STUDENT NUMBER.....

GOSFORD HIGH SCHOOL

YEAR 12

PHYSICS

HALF YEARLY

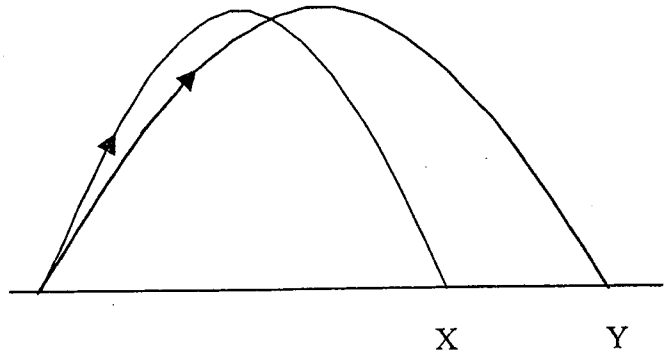
2008

Time allowed: 2 hours + 5 minutes reading time

Part A: 15 marks
Attempt questions 1-15 on the multiple choice answer sheet
Allow about 30 minutes for this part

Part B: 55 marks
Attempt questions 16-28
Allow about 1 hour and thirty minutes for this part
All relevant working should be shown in this section

1. The diagram below shows the paths of flight of two projectiles, X and Y.



Which of the following is the same for X and Y?

(A) horizontal velocity
(B) time of flight
(C) range
(D) initial velocity

2. The escape velocity of a particular planet is 4 500 ms^{-1}.

Which of the following statements is correct?

(A) An object fired at 4 000 ms^{-1} would always return to the planet's surface.
(B) An object fired vertically at 4 000 ms^{-1} would be unable to go into orbit.
(C) An object with an initial vertical speed of 4 500 ms^{-1} would escape the planet.
(D) An object travelling at 5 000 ms^{-1} would not escape the planet.

3. In order to escape from the Sun's gravitational field, interstellar spacecraft need an escape speed over 600 km s^{-1}. Pioneer 10, launched in 1972, had a launch speed of only 15 km s^{-1}.
What was the main reason Pioneer 10 was able to escape the Sun's gravitational field?

(A) The spacecraft used a solid fuel during liftoff and thus by reducing its total mass was accelerated to the required value.
(B) The rocket engines were fired once in a stable parking orbit and thus extra thrust was sufficient to accelerate the spacecraft to the required value.
(C) The spacecraft utilised the principles of conservation of momentum and energy to accelerate them through the gravitational fields of planets it encountered along the way.
(D) The spacecraft used a solid fuel rocket engine designed to burn at a constant rate during launch and thus was accelerated to the required value.

4. Galileo was able to deduce a relationship to explain parabolic projectile motion.
Which of the following statements is in agreement with Galileo's findings on projectile motion?

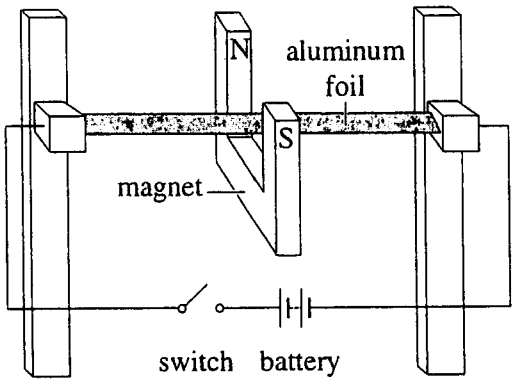
(A) The distance an object travels from rest is proportional to the square of the time elapsed.
(B) The rate at which an object dropped is dependent upon its mass.
(C) The square of the distance an object travels from rest is proportional to the time elapsed.
(D) The rate at which an object dropped is not dependent upon its velocity.

5. For a satellite in a low Earth orbit, the altitude above the Earth is small in comparison with the Earth's radius.
Compared to a geostationary satellite a low Earth satellite will have a period of orbit which is
(A) the same
(B) slower
(C) faster
(D) twice as slow

6. Which statement is true for a step-down transformer?
(A) It reduces current and voltage.
(B) It has more turns in the primary than in the secondary.
(C) It has less turns in the primary than in the secondary.
(D) It has a non-laminated iron core.

7. Energy is lost in transmission lines. How can this loss be reduced?
(A) Use thinner wires in the transmission line.
(B) Increase the current in the transmission line.
(C) Decrease the current in the transmission line.
(D) Heat the wire.

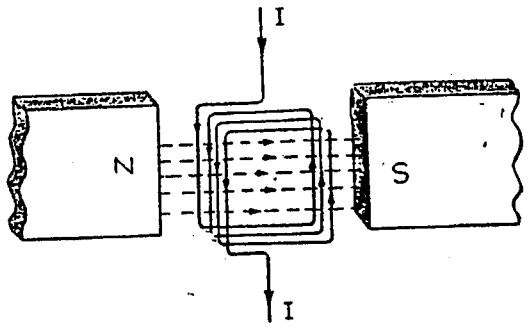
8. A thin piece of aluminium foil is connected by a conducting wire to a switch and battery as shown. The foil is placed between the poles of a magnet.



When the switch is closed, the aluminium strip will
(A) move towards the south pole of the magnet
(B) move upwards out of the magnet
(C) move towards the north pole of the magnet
(D) move downwards into the magnet.

9. Alternating current is used for commercial electricity transmission due to the ease and efficiency at which its voltage and current can be changed.
Which set of conditions is the most energy efficient way of transmitting alternating current?
(A) High voltage and high current.
(B) High voltage and low current.
(C) Low voltage and high current.
(D) Low voltage and low current.

10. A coil carrying a direct current is suspended in a magnetic field as shown.



How does the coil move when the current is first switched on?

(A) The coil rotates continuously.
(B) The coil moves to the vertical position and stops.
(C) The coil oscillates about the vertical axis before coming to rest.
(D) The coil will not rotate as there is no commutator.

11. Which alternative correctly identifies features of the galvanometer and the loudspeaker?

	Galvanometer	**Loudspeaker**
(A)	Curved magnetic pole surfaces	Counterbalancing spring
(B)	Counterbalancing spring	Plane of coil parallel to magnetic field
(C)	Plane of coil perpendicular to magnetic field	Curved magnetic pole surfaces
(D)	Alternating current	Direct current

12. Eddy current transformations in many applications result in the loss of useful energy, but there are some beneficial practical applications. The list showing only beneficial applications is

(A) electromagnetic braking; damping oscillations in balances; heating effects in solid iron cores.
(B) electromagnetic braking; increasing oscillations in balances; inductive heating.
(C) increasing oscillations in balances; inductive heating; heating effects in solid iron cores.
(D) eddy current testing of material; damping oscillations in balances; inductive heating.

13. What measurements could be made from the Earth to determine the mass of the Sun?

(A) The diameter of the Sun and its average density.

(B) The distance to the Moon, its orbital period and the gravitational constant.

(C) The distance to the Sun, the orbital period of Earth and the gravitational constant.

(D) The mass of the Earth and its distance from the Sun.

14. The Michelson-Morley experiment showed that

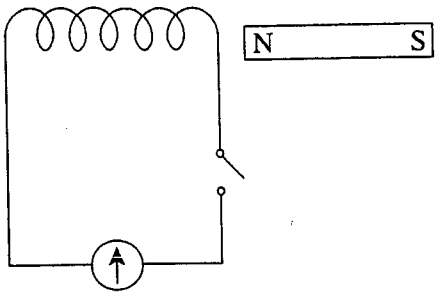
(A) objects travelling relative to the ether contract along their direction of motion.

(B) objects travelling relative to the ether show a time dilation.

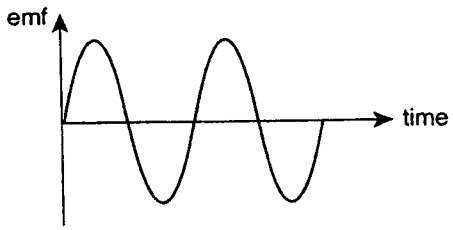
(C) the ether doesn't exist.

(D) no motion relative to the ether was detectable.

15. A bar magnet and a coil, which is connected to a galvanometer and a switch, are initially at rest with respect to one another as shown in the diagram below.

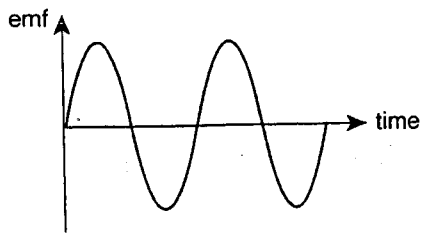


The switch is then closed and the magnet is moved towards the coil and then back away from the coil. This action is then repeated. The galvanometer indicates that a current is induced within the coil. If the electromotive force (emf) is plotted against time a graph as shown below is obtained.

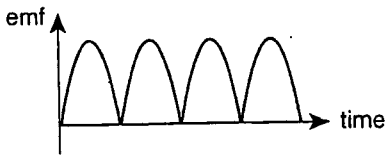


If the experiment is then repeated with the same materials but with the motion of the bar magnet being half the original velocity, which of the graphs below will indicate the new emf plotted against time.

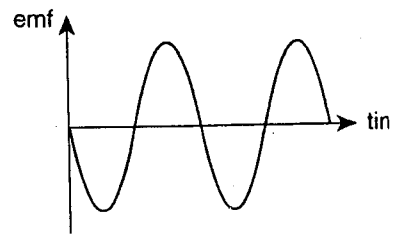
(A)



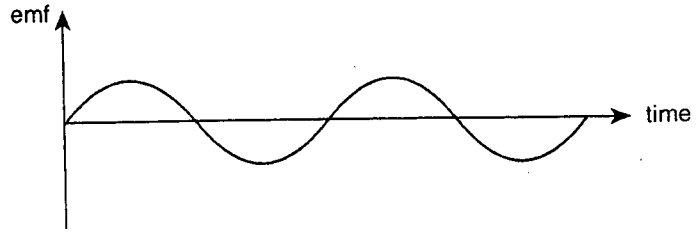
(B)



(C)



(D)



Question 16 (4 marks) **Marks**

A projectile is launched at 60 ms^{-1} at an elevation of 30°.

(a) Calculate the vertical component of its velocity. **1**

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(b) Calculate the time of flight of the projectile. **1**

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(c) Calculate the maximum height of the projectile above its launch position. **1**

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(d) Calculate the range of the projectile. **1**

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Question 17 (4 marks) **Marks**

The acceleration due to gravity varies around the Earth's surface.

(a) State two reasons as to why the acceleration due to gravity on the surface of the Earth is not a constant value. **2**

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(b) A planet has been discovered orbiting a nearby star. Its mass is three times the mass of the Earth, its diameter is four times that of the Earth and its orbital radius is twelve times that of the Earth. **2**

Calculate the value of the acceleration due to gravity on the newly discovered planet.

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Question 18 (4 marks) **Marks**

(a) An astronaut repairing a satellite in orbit lets go of his spanner. Describe the spanner's subsequent motion after leaving the astronaut's hand. **1**

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(b) The spanner has a rest length 30 cm and a rest mass of 5 kg. If the speed of the spanner was later determined to be $0.3c$, determine the length and mass observed by a stationary observer on nearby Earth. **3**

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Marks

Question 19 (5 marks)

(a) Scientists utilise the motion of the Earth and the location of the launch site to assist in attaining the required velocity for a stable orbit. Explain the best direction and most suitable location to launch a rocket. **2**

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(b) Special precautions must be taken with spacecraft returning to the Earth's atmosphere. Discuss what precautions must be taken to ensure that a manned spacecraft safely returns to Earth. **3**

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Question 20 (2 marks)

A 1 570 kg satellite orbits a planet in a circle of radius 5.94×10^6 m. The gravitational force of attraction between this satellite and the planet is 1.57×10^6 N. Determine the mass of the planet. **2**

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Marks

Question 21 (4 marks)

Explain, with the aid of a labelled diagram, the main electromagnetic principles which operate within a moving coil galvanometer. **4**

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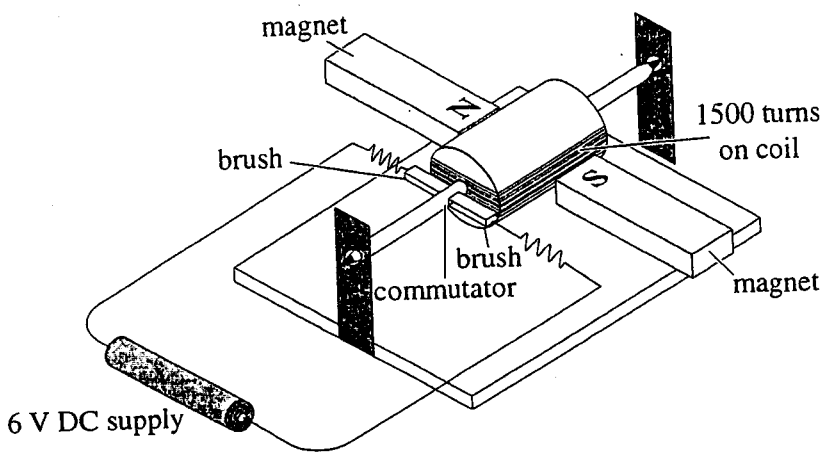
Marks

Question 22 (4 marks)

A group of physics students constructed a working model of an electric motor. A diagram of their model is shown below.



By taking careful measurements from their model the following results were obtained.

Number of turns of armature coil	1500
Resistance of coil	50 Ω
Voltage	6.0 V
Maximum torque	0.055 Nm
Magnetic flux	2.0 T

(a) Determine the area of the armature coil of the motor. **2**

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The students wished to increase the magnitude of the torque, but did not wish to alter the constructed motor.

(b) Describe exactly how they could increase the torque without making any structural changes to their model. **2**

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Question 23 (5 marks)

Eddy currents are produced in many electrical devices. They are useful in some situations and cause problems in others. **5**

Outline the production of eddy currents and their uses and problems.

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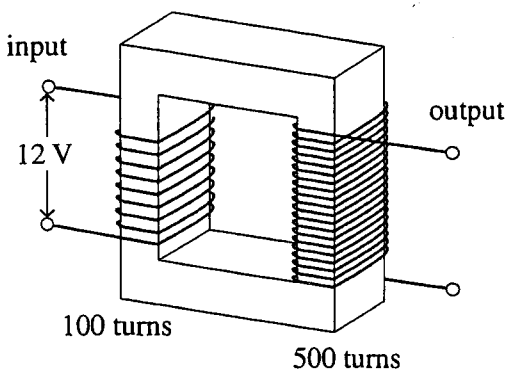
Question 24 (5 marks)



(a) Name the electrical device shown in the diagram above. **1**

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(b) By examining the feature shown in the diagram, determine the output voltage for this device. **2**

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(c) Explain how power loses from this device can be reduced. **2**

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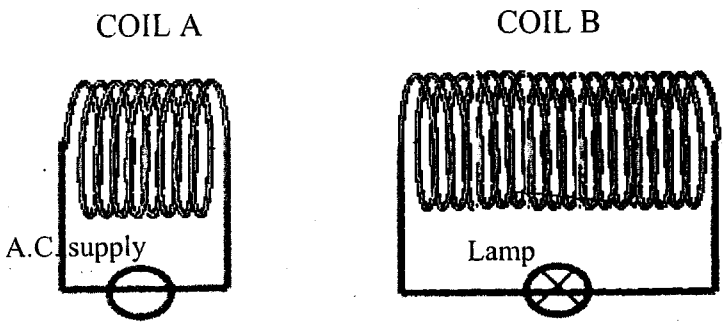
Question 25 (4 marks) **Marks**

(a) Two coils of wire are situated near to each other as shown. Coil A is connected in series with a source of alternating current, while coil B has a small lamp in a series connection **2**

Explain why the lamp connected to coil B glows when circuit A is switched on.



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(b) A piece of soft iron in the shape of a rod is passed through both coil A and coil B. The following observations were made during the experiment: **1**

(i) the rod became warmer

(ii) the lamp glow became brighter

Describe why the rod becomes warmer.

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(c) Account for the change observed in the brightness of the lamp. **1**

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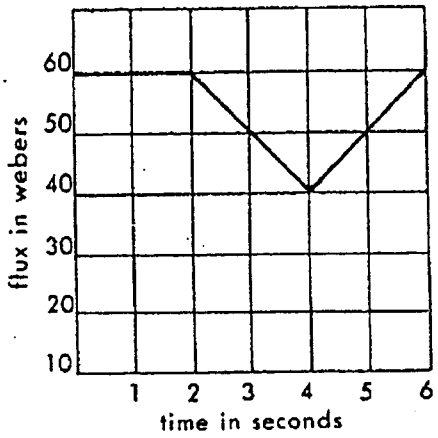
Question 26 (4 marks) **Marks**

The graph below shows the change in flux experienced by a conductor in a closed circuit.



(a) State one way in which the flux experienced by a conductor can be changed. **1**

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(b) Compare the current induced in the conductor during the time intervals 0 – 2 seconds, 2 – 4 seconds and 4 – 6 seconds. Explain your reasoning. **3**

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27. Describe an experiment that could be conducted in the school laboratory to demonstrate the production of alternating current. **4**

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28. Evaluate the importance of the 'Battle of the Currents' and explain why AC electrical distribution systems eventually triumphed even though DC Distribution systems were developed first. **6**

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