JAMES RUSE AGRICULTURAL HIGH SCHOOL

Student Number

PHYSICS

HSC Course

Assessment Task 1: THEORY TASK

TERM 4, 2006

Total marks: 30

General Instructions

- Reading time – 5 minutes
- Working time – 40 minutes
- Write using black or blue pen

- Draw diagrams using pencil
- Write your Student Number on the Part A Answer Sheet and the Part B Question and Answer book

- Total marks for this paper - 30

This paper has two parts, Part A and Part B

Part A
Total marks 10
- Attempt all questions
- Allow about 12 minutes for this part

Part B
Total marks 20
- Attempt all questions
- Allow about 28 minutes for this part

Section A: Multiple Choice: (1 mark each)

Write your answers on the multiple choice grid

Student Number	

Place a **X** in the correct box.

Question	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

PART A

Total marks 10

Attempt all questions

Each question is worth one mark.

1. The table shows the masses and radii of four imaginary planets, expressed as ratios of the Earth's mass and radius.

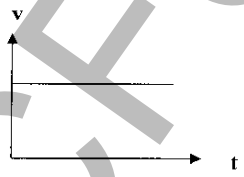
Planet	Mass (x Earth's mass)	Radius (x Earth's radius)
W	4	3
X	2	4
Y	0.5	1
Z	0.5	0.5

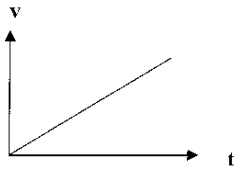
On which planet would an astronaut have the greatest weight?

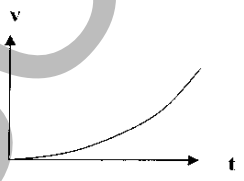
(A) W
(B) X
(C) Y
(D) Z.

2. In Newton's imaginary analysis of projectile motion, a cannon was used to fire a cannon ball horizontally from the top of a high mountain.

Which of the graphs below represents the horizontal velocity of the cannon ball against time if we neglect air resistance?

(A)


(B)


(C)


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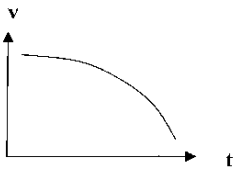
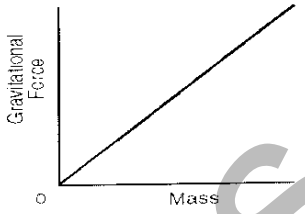


3. An astronaut of mass 80 kg experiences a force of 1176 N from his seat during launch when the rocket is just above the launch pad. What is the acceleration of the rocket?

(A) 2.0 g
(B) 1.5 g
(C) 1.0 g
(D) 0.5 g

4. The graph below represents the relationship between gravitational force and mass for objects near the surface of Earth.
What does the slope of the graph represent?



(A) acceleration due to gravity
(B) universal gravitational constant
(C) momentum of objects
(D) weight of objects

5. For a satellite moving in uniform circular motion around Earth, the centripetal force is provided by the gravitational force.
Given that the masses of the Earth and satellite are M_E and M_S and the distance of the satellite from the centre of Earth is d, which equations could be used to calculate the speed of this satellite?

(A) $v = \frac{GM_E}{d}$

(B) $v = \sqrt{\frac{GM_E}{d}}$

(C) $v = \sqrt{\frac{GM_E}{d^2}}$

(D) $v = \sqrt{\frac{GM_E M_S}{d}}$

6. An earthworm has eight hearts located at different parts of its body. The eight hearts must all beat at the same time in order to produce effective blood circulation. If an earthworm flies past us in a rocket ship travelling at 0.6 c, it's front hearts will be out of synch with its rear hearts. Nevertheless, the earthworm remains alive because

(A) the worm is so short (due to length contraction) that it no longer requires effective blood circulation.
(B) the worm is not perfectly rigid.
(C) both the heartbeats and the respiration rates slow down.
(D) the hearts remain synchronized in the worm's own frame of reference.

7. An observer in a closed laboratory wishes to determine whether the laboratory is at rest or in motion at constant velocity. Which statement is correct?

(A) He cannot find out by measuring the apparent velocity in the laboratory.
(B) He can find out by measuring his mass.
(C) He can find out by comparing two different clocks in the laboratory over a period of time.
(D) He cannot find out.

8. A very small particle called a muon, when at rest, has a mean life before it decays of 2.2×10^{-6} s. What will be the mean life for a muon, travelling at 0.6 c, as measured by a stationary observer?

(A) 2.75×10^{-6} s
(B) 3.5×10^{-6} s
(C) 2.2×10^{-6} s
(D) 1.76×10^{-6} s

9. The slingshot effect is used to increase the speed of a spacecraft as it approaches, swings around and leaves a planet. Which statement is correct?

(A) The energy of the planet stays constant.
(B) The momentum of the planet is constant.
(C) There is no energy loss or gain for the planet-spacecraft system.
(D) The potential energy of the spacecraft is constant.

10. Which statement is true about geostationary satellites?

(A) They have a period of about 90 minutes and orbit at an altitude of about 250 km.
(B) They have a period of about 24 hours and orbit at an altitude of about 250 km.
(C) They have a period of about 24 hours and orbit at an altitude of about 36 000 km.
(D) They have a period of about 90 minutes and orbit at an altitude of about 36 000 km.

Student Number

Part B
Total marks (22)
Attempt Questions 11-15
Allow about 28 minutes for this part
Show all relevant working in questions involving calculations.

11. Calculate the acceleration due to gravity at a height of 1000 km above the Earth's surface. (The radius of the Earth is 6380 km) **(2 marks)**

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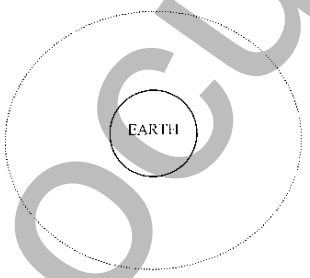
12. A satellite is orbiting the Earth in a more or less circular path, completing each orbit in 90 minutes.



(a) Analyse the force(s) acting on the satellite. **(2 marks)**

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(b) Explain how the average distance of the satellite above the Earth's surface can be determined and calculate the value. (The radius of the Earth is 6380 km) **(3 marks)**

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13. A spaceship built by the occupants of Io had a length of 24.65 m when it rolled out of the factory there. It is seen by an observer, Jruse, on Earth as it travels at 90° to his line of vision at 0.8 c. **(3 Marks)**

(a) Determine the length of the spaceship as measured by Jruse.

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(b) Determine the length of the spaceship as recorded by one of the ship's crew who is space-walking next to the spaceship.

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14. Spacecraft such as the Space Shuttle are deigned to return astronauts safely to the Earth's surface.
Discuss important issues associated with safe re-entry into the Earth's atmosphere and landing on the surface of the Earth and the ways in which the risks are minimised.
(5 marks)

15. A projectile is launched from a platform 7.3 m above the ground with velocity of 14.6 ms^{-1} at an angle of 38° to the horizontal. **(5 marks)**

(a) Determine the initial horizontal and vertical components of the velocity at launch.

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(b) Determine the maximum height reached by the projectile.

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(c) Determine the time of flight of the projectile.

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End of task