See Kyh Shin

CONFIDENTIAL*/SULIT*
Identity Card number:.....
(No. Kad Pengenalan)

Centre number/index number:.....
(Nombor Pusat/ Angka Giliran)

960/2 PHYSICS (FIZIK) STPM TRIAL 2006

PAPER 2 (KERTAS 2)

STRUCTURE AND ESSAY (STUKTUR DAN ESEI)

Dua jam setengah(Two and a half hours)

PERSIDANGAN KEBANGSAAN PENGETUA-PENGETUA SEKOLAH MENENGAH MALAYSIA CAWANGAN MELAKA

PENILAIAN PENGESANAN PEPERIKSAAN SIJIL TINGGI PERSEKOLAHAN MALAYSIA 2006

Instruction to candidates:

Answer **all** *the questions in section A in the spaces provided. All working* **must** *be shown. For calculation, relevant values of constants in the data booklet* **must** *be used. For numerical answers, unit* **must** *be quoted whenever they are appropriate.*

Answer any **four** *questions from section B. For this section, write your answers on the answer sheets provided. Begin each answer on a fresh sheet of paper, and arrange your answers in numerical order. Tie your answer sheets to this booklet.*

Answer may be written in either English or Malay.

Arahan kepada calon:

Jawab **semua** *soalan dalam bahagian A dalam ruang yang disediakan.. Semua kerja* **mestilah** *ditunjukkan. Bagi penghitungan nilai pemalar yang berkaitan dalam* Buku Data **mestilah** *digunakan. Bagi jawapan berangka, unit* **mestilah** *dinyatakan di mana-mana yang sesuai.*

Jawap mana-mana **empat** *soalan. dalam bahagian B. Untuk bahagian ini, tulis jawapan andapada helaian yang dibekalkan. Mulakan setiap jawapan pada helaian kertas yang baru, dan susur jawapan anda mengikut tertib berangka. Ikat kertas jawapan anda bersama dengan kertas soalan ini.*

Jawapan boleh ditulis dalam bahasa Inggeris atau bahasa Melayu.

For examiner's use (Untuk kegunaan pemeriksa)	
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Total (Jumlah)	

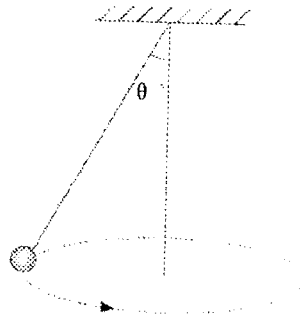
This question paper consists of 15 printed pages and 1 blank pages.
(Kertas soalan ini terdiri daripada 15 halaman bercetak dan 1 halaman kosong.)

* This question paper is CONFIDENTIAL until the examination is over. **CONFIDENTIAL***
*Kertas soalan ini SULIT sehingga peperiksaan kertas ini tamat. **SULIT***

Section A [40 *marks*]

Answer **all** *the questions in this section.*

1 A ball of mass 500g hangs from a string of length 1.0 m and moves with a constant speed of 2.0 m s^{-1} in a horizontal circle as shown. The string makes an angle of θ with the vertical.



(a) Find the magnitude of the resultant force acting on the mass and state its direction.

[2]

(b) Calculate the value of θ.

[2]

(c) Calculate the tension in the string.

[1]

2 Phobos is one of the satellites of Mars with an orbital radius of 9.4×10^6 m and orbital period of 7 hours and 39 minutes.

(a) Calculate the mass of Mars.

[2]

(b) Given the diameter of Mars is 6800 km, Calculate the gravitational field strength on the surface of Mars.

[2]

(c) If a boy can jump a height of 1.5 m on the Earth's surface, what is the height he can reach on the surface of Mars?

[1]

3 The first law of thermodynamics may be expressed in the form

$$Q = \Delta U + W$$

Where Q is the thermal energy or heat supplied to the system
ΔU is the increase in internal energy
W is the work done by the system

Complete the table below for each of the changes shown. Write down the symbol "+" for an increase, the symbol "-" to indicate a decease and the symbol "0" for no change, as appropriate.

	Q	ΔU	W
The compression of an ideal gas at constant temperature			
The heating of a solid with no expansion			
The melting of ice at 0 °C to give water at 0 °C (Note: ice is less dense than water)			

[3]

4 Prior to entering a tunnel, the sound intensity from a train is 2.0×10^{-4} W m^{-2}. When it enters the tunnel, the sound intensity level of the train changes by + 10 dB. The reference intensity is 1.0×10^{-12} W m^{-2}.

(a) What is the sound intensity level of the train before entering the tunnel?

[2]

(b) What is the sound intensity of the train in the tunnel?

[2]

5 A 1.00-cm-highobject is placed 10.0 cm from a convex mirror whose radius of curvature is 30.0 cm.

(a) Sketch a ray diagram to show the formation of image by the mirror.

[2]

(b) Calculate using mirror's equation, the image distance and the linear magnification.

[3]

6 (a) An inductor, a resistor, a battery, and a switch are connected in series.
Sketch a graph to show the variation of the current with time after the switch is closed.

[1]

(b) A 200-mH inductor and a 50-Ω resistor is connected across the terminals of a 9.0-V battery of negligible internal resistance.

(i) What is the final steady current that flows in the circuit?

[1]

(ii) Find the initial rate of increase of current.

[3]

7 (a) Two small spheres of equal charges are placed 5.0 mm apart. Calculate the charge on one of the sphere if the force of repulsion between them is 2.5×10^{-3} N.

[2]

(b) A small sphere of mass 6.0×10^{-6} kg remains stationary when placed in an electric field of intensity 5.0×10^{4} Vm^{-1} acting vertically downwards.

(i) State whether the sphere is positively or negatively charged ?

[1]

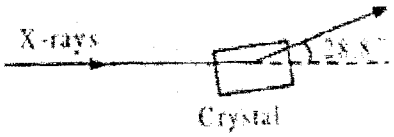
(ii) Calculate the magnitude of the charge on the sphere.

[2]

8 (a) Find the minimum accelerating potential required to produce X-rays of 1 .00 nm.

[2]

(b) X-rays of wavelength of 0.140 nm are directed to a certain crystal. The first – order maximum occurs at an angle of deviation of 28.8°



(i) What is the Bragg's angle?

[1]

(ii) Hence, find the interplanar spacing for this diffraction.

[2]

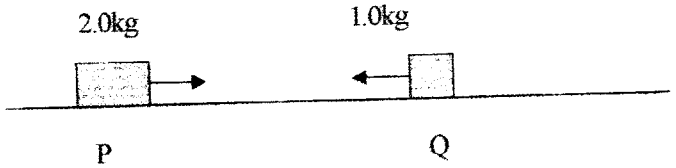
Section B [60 *marks*]

Answer any **four** *questions in this section.*

9 (a) Define Newton's second and third law of motion. [2]

(b) Apply these laws to the collision between two bodies, which were initially moving with unequal velocities along the same direction, and show that linear momentum is conserved. [3]

(c) The diagram below shows two objects P and Q of masses 2.0 kg and 1.0 kg respectively are moving towards each other on a smooth surface with the same speed of 3.00 m s^{-1}. If the collision is head-on and elastic, and the time of impact is 20 ms.



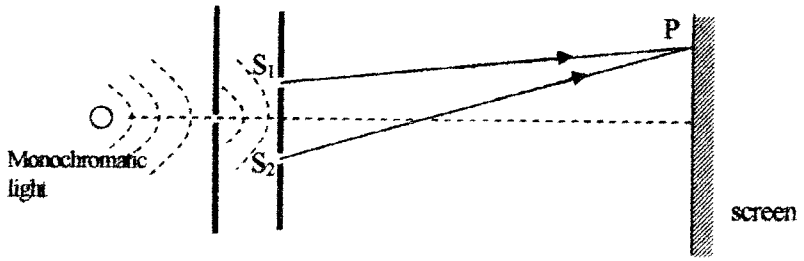
(i) By considering the momentum and kinetic energy of the system, determine the magnitude and direction of the velocities of the objects after collision. [5]

(ii) On the same axes, sketch the momentum-time graph to show the variation of momentum of each object with time for the duration before collision, during collision and after collision. [3]

(iii) Find the average force acted by the object P onto Q during the collision. [2]

10 (a) State the condition for two light sources to produce interference phenomenon. [1]

(b) The schematic diagram below shows the Young's double slit experiment.



The wavelength of the monochromatic source is λ.

(i) State in terms of λ for the path difference between S_1P and S_2P if a bright fringe is formed at P. Explain the terms used in your expression [2]

(ii) State in terms of λ for the path difference between S_1P and S_2P if P is the position for the 5th dark fringe. [2]

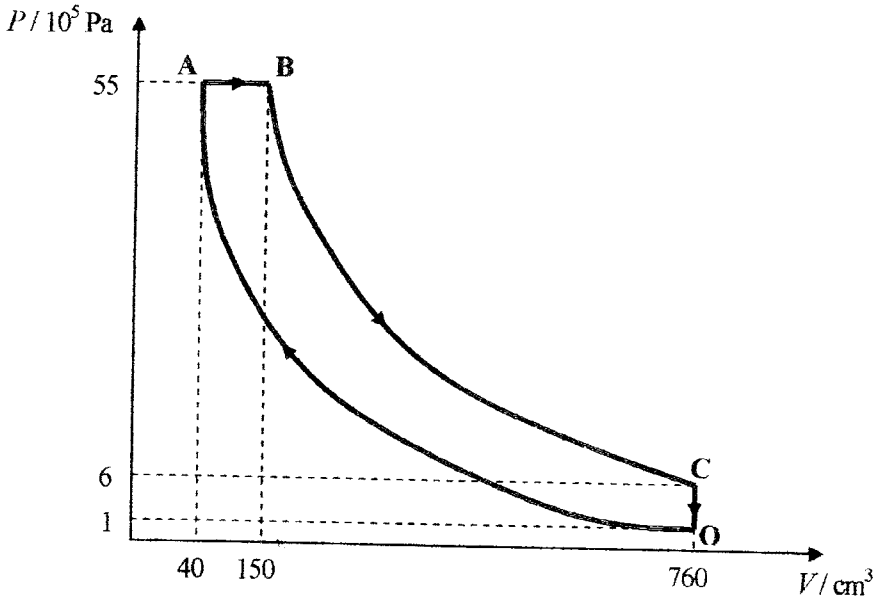
(iii) If λ is 560 nm, the slit separation is 0.5 mm, distance of screen from the slits is 1.0 m and P is the 10th bright fringe, calculate the distance of P from the central. [4]

(iv) With reference to (a)(iii), if the space in between the Young's double slit and the screen is filled with a medium of refractive index 1.5, what type of fringe is observed at P. Explain your answer. [2]

(c) A diffraction grating with 250 lines mm^{-1} is used to examine the sodium spectrum. Calculate the angular separation between the sodium doublet lines (588.995 nm and 589.592 nm) for the second order diffraction. [4]

11 (a) (i) Differentiate between thermal energy and heat. [2]
(ii) What is the internal energy for an ideal gas and a real gas? [2]

(b) The graph below shows an idealized diesel cycle.



A mass of gas in a vessel is firstly compressed adiabatically from O to A where 400 J of work is done on the gas. During the process A to B, diesel is injected into the gas and this causes heating at constant pressure as the diesel burns. The gas and burned fuel then expand adiabatically from B to C and during this process 1200 J of work is done by the system. Finally, heat is released to the surrounding as exhaust in process C to O.

(i) Calculate the work done by the gas in the process A to B. [3]
(ii) The heat generated in the burning of diesel in process A to B is 2500 J. Calculate the heat released in process C to O. [5]
(iii) Determine the efficiency e of the engine, given that

$$e = \frac{\text{Net work done}}{\text{Heat supplied to the system}}$$ [3]

12 (a)(i) Draw a labelled circuit diagram of a potentiometer used to compare EMF's of two cells. [2]

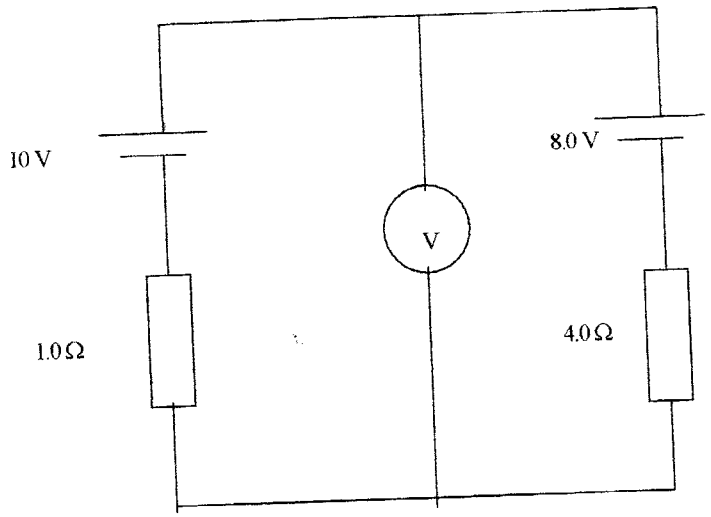
(ii) Explain why no current flows through the galvanometer when the potentiometer is balanced. [1]

(iii) Write an expression for the ratio of the two e.m.f.'s. [1]

(b) A potentiometer with a 200.0 cm long slide wire is used to measure the e.m.f. of a thermocouple. The resistance of the slide wire is 6.000 Ω, the current flowing through it is 2.000 mA and the balance point is 1.055 m from one end. Calculate the e.m.f. of the thermocouple. [4]

(c) Define i) potential difference and the unit volt [2]

(d)



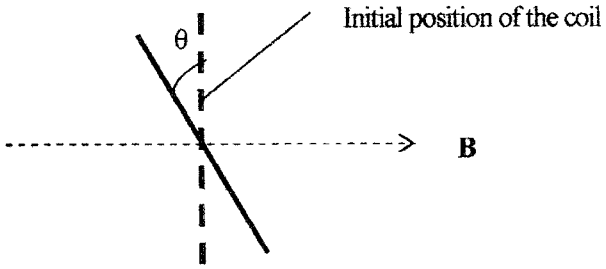
In the above circuit, the batteries have negligible internal resistances and the voltmeter has a very large resistance. Calculate

(i) the current that flows in the circuit and state its direction; [3]

(ii) the reading of the voltmeter [2]

13 (a) State the laws of electromagnetic induction. [2]

(b) A plane coil of wire of 20 turns and area of 0.040 m^2 is placed with its plane at right-angles to a uniform magnetic field of flux density 0.30 T.



(i) Write an expression for the flux linkage through the coil when its is at an angle θ from its initial position. Explain all the symbols used. [2]

(ii) Hence deduce maximum e.m.f. induced in the coil if it is rotated steadily at 10 revolution per second about an axis parallel to its plane passing through its centre and perpendicular to the magnetic field. [4]

(c) (i) Write an expression for the force per unit length acting between two infinitely long, straight and parallel current carrying conductors. Explain all the symbols used. [2]

(ii) Use the expression to define the unit 'ampere'. [1]

(d) A wire of diameter 0.50 mm could carry a large current.

(i) Calculate the weight of 1.0 m of this the wire (density of the wire = 8600 kg m^{-3}). [1]

(ii) Find what current would have to flow to levitate (lift up and float in air) 1.0 m length of this wire placed horizontally along the east-west direction at a point where the Earth's magnetic field is 56 μT horizontally in a northerly direction [3]

14 (a) Explain what is meant by

(i) mass number

(ii) atomic number and

(iii) isotope [3]

(b) A nucleus decays by emitting an alpha α particle followed by two beta β particle. Write the nuclear equations to show that the final nucleus is an isotope of the original nucleus. [2]

(c) The reaction shows that radium (Ra) decays into radon (Rn)

$$^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He + \gamma$$

(i) Explain what is meant by the conservation of mass-energy in a nuclear reaction. [2]

(ii) Calculate the energy released when a radium nucleus decays. [3]

(iii) If 4.0% of the energy released is changed into gamma rays, calculate the wavelength of the gamma rays. [3]

(iv) Explain what happen to the rest of the 96% of the energy. [2]

[Mass of ^{226}Ra atom = 226.025406 u

^{222}Rn atom = 222.017574 u

^{4}He atom = 4.002603 u]