ST PAUL'S SCHOOL
JUNIOR SCHOLARSHIP EXAMINATION

MAY 2016

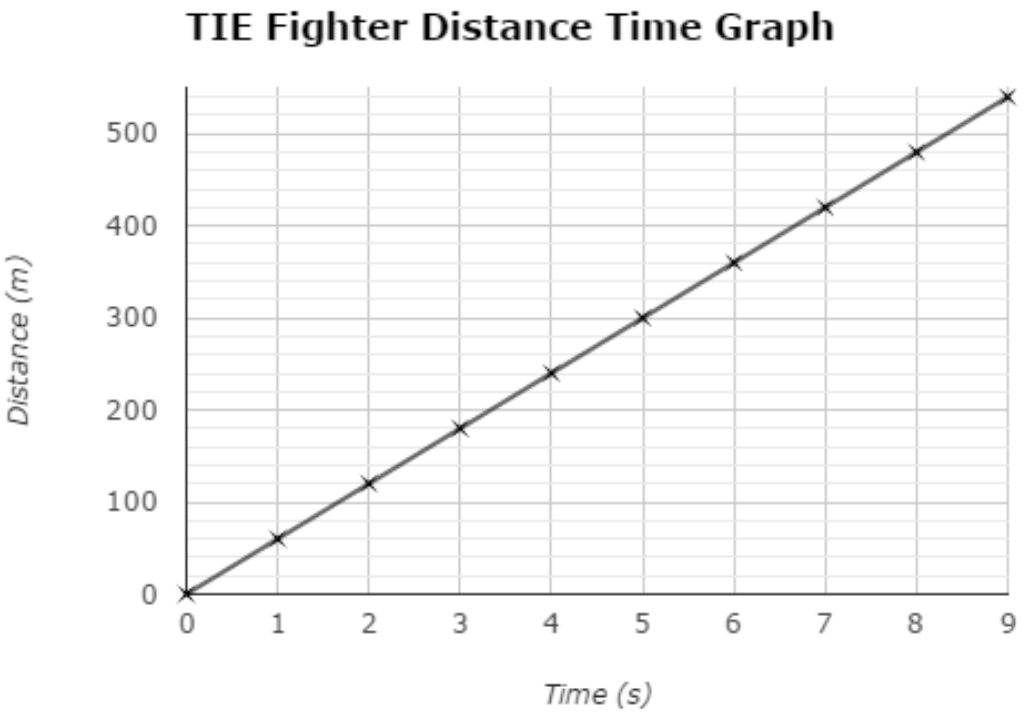
PHYSICS

Although this paper uses the films of the series Star Wars as context, no knowledge of the films or characters is expected or necessary.

Name.....

1. In a trailer for the Star Wars film *The Force Awakens* a TIE fighter spacecraft makes a journey across the shot that is described by the distance-time graph below.

Photo by: Lucasfilm/Screenshot by CNET



a) Use the graph to state how far the TIE fighter has travelled after 5 seconds.

_____ [1]

b) Calculate the speed of the TIE fighter over the first 5 seconds.

_____

_____

_____

[1]

c) A second TIE fighter enters the shot 2s after the first. It also travels at constant speed and overtakes the first one at 4s (i.e. 2s after the second fighter enters the shot). Draw a line on the graph showing its journey.

[2]

d) How long does the second TIE fighter take to travel 1km?

_____

_____

_____

_____ [3]

TURN OVER

2. Classic battles in all Star Wars movies are fought between Tie Fighters and X-Wing spacecraft.

a) We frequently see *and hear* exploding TIE fighters in the movie in both the planetary atmosphere, and in space. In which of these environments would we NOT expect to hear any sound and why?

_____

_____

_____

[2]

b) The scene above shows a laser weapon being fired. Usually a laser cannot be seen except where it hits a surface. Why might the laser beam be visible in this instance?

_____

_____

[1]

c) The laser guns are controlled by a master switch. When that is closed then either the pilot or the gunner (a second person in the spaceship) can fire the lasers. Draw a circuit diagram with three normally open switches switches labelled M (master), P (pilot) and G (gunner) to show how this would work. Use a bulb to represent the laser and a battery to represent the power supply.

[3]

3. In a scene from the movie The Empire Strikes Back, Yoda uses the Force to raise an X-Wing spacecraft, impressing his student, Luke.

a) If the gravitational field strength on Dagobah is 9 N/kg, and the X-Wing has a mass of 5600kg, what is the weight of Luke's X-Wing? Starting from the equation given, show all of your working, and give the unit.

Weight = mass x gravitational field strength

_____

_____ [2]

b) If the X-Wing spacecraft is hovering, stationary above the surface of Dagobah, what is the value of the upward force Yoda is generating?

_____ [1]

c) What is the total vertical force acting on the spacecraft?

_____ [1]

TURN OVER

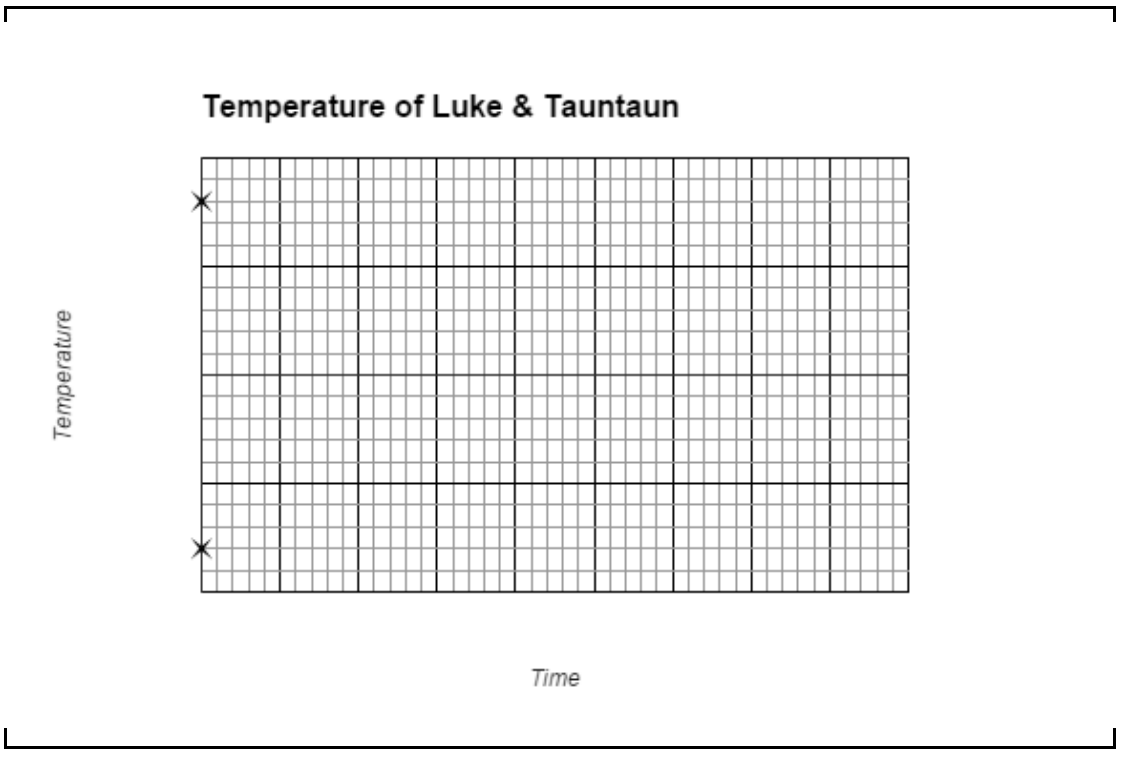
d) How would the total vertical force on the spacecraft compare to your answer in b) if the spacecraft was rising at a constant speed? Underline the correct answer.

Force is now GREATER THAN IN B) LESS THAN IN B) THE SAME AS IN B)

[1]

4. On the ice-planet of Hoth, Luke's friend Han searches for Luke. When Han finds Luke, he is very cold and night is falling. To keep him warm, Han cuts open the belly of a large animal he was riding, called a Tauntaun, and puts Luke inside. Sketch a graph to show how the temperature of the Tauntaun and the temperature of Luke will change over time, starting from when Luke is put inside the animal. You will need to draw two separate lines, one for Luke and one for the Tauntaun, label them and use the starting points given. The upper cross is the starting temperature of the Tauntaun, the lower cross is Luke's starting temperature.

[3]



5. Luke is missing again in the latest film, *The Force Awakens*. A piece of a star map is needed to find him.

a) The map shows groups of many billions of stars relatively close together. What is such a group of stars called?

_____ [1]

b) Approximately how many of these groups are there in the Universe?

_____ [1]

c) Given the extremely large number of stars and planetary systems in the Universe, many people are surprised that we have not detected signs of alien life, such as that depicted in the Star Wars films. Scientists have calculated the chance of alien life existing as nearly certain. Suggest two reasons why we have not seen any signs of alien life:

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_____

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_____

_____ [2]

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