0 1

Eric the Astronaut is stranded in deep space, where the local gravitational field strength if 0 N/kg.

0 1 . 1

State Newton's first law, and explain what it can tell us about the motion of Eric in deep space.

[3 marks]

0 1 . 2

Fortunately, Eric is rescued by a passing spacecraft. Before returning to Earth, he stops to complete his mission to make a few repairs to a small satellite which is orbiting the Earth at a constant **speed**, as shown below.

Derek hears about this exciting mission back down on Earth, and says that Newton's first law still applies to the motion of Eric. Is he correct? Explain your answer.

[2 marks]

0 2 Newton's second law is often written in symbol form as follows:

F = m a

0 2 . 1 State the meaning of the term **F** in the above equation.

_____

[1 mark]

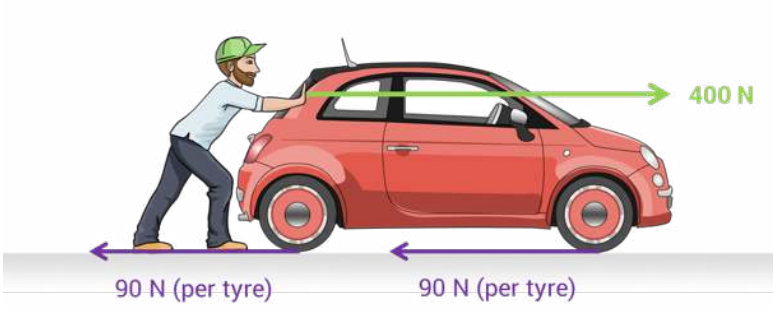
0 2 . 2 State the meaning of Newton's second law in words.

_____

_____

[2 marks]

0 2 . 3 Pádraig is trying to push-start his car by applying a force of 400 N to it, as shown below.



If the force of friction acting between **each tyre** and the road is 90 N and the mass of the car is 1600 kg, calculate its acceleration. You may neglect the effects of air resistance in answering this question.

Acceleration = _____ m/s^2

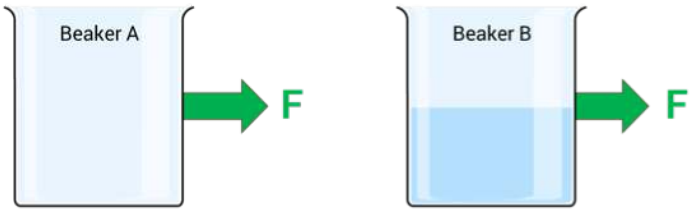
[3 marks]

0 2 . 4 The road surface on which the car is sitting is perfectly flat. Calculate the reaction force exerted on the car **at each wheel**. Take g = 9.8 N/kg.

Answer = _____ N

[2 marks]

0 3 Prav sets two beakers onto a table. Beaker A is empty, and beaker B contains 200 cm^3 of water. He then taps each beaker, applying the same force to each, and notices that beaker A moves further than beaker B.



0 3 . 1 Explain what is meant by the **inertial mass** of an object.

[2 marks]

0 3 . 2 Explain why beaker A moved further than beaker B.

[2 marks]

0 4 Newton's third law is often misunderstood. It explains many important things, such as how we use friction to enable us to walk.

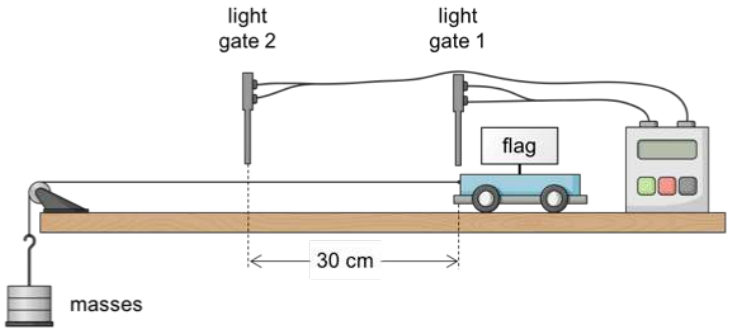
0 4 . 1 State Newton's third law.

[2 marks]

0 4 . 2 Explain, making reference to Newton's third law, how the force of friction allows us to walk across a surface.

[2 marks]

0 5 The below setup is being used to investigate how the acceleration of a trolley is affected by the resultant force which is exerted on it.



The light gates are set up so as to measure the average velocity at which the trolley is moving as it passes through them.

0 5 . 1 Show that the force of tension in the string is approximately equal to 3 N when a mass of 300 g is attached to its end. Take g = 9.8 N/kg.

[2 marks]

0 5 . 2 On a given run of the trolley, with a resultant force of 3 N still acting on it, the following results are obtained:

Velocity in light gate 1 = 0.20 m/s
Velocity in light gate 2 = 0.72 m/s

The flag which is attached to the top of the trolley is 10 cm long.
Calculate how long the trolley took to pass through **light gate 1**.

Time = _____ seconds

[2 marks]

0 5 . 3 Use the correct equation from the *Physics equation sheet* to calculate the acceleration of the trolley on this run.

Acceleration = _____ m/s^2

[3 marks]

0 5 . 4 Hence calculate the mass of the trolley.

Mass = _____ kg

[2 marks]