Blakehurst High School

Year 12 Half Yearly Examination 2002

2U Physics

Time allowed : 1½ hours plus 5 minutes reading time.

Instructions:

Attempt **all** questions

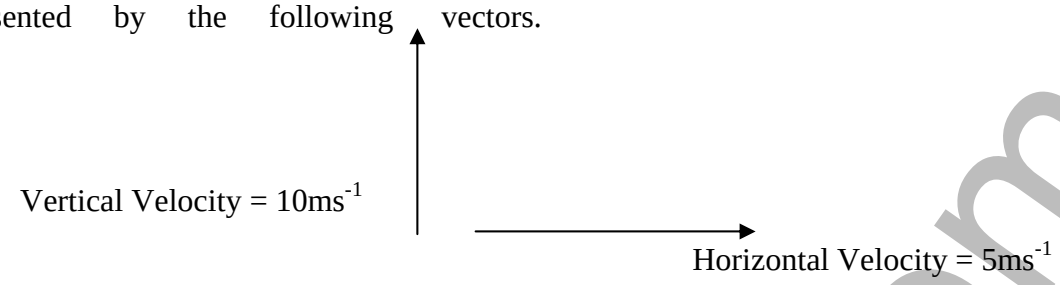
This paper has 2 parts:

Part A: 10 multiple choice questions – Answer on the grid provided.

Part B: 40 marks - Answer in the spaces provided.

Part A: 10 multiple choice questions – Answer on the grid provided.

1. The horizontal velocity and vertical velocity of a projectile were measured. They are represented by the following vectors.



The actual velocity of the projectile is

(A) 15 ms^{-1} at 63.4^0 to the horizontal
(B) 15 ms^{-1} at 45^0 to the horizontal
(C) 11.2 ms^{-1} at 30^0 to the horizontal
(D)11.2 ms at 63.4^0 to the horizontal

2. When a rocket burns its fuel at a steady rate while being launched, its acceleration-

(A) is constant as there is no gravity in outer space
(B) is constant, as the force applied is constant
(C) decreases, as the fuel is slowly consumed
(D) increases, as the mass of the rocket decreases

3. Refer to the following information about a group of satellites in orbit around a particular star.

Satellite	**Period (units)**	**Distance to Star (units)**
Sat 1	4	2
Sat 2	2.37	1.41
Sat 3	x	3

Considering the information in table, the period of Sat 3 would be closest to

(A) 7.38
(B) 6
(C) 3.96
(D) 9

4. An astronaut is orbiting the Earth in a spacecraft. The acceleration due to gravity at that distance is half the value on the surface of the Earth. Which of the following is true when compared to the values at the surface?

	Weight	**Mass**
A	Zero	Same
B	Half	Half
C	Zero	Half
D	Half	Same

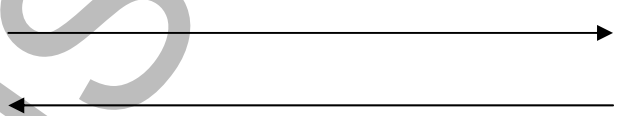
5. A spacecraft in geosynchronous orbit around Earth is 42,000 km from its centre.
A day on Mars is 1.03 Earth days and Mars' mass is one tenth that of the Earth.
The distance the spacecraft would have to be from the centre of Mars to be in a synchronous orbit above a ground bas station is approximately

(A) 42,000 km
(B) 20,000 km
(C) 35,000 km
(D) 43,300 km

6. A spacecraft traveling at 0.9c, had a length of 120 m when it left its home base.
Its length observed by from home and by its crew is:

	Home	**Crew**
(A)	120 m	52 m
(B)	120 m	120 m
(C)	52 m	120 m
(D)	52 m	52 m

7. Two wires are carrying a current as shown:



If the current is increased then the force between the two wires will be:

(A) increased and the direction reversed.

(B) increased and the direction remain the same.

(C) decreased and the direction reversed.

(D) decreased and the direction remain the same.

8. The force experienced by a wire carrying a current of 10 A of length 2 m in a magnetic field of strength 2×10^{-4} tesla is:

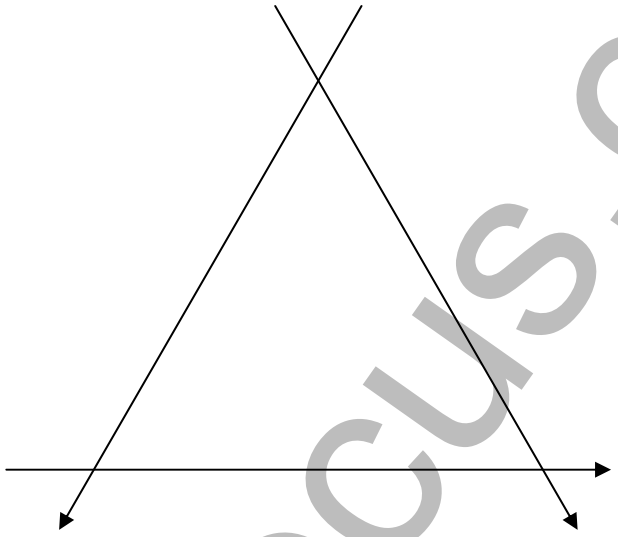
(A) 4×10^{-4} N

(B) 2×10^{-4} N

(C) 4×10^{-3} T

(D) 2×10^{-3} T

9. Three insulated wires are arranged at the points of an equilateral triangle as shown below. Each wire carries a current of 10.0 A.



The direction of the magnetic induction at the centre of the triangle is best described by:

(A)

(B)

(C) **X**

(D) .

10. A cigar shaped U.F.O. and length 100m descends to earth vertically at the equator at the rate of 70 ms-1.

If the horizontal component of the earth's magnetic field is 0.5 T and the ends of the spaceship are aligned in an East-West direction, what is the induced emf between the ends?

(A) 3.3 X 10 V.

(B) 7.0 X 10 V.

(C) 1.75 X 10 V.

(D) 1.75 X 10 V.

Part B: 40 marks - Answer in the spaces provided.

11. Outline, by using a labelled diagram, a simple procedure for an experiment that would allow you to demonstrate that the closer a satellite is to its parent body, the faster it moves to maintain a stable orbit. (4)

12. Below is a set of results obtained by a student trying to determine a value for acceleration due to gravity using pendulum motion.

Trial	Pendulum length (l)	Period (s)
1	1.00	2.00
2	0.95	1.95
3	0.90	1.89
4	0.85	1.84
5	0.80	1.79

(A) The equation used is as follows:

$T = 2\Pi \sqrt{l/g}$

where T = period of pendulum , s
l = length of pendulum, m
g = acceleration due to gravity, ms^{-2}

Rearrange the equation to make 'g' the subject of the equation. (1)

(B) Plot the above data on the axes below. Put T^2 on the 'y' axis and length on the 'x' axis. (2)

(C) Find the gradient (1)

(D) From this experiment, calculate the value of 'g' (2)

(E) Explain why this method usually produces very accurate and reliable results. (2)

13. Account for the orbital decay of satellites in low earth orbit. (2)

14. (A) Define a geostationary orbit. (1)

(B) State the period of rotation of a geostationary satellite in seconds. (1)

(C) Calculate the radius of a geostationary satellite. (1)

(D) Calculate the altitude of a geostationary satellite. (1)

15. Discuss the current problems involved in manned extended space travel. (4)

16. Discuss the implications of time dilation and length contraction for space travel. (3)

17. Describe and evaluate the Michelson-Morley attempt to measure the relative velocity of the Earth through the aether. (4)

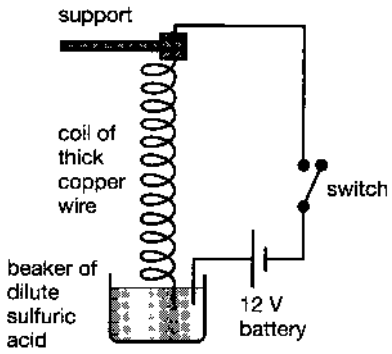
18. A straight conductor has a portion 25 cm long which is at right angles to a uniform magnetic field of flux density (magnetic field strength) of 0.80 tesla. (3)

(A) What current flows in the conductor when the force on this portion is 4.0 N.

(B) What would be the force on the wire if the wire were parallel to the magnetic field.

19. Explain how you would determine the direction of a magnetic field surrounding a conductor carrying a current. (2)

20. A coil of thick copper wire is supported above a beaker of sulfuric acid. The coil is connected to a 12 V car battery which supplies a large (30 A) current.



When the switch is closed, the coil contracts until the bottom of the end lifts out of the acid and sparks occur from the bottom of the coil. The coil relaxes and dips back in the acid and the process repeats.

Explain these observations. (4)

21. Compare the structure and function of a generator to an electric motor. (4)

Marking Guidelines.

11. Outline…….closer a satellite……faster it moves. (4)

Outline procedure with labelled diagram and steps	(4 marks)
Outline with unlabelled diagram and septs **OR** Outline with labelled diagram and instructions in steps	(3 marks)
Outline no diagram steps	(2 marks)
Outline no diagram no steps	(1 mark)

12. Acceleration due to gravity (7)

(a)	rearrange	(1 mark)
(b)	plot correctly – line of best fit	(2 marks)
	plot correctly – no line or best fit **OR** one point incorrect line of best fit	(1 mark)
(c)	gradient	(1 mark)
(d)	gradient = $\frac{4\,\Pi^2}{g}$ subst correct	(2 marks)
	subst currently in incorrect grad	(1 mark)
(e)	explain – need to measure L and T only → very accurate	(2 marks)
	mention of measuring	(1 mark)

13. Account for…….. (2)

2 reasons – collisions with atm -lose energy/speed -burn up	(2 marks)
1 reason	(1 mark)

14. Discuss……manned extended space flight (4)

identify one issue – 3 points -current slow maximum velocity - acceleration much lower if manned 3 points - life span - fuel - food, 0_2 - increase mass → more fuel **OR** Identify 2 issues and 1 point for each	(4 marks)

Identify one issue – 2 points **OR** Identify two issues - 1 point	(3 marks)
Identify 1 issue - 1 point **OR** Identify 2 issues	(2 marks)
Identify 1 issue - 0 points	(1 mark)

15. iscuss the implications of time dilation for space travel. (3)

Discusses in detail that time dilation affects passage of time for earth observer and traveler differently.	3
States that time dilation affects passage of time for earth observer and traveler differently.	2
States what time dilation is	1

17. Describe and evaluate the Michelson-Morley attempt to measure the relative velocity of the Earth through the aether. (4)

Shows a detailed knowledge of the experiment and evaluates the null result of the experiment.	4
Shows a sound knowledge of the experiment and a basic knowledge of the meaning of the results.	3
Shows a basic knowledge of the experiment	2
States the aim of the Michelson-Morley experiment or has a limited knowledge of the results.	1

18. A straight conductor has a portion 25 cm long which is at right angles to a uniform magnetic field of flux density (magnetic field strength) of 0.80 tesla. (3)

(A) What current flows in the conductor when the force on this portion is 4.0 N.

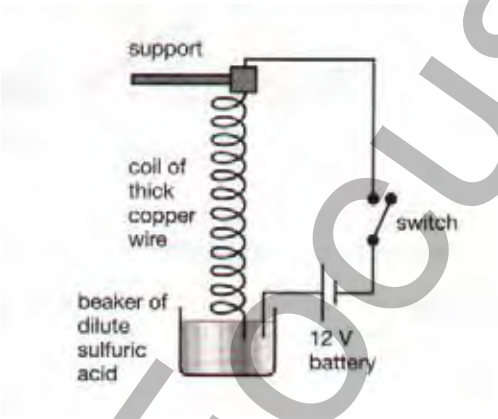
(B) What would be the force on the wire if the wire were parallel to the magnetic field.

A Correctly calculates the current using F= BIl with correct units. I = 20 A	2
Correctly calculates the current using F= BIl without correct units. **OR** Uses the correct formula but does not calculate the correct answer.	1
B States the force is zero.	1

19. Explain how you would determine the direction of a magnetic field surrounding a conductor carrying a current. (2)

Correctly describes the use of the right hand screw rule **OR** Describes an experiment using magnets or iron filings to show the field.	2
Outlines the use of the right hand screw rule **OR** Outlines an experiment using magnets or iron filings to show the field.	1

20. A coil of thick copper wire is supported above a beaker of sulfuric acid. The coil is connected to a 12 V car battery which supplies a large (30 A) current.



When the switch is closed, the coil contracts until the bottom of the end lifts out of the acid and sparks occur from the bottom of the coil. The coil relaxes and dips back in the acid and the process repeats.

Explain these observations. (4)

Shows a thorough knowledge of the effects of the electromagnetic field and its affect on this experiment.	4
Shows a sound knowledge of the effects of the electromagnetic field and its affect on this experiment.	3
Shows a basic knowledge of the effects of the electromagnetic field and its affect on this experiment.	2
Makes some simple observations of the effects of the electromagnetic field.	1

12. Compare the structure and function of a generator to an electric motor. (4)

Accurately identifies all parts of a generator and motor; shows the similarities and describes the differences and the function of each device.	4
Identifies most parts of a generator and motor; shows the similarities and describes the differences and the function of each device.	3
Identifies most parts of a generator and motor; shows some of the similarities and mentions the differences and the function of each device.	2
Mentions the differences between and the function of each device.	1