symbols is fine.
3. Substitute in values with their units.
4. Calculate your answer and check is reasonable.
5. Give your answer to a sensible number of significant figures (2 or 3) and with the correct unit.

Example layout: Calculate the KE of a 200g ball travelling at 100km/h.

$$m = 200\text{g} = 0.2 \text{ kg}, \quad v = 100\text{km/h} = 27.8\text{ms}^{-1}$$

$$KE = \frac{1}{2} mv^2 = \frac{1}{2} \times 0.2\text{kg} \times (27.8\text{ms}^{-1})^2 = \underline{\underline{77.3 \text{ J}}}$$

Print out the following pages and bring them completed, with clear, legible, well set out and easy to follow working, with you ready for your very first A level physics lesson.

Physics Summer Work Calculations

Name _____

1. The note "middle C" has a frequency of 261.6 Hz. The speed of sound is 330 ms^{-1} (this means that the sound produced when you press middle C on a piano travels at 330 ms^{-1}). Calculate the wavelength of middle C.
2. Calculate the wavelength of ultrasound with a frequency of 261.6kHz and a speed of 330 ms^{-1}
3. Calculate the frequency of sound with a wavelength of 2 cm and a speed of 880 ms^{-1}
4. Find the wavelength of microwaves that have a frequency of 2.45 GHz.
(Stuck? Microwaves travel at the speed of light.)
5. A light bulb connected to the mains supply of 230V has a resistance of $2\text{k}\Omega$.
Calculate the power of the bulb. (A two-step calculation)
6. Calculate the energy that could (in theory) be generated from 1 kg of mass.

7. What is the gravitational potential energy gained by a 1kg mass raised by each of the following?
($g = 10 \text{ Nkg}^{-1}$)
- a. 1 mm ?
 - b. 1 km ?
8. What potential difference would be needed to produce a current of $0.6 \mu\text{A}$ through an $8 \text{ M}\Omega$ resistor?
9. A snail has a mass of 12g and a kinetic energy of $4.7 \mu\text{J}$. Calculate the velocity of the snail.
Note: the standard unit of mass is kg not g. So for this question you need to convert g to kg.
10. During hydrogen fusion, mass is converted to energy. How much mass is needed to release 450 MJ?
11. Red light has a wavelength of 700nm. Find its frequency.
12. A length of glass rod has a resistance of $2 \text{ T}\Omega$. What current is produced when a voltage of 240 V is applied?

13. An alpha particle has a mass of 6.6×10^{-27} kg. When an alpha particle leaves a nucleus it has a kinetic energy of 6.8×10^{-13} J. Find the velocity of the alpha particle.
14. The Curiosity rover on Mars has a mass of 899 kg. During the last 10km of its descent to the planet's surface it lost 34.2 MJ of gravitational potential energy. When moving across Mars it has a top speed of 0.14 km/hour.
- Calculate the acceleration due to gravity on Mars.
 - Calculate its maximum kinetic energy when travelling on the surface of Mars.
15. Earth completes one orbit around the Sun per year (365.25 days) The Earth's mean distance from the Sun is 1 AU (150 million km) and its mass is 6×10^{24} kg.
- Use the equation for the circumference of a circle to find the distance that Earth travels in a year.
 - Calculate the Earth's orbital speed in ms^{-1} .
 - Find the kinetic energy of planet Earth due to its orbit around the Sun.