BLAKEHURST HIGH SCHOOL

YEAR 12 HALF YEARLY EXAM

PHYSICS

2006

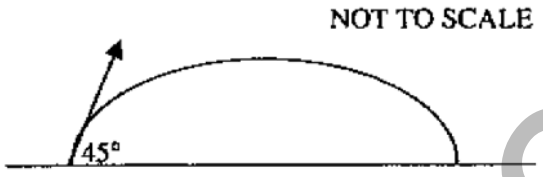
1½ HOURS

NAME: _____

Part A

Total marks 10
Attempt Questions 1 – 10
Allow about 20 minutes for this part

1. Examine the diagram below of an arrow fired from a bow, at ground level.



The angle to the horizontal is 45°. The initial horizontal velocity is 100 ms^{-1}. The initial vertical velocity of the arrow (in ms^{-1}) is:

(A) 100
(B) 141.4
(C) 10
(D) 1000

2. The Earth, whose radius is 6.38 x 10^6 m and mass 5.98 x 10^{24} kg, has an artificial satellite, which orbits at a particular altitude. The mass of the satellite is 540 kg and has acceleration due to gravity at this altitude is 0.233 ms^{-2}. What is the altitude of this orbiting satellite?

(A) 4.41 x 10^4 km
(B) 4.41 x 10^7 km
(C) 3.50 x 10^4 km
(D) 3.50 x 10^7 km

3. The Kepler's Law of periods $T^2 = kr^3$ shows the relationship between the period and the orbital radius of a plant that revolves around a start. The value k, a constant, can be changed by varying:

(A) The period of the plant
(B) The orbital radius of the plant
(C) The mass of the plant
(D) The mass of the star

4. The Russian space station which was orbiting Earth for many years eventually crashed into the Earth. This occurred because of:

(A) a reduction in its orbital velocity due to friction from the magnetosphere
(B) a reduction in its orbital velocity due to friction from the atmosphere
(C) an increase in its orbital velocity due to a stronger gravitational force
(D) a reduction in its orbital velocity causing the gravitational force to increase

5. Which of the following was essential to allow Einstein to develop his Special Theory of Relativity?

(A) The speed of light was constant
(B) Energy and matter were equivalent
(C) Time dilates when objects approach the speed of light
(D) All of the above were essential in developing Special Relativity

6. In newer cars, DC generators have been replaced by AC generators (alternators) even though most cars run on a 12V DC electrical system. The reason for this change is:

(A) Slip rings used in alternators do not wear out the brushes as quickly as the split rings in DC generators.
(B) Slip rings are more efficient; as there is no insulator needed they are continually producing current.
(C) Solid state diodes easily convert AC into DC.
(D) All of the above

7. Two long staraight parallel conductors are separated by a distance of 5 mm. One carries a current of 10 A, the other 5 A in the same direction. The force per metre between the two conductors would be closest to:

(A) Attractive 2 mN
(B) Repulsive 2 mN
(C) Attractive 2 x 10^{-6} N
(D) Repulsive 2 x 10^{-6} N

8. Find the magnitude of the force acting on a 20 cm conductor, carrying a current of 2 A, when placed at 30° to a magnetic field of 4T.

(A) 0.4 N
(B) 0.8 N
(C) 1.6 N
(D) 3.2 N

9. A small square coil of side 2 cm x 2 cm has 10 turns carries a current of 2 A. Find the maximum torque that it could produce when placed in a field of 5 T.

(A) 0.02 Nm
(B) 0.04 Nm
(C) 20 Nm
(D) 40 Nm

10. The electricity produced by most generators is in the form of alternating current. In general AC generators, motors and other electrical equipment are simpler, cheaper and more reliable than their DC counterparts. AC electricity can be easily transformed into higher or lower voltages making it more versatile than DC electricity. However Edison argued strongly for a ban on the distribution of electricity using AC.

His main argument against AC distribution was:

(A) He didn't invent it himself.
(B) The high voltages involved were too dangerous to handle and would lead to deaths.
(C) AC distribution wouldn't work because it would be impossible to synchronise the phases.
(D) The strong revolving magnetic field in AC generators was too dangerous to work near.

Part B.
Total marks 40.
Allow about 1 hour and 10 minutes for this part.

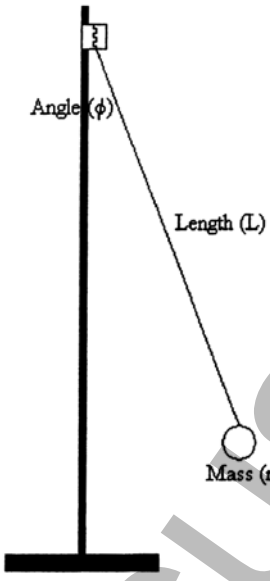
11. (a) Explain the difference between a satellite that has a geostationary orbit and one that has a low earth orbit. (2)

(b) What is ONE advantage of a geostationary satellite over a low earth orbiting satellite? (1)

(c) Give an example of an application where scientists would choose to use a low earth orbiting satellite over a geostationary satellite. Explain why they would choose the low earth orbiting satellite for this particular application. (2)

12. Two students carried out an investigation to determine the acceleration due to gravity using pendulum motion.

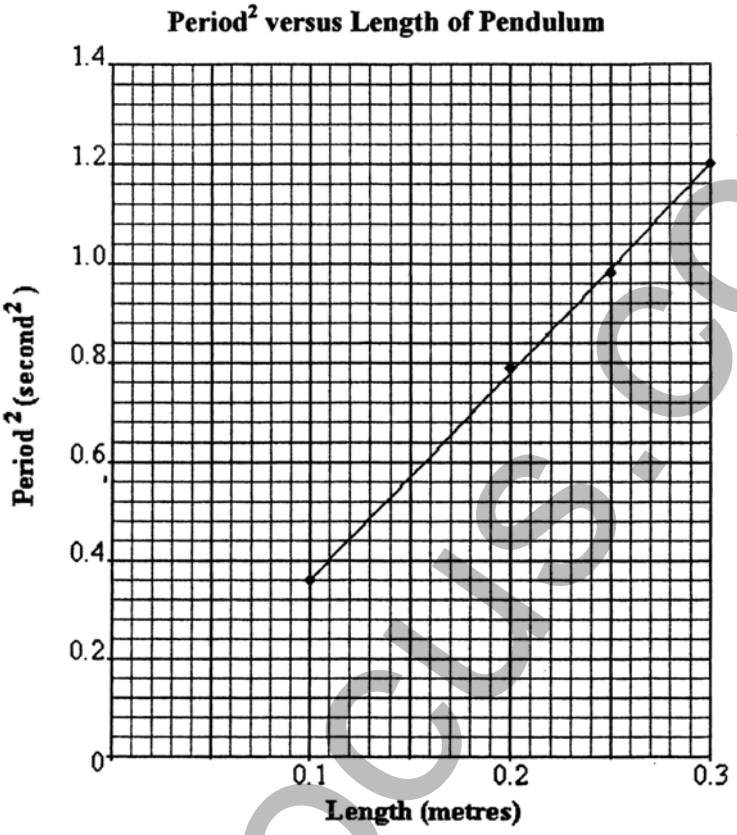
They set up the equipment as shown in the diagram below:



Their results allowed them to construct the following table. One value was omitted.

Length - L (metres)	Period^2 (T^2) (seconds^2)
0.10	0.36
0.15	Not calculated
0.20	0.79
0.25	0.97
0.30	1.2

The results from the table were used to plot a graph of period^2 against length as shown below:



(a) State the value and units for the missing data. (2)

(b) Given that the period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{L}{g}}$, describe how the value of acceleration due to gravity can be determined from the slope of the graph. (2)

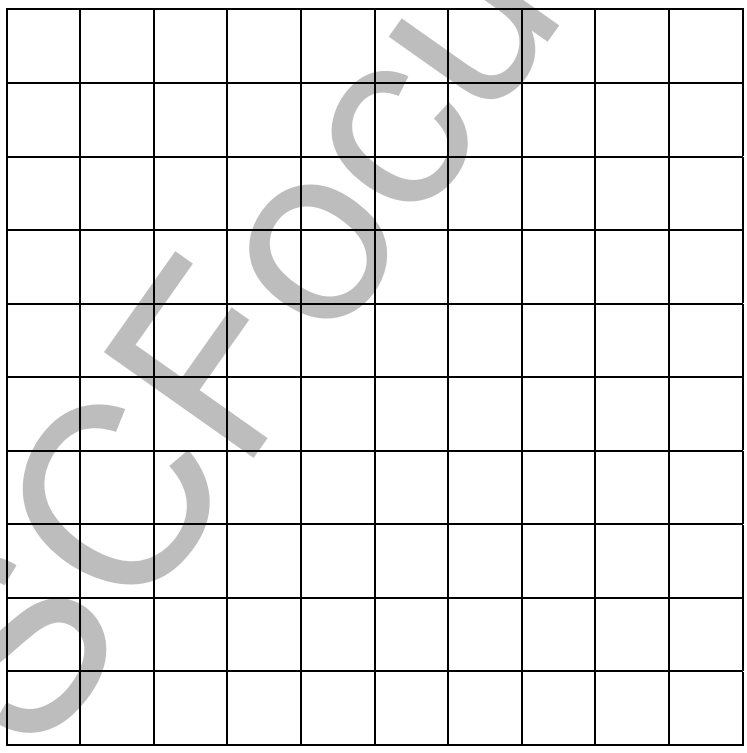
13. The table below shows the orbital radius and period of the four "Galilean Moons" of Jupiter.

Moon	Orbital distance, r (km)	Orbital period, T (days)
Io	421,600	1.8
Europa	670,900	3.6
Ganymede	1,070,000	7.2
Callisto	1,883,000	16.7

(a) Complete the table below: (2)

Moon	r^3	T^2
Io		
Europa		
Ganymede		
Callisto		

(b) Plot r^3 against T^2. (2)



(b) What property of the system can be determined from the gradient of this line? (1)

14. Human beigns travelling to the starts are a common feature of science fiction. Voyager 2, one of the fastest travelling man-made objects, is now making its way towards the starts at around 1.08×10^5 km/hr. Imagnine that this space probe was to travel straight towards out nearest start, Alpha-Centauri, a distance of 4.10×10^{13} km away.

(a) Determine how long in years it would take to reach Alpha- Centauri at its current speed. (1)

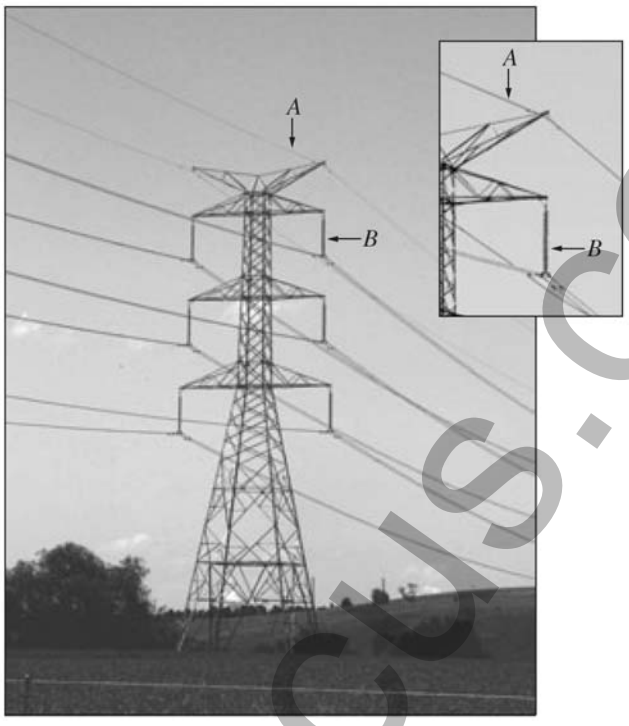
(b) Comment on what your answer implies for the future of long-distance space travel. (2)

15. The theory of special relativity discusses the physical consequences of the absence of a universal frame of reference. This special theory of relativity, published in 1905 by Albert Einstein, is concerned with problems involving inertial frames of reference. Its fundamental principles, however, caused apparent discrepancies in measurements.

(a) What are inertial frames of reference? (1)

(b) State TWO fundamental principles upon which the special theory of relativity is based. (2)

16. Look at the high voltage transmission tower shown in the photograph below. Name one of the labelled features and describe how it is designed to protect the transmission lines in the event of a lightning strike. (2)



17. Describe how the principle of an AC induction motor could be demonstrated in the Science laboratory. (3)

18. When an electric saw becomes jammed in a piece of heavy timber and slows down, smoke can be seen issuing from the electric motor. Explain this observation. (3)

19. All transmission lines have some resistance, whether they are made of copper, steel, or aluminium. This resistance leads to power losses, which can be calculated using the equation:

$$P_{loss} = I^2 \times R$$

Where I is the current in the cable in amps, and R is the resistance of the cable in ohms. (6)

(a) 120 kW of power is to be sent 500 km through a cable of 0.4 Ω resistance. If the voltage is limited to 240V calculate the current in the cable.

(b) Calculate the power loss during the transmission.

(c) In NSW our long distance transmission cables operate at 5×10^5 V. Recalculate the energy lost at 5×10^5 V.

(d) Use your results to explain the advantages of transforming electrical power to high voltages for long distance transmission.

20. Asses the impact of the development of AC generators on society and the environment. (6)

Year 12 PHYSICS
HALF YEARLY, 2006

NAME: _____

Answer Sheet Part A

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