A Level Physics Summer Tasks

A Level Physics is fantastic choice, we cover a diverse range of topics, and a physics qualification can open up many paths for you. We study OCR Physics A, the first-year content builds very much on what you have covered at GCSE, while we will recap this in lessons it is important you have the very best possible start. Therefore, there are a series of tasks for you to complete below, most are mandatory, however there are some optional additional tasks. You must complete at least 100 points worth of work and bring this with you to our first lesson in September.

If you have any questions I can be contacted at: afrankish@bedfordsixthform.ac.uk

I will aim to check my emails at least once a week during the holidays and get back to you when I can.

**Units (10 points)**

Units play a key role in all sciences, but it is especially important in physics as we will often have to convert between different units in calculations.

Fill in the blanks in the table below:

|  |  |  |
| --- | --- | --- |
| **Quantity** | **SI Unit** | **Unit Symbol** |
| Distance |  |  |
| Mass |  |  |
| Time |  |  |
| Electrical Current |  |  |
| Temperature |  |  |
| Mass of material |  |  |
| Frequency |  |  |
| Force |  |  |
| Energy |  |  |
| Power |  |  |
| Pressure |  |  |
| Electrical charge |  |  |
| Electrical potential difference |  |  |
| Electrical resistance |  |  |
| Magnetic flux density |  |  |

**My score out of 15:**

**Unit Conversions Practice (30 points)**

You need to now the unit prefixes below and the conversion factors for each. In the conversion factor you will notice that there is a pattern in the powers. As we go up they increase in 3, as we go down they decrease by 3.

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Factor** |
| Tera | T | X 10 12 |
| Giga | G | X 10 9 |
| Mega | M | X 10 6 |
| Kilo | K | X 10 3 |
| Milli | m | X 10 –3 |
| Micro | µ | X 10 –6 |
| Nano | n | X 10 –9 |
| Pico | p | X 10 *-*12 |

Sometimes we have some unit prefixes that don’t follow the ordinary pattern of **powers of 3** they are listed here:

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Factor** |
| Deci | d | X 10 –1 |
| Centi | c | X 10 –2 |

Converting to **base units**, using prefixes:

A base unit is the standard unit or SI unit that we need to be using in an exam question. For example if it is in ***km*** we need to convert to ***m*** before attempting any calculations.

A good way of doing this is by replacing the symbol with the conversion factor.

**Example 1:** 20 km into meters (m)

20 **k**m the prefix is k *-* ‘Kilo’

Write in the conversion factor instead of **k** but leave the m unaffected 20 **x 103** m

The answer not in *official* standard form is fine for science and can be quite easily added to a calculator for use in a question.

It can be difficult sometimes with smaller prefixes such as micro– or nano– as the factor has a **negative** in the power. Just remember that this means it is smaller than the base unit. For example mm (prefix milli) is smaller than m.

**Example 2:** 0. 3 nano Newtons (nN) into Newtons (N)

0.3 **n**m the prefix is n *-* ‘nano’

Write in the conversion factor instead of **n** but leave the N unaffected 0.3 **x 10-9** N

Again the answer will not always come out in *official* standard form but this is more than good enough for use in science questions.

Practice the Skill:

Covert the following units into their standard units (SI):

1. 300 nm
2. 50 pm
3. 870 km
4. 56 mT
5. 984 GN
6. 1000 µm
7. 2 Ms
8. 3400 dm
9. 467 mg
10. 5.89 mJ
11. 8.70 µN
12. 50.6 km

Converting **between units**, using prefixes:

Sometime an exam question will require you to convert between two units, that are not the standard unit (SI). For example you could be asked to write milli- metres (mm) in nanometres (nm). This can be done using the the conversion factors and the prefixes.

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Factor** |
| Tera | T | X 10 12 |
| Giga | G | X 10 9 |
| Mega | M | X 10 6 |
| Kilo | K | X 10 3 |
| Milli | m | X 10 *-*3 |
| Micro | µ | X 10 –6 |
| Nano | n | X 10 –9 |
| Pico | p | X 10 *-*12 |

The **negative difference** in power

The **positive difference** in power

If we have a larger prefix, such as Tera, and we are making it into a smaller prefix, such as Kilo, we end up with a positive power (That is equal to the difference of the factor’s powers) in the ‘x 10’.

**Example 3:** Write 1 2 Terameters (Tm) in Kilometers (km): Tera has a factor of 10**12**, Kilo has a factor of 10**3**

The difference in powers = **12** *-* **3** = **9**

It is **down** the conversion table so power is **positive**.

The answer is 12 Tm = 12 x 10**9** km

If we have a smaller prefix, such as nano, and we are making it into a larger prefix, such as micro we end up with a negative power (That is equal to the difference of the factor’s powers) in the ‘x 10’.

**Example 4:** Write 0. 8 nanoseconds (ns) in microseconds (µs): nano has a factor of 10**-9**, micro has a factor of 10**-6**

The difference in powers = **9** *-* **6** = **3**

It is **up** the conversion table so power is **negative**.

The answer is 0.8 ns = 0.8 x 10**-3** µs

From a science point of view, it is perfectly acceptable to write the answer as it appears in the examples. You do not have to try to write it out with all the zeros. For example 0.8 x 10**-3** µs, you do not have to write this as 0.008 µs.

Convert the following:

1. 5.68 mm in nm
2. 87.6 pm in nm
3. 750 nm in km
4. 56 kN in mN
5. 984 GJ in TJ
6. 9.08 µm in pm
7. 1.068 mT in pT
8. 12 m in km
9. 47 GN in mN
10. 36 ms in ns

Converting to non*-*standard units:

Sometimes in a physics exam it will ask you to leave your answer in something that is not the SI unit. For example if a question as you to calculate a force but **leave it in kN (KiloNewtons)**. The process is similar to that we have used previously and requires us to use the conversion factors.

**Example 5:** Leave an answer of 35000 N in kN

First Count how many numbers follow the first number 3**5000** Here that is **5**, this is the power of the factor.

So in standard form the number is 3.5 x 10**5** N ,Kilo has a factor of x 10**3** The difference in factors is = **5** *-* **3** = **2**

So the answer is: 3.5 x 10**2** kN

Units with powers:

We can use the prefixes to help us understand why the unit of volume, and for that matter any unit with a power, behaves differently when converting between them.

**Example 6:** What is the conversion factor for cm3 into m3

Replace the centi prefix with its factor (x 10*-*2) 1 **c**m3 = 1 (**x 10-2** m)**3** To work out the new power, **-2** x **3** = **-6**

1 cm3 = 1 x 10**-6** m3

Vectors and scalars (20 points)

Define the following:

Scalar:

Vector:

 Sort these quantities into scalar and vector.

Distance speed momentum power acceleration energy displacement

mass volume temperature force pressure velocity weight

|  |  |
| --- | --- |
| **Scalar** | **Vector** |
|  |  |

 Car (A) is driving -21 m/s west with a forward thrust of 1500N. Car (B) is driving 30 m/s east with a forward thrust of 2000N. Show this information as force arrows on the diagrams below.

B

A



 The length of the arrows are important for displaying information of the force. Describe how the length of the arrows would change if Car B accelerated from 30 m/s to 35 m/s.

Resolving forces (20 points)

For each of the following resolve the resultant force into its components. Be careful to ensure it is in the direction shown by the dotted line. The first two have both guidelines done for you. You must work out the other guidelines using a protractor

State the magnitude of each of the components using the scale 1cm = 1N.



**3.3N**

**5N**

**5N**

**4N**

**3.5N**

**3N**

Circuit Symbols (20 points)

|  |  |  |
| --- | --- | --- |
| Circuit Symbol | Name | Description – what does the device do? |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| thermistor symbol |  |  |
|  |  |  |

Optional task (30 points):

**Should we be concerned about nuclear energy?**

Nuclear energy is a controversial topic - there are many pros and cons of converting nuclear energy into useful forms such as electrical energy. Nuclear fuel sources are very energy dense, the process of nuclear fission does not release greenhouse gases. However, the nuclear waste that is produced as a result of nuclear fission must be stored for many years in order to become safe. Additionally, when many people think of nuclear power, they think of nuclear disasters such as what happened at Chernobyl and Hiroshima.

**Starting point:**

Watch these videos and refer to the notes you have already made on this chapter.

How does nuclear power work?

<https://www.youtube.com/watch?v=rcOFV4y5z8c>

(Nuclear Energy Explained: How does it work? 1/3 – Kurzgesagt – In a Nutshell)

Pros and cons

<https://www.youtube.com/watch?v=HEYbgyL5n1g>
(3 Reasons Why Nuclear Energy Is Terrible! 2/3 - Kurzgesagt – In a Nutshell)

<https://www.youtube.com/watch?v=pVbLlnmxIbY>

(3 Reasons Why Nuclear Energy Is Awesome! 3/3 - Kurzgesagt – In a Nutshell)

**Your task:**

You are going to write a short essay on the pros and cons of nuclear power. This should be based on what you have learned and researched.

Your report:

* Should be approximately one side of A4.
* Should include a list any sources of information you used.
* You should have a conclusion to your work which is based on your own opinion, but backed up by what you have learned.

Optional task (30 points)

MOOCs are Massive Open Online Courses which cover a huge range of subjects. They can usually be completed at your own pace and a number of them are free to access including a wide variety from the Open University.

Your task is to choose a physics-based course from the list and complete it. You will receive a certificate once completed, to be awarded these points you will need to bring in either a copy of your certificate or a picture of the certificate on your phone.