PHYSICS TRANSITION WORK

JLC JOHN LEGGOTT COLLEGE

SUMMER TASK FOR STUDENTS STARTING SEPTEMBER 2025

We look forward to seeing you in our Science Department this September!

Please answer the questions below on this sheet, electronically, or on a separate sheet of paper. Bring them to your first lesson in A Level Physics where they will be collected and checked.

SECTION ONE:

a) 4762 is a four digit number, if we rounded this to 3 significant figures (s.f.) it would be 4760. To 2 s.f. it would be 4800. Round the following numbers:
5621 to 3s.f.
7180 to 2s.f.
90911 to 3s.f.
18.23 to 3s.f.
0.00146 to 2s.f.

b) The SI unit of length is the metre, scientists measure lengths in metres rather than feet or miles or any other unit. Find and record the SI unit of the following:
Time
Energy
Speed
Electric current
Density

c) State a quantity which has the following as its SI unit, there may be more than one answer possible but only one answer is needed:
Newtons
Joules per second
Volts
Hertz
Kelvin

d) One of the most well-known equations in GCSE and A Level Physics is **F = ma**, resultant force equals mass times acceleration. This is sometimes called Newton's Second Law. If a mass of 2.3kg has an acceleration of 6.2ms^{-2}, the resultant force is F = 2.3 x 6.2 = 14.26N. For each of the following, calculate the resultant force:

- A mass of 1.7kg is accelerated at 3.4ms^{-2}.
- A mass of 77.1kg is accelerated by 1.41ms^{-2}.
- A mass of 5600kg is accelerated by 0.082ms^{-2}.

e) In the example in question 4, the numbers put into the calculation (2.3 and 6.2) are both to 2s.f., so we will round the answer to 2s.f. as well, so 14.26N becomes 14N. This is an appropriate number of significant figures. Round each of your answers to question 4 to an appropriate number of significant figures.

f) Rearrange **F = ma** so that m is the subject of the equation. It may help to visit https://www.youtube.com/watch?v=wA112YyHIOQ .

g) If a mass of 3kg has a resultant force of 19.5N on if, I can find the acceleration using a = F/m, a = 19.5/3 = 6.5ms-2. Find the acceleration in the following scenarios:

- A 4 kg mass is accelerated by a 28N force.
- An 80kg person is accelerated by a 200N force.
- A resultant force of 65.52N accelerates a mass of 9.1kg.

h) **Momentum** is calculated by doing mass multiplied by velocity, **p = mv**, where p is used for momentum because m is already used for mass. Calculate the following:

- The momentum of a 0.3kg ball travelling at 4.2ms^{-1}.
- The velocity of a car of mass 1200kg with a momentum of 36000 kgms^{-1}.

i) Quantities in physics are either scalars or vectors. Scalars do not have a direction, an example is energy; vectors do have a direction, forces are vectors as they push or pull objects in certain directions. For each of the following, state whether it is a scalar or a vector:

- Distance
- Displacement
- Speed
- Velocity
- Momentum
- Density

j) For each of your answers to Q3, state if they are scalars or vectors.

k) **Challenge 1 - Difficulty Rating - Easy: *Track Trouble*...**

An athletics track is a loop which is 400m in length. I propose that a 200m runner goes further than a 100m runner, a 400m runner and an 800m runner. Explain why I am right. It may help to draw it out and consider the finish point for each of them if they have the same start point.

l) **Challenge 2 - Difficulty Rating - Hard: *Hikers' Predicament*...**

Phil and Cindy are avid hikers. At 2 p.m., they both start from the same place, but walk along different paths.

Phil walks at a speed of 3 kilometres per hour for 2 hours, in the northeast direction (i.e., at a 45 angle to north), and then Phil stops to prepare a campsite.

While Phil was walking, Cindy walked at a speed of 3.5 kilometres per hour for 2 hours, due west. At 4 p.m., Cindy realizes that it's going to be dark in 3 hours. For this reason, she decides to hike to Phil's campsite. For safety reasons, she must reach his campsite by 7 p.m. But Cindy doesn't want to walk any faster than needed to reach Phil's campsite in time.

At what speed, and in which direction, should Cindy walk to reach Phil's campsite?

SECTION 2: *Confounding Questions:* Research **<u>one</u>** of the following "confounding questions" and produce a written answer of your views and opinions in around 250 words.

1. What is a photon and does it experience time?
2. How do we know that light can be bent into curved paths in empty space and what does this mean about space?
3. Could life evolve on a planet orbiting a blue supergiant star, and if so, how might the life-forms be different to those on Earth?
4. Are there more stars in our Universe than grains of sand on Earth, or vice-versa?
5. What is quantum entanglement and is it a real phenomenon?