UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	PHYSICS I
COURSE CODE	:	DAS 14103/DSF 1963
PROGRAMME	:	1 DAA/DAI/DAM/ DAE/DAL
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	2 1/2 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN PART A AND **THREE (3)** QUESTIONS IN PART B

THIS QUESTION PAPER CONSISTS OF FOURTEEN (14) PAGES

PART A

Q1 (a) What is the difference between "work" and "energy"?

(3 marks)

(b) **Figure Q1(b)** shows a solid mass of 15 kg is pulled 30 m on a plane making an angle 25° to horizontal. The force of 140 N is acting in parallel with the inclined plane. If the force of friction between the block and the plane is 44 N and the acceleration of gravity g = 9.81 ms^{-2},

(i) What is the value of work done by the force?
(ii) What is the work done by friction?
(iii) What is the net force acting on the block?

(7 marks)

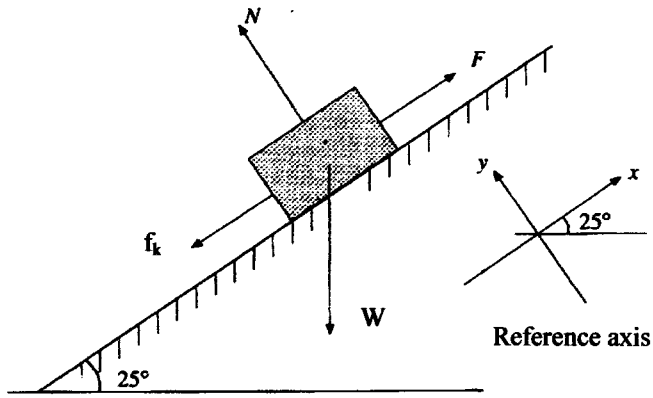


Figure Q1(b)

(c) Read carefully the statements below:

Steam engine - Here the coal burns and the heat due to the combustion of coal converts water into steam and the force exerted by the steam on the piston of the engine moves the locomotive.

Hydroelectric power plant - Here water stored in a reservoir is made to fall on turbines which are kept at a lower level and which in turn are connected to coils of an a.c. generator.

From the statements, what is the physical principle associating with the above two statements?

(3 marks)

(d) How fast should a man of mass 50 kg run, so that his kinetic energy is 625 J?

(3 marks)

(e) A boy spends 800 J of energy while lifting a body of mass 40 kg from a well. Calculate the depth of the well. Given g = 9.81 m/s^2.

(4 marks)

Q2 (a) **Figure Q2 (a)** shows a system of mass-spring on a horizontal frictionless surface. The spring is compressed at position x = - 6.0 cm from equilibrium and then released from that point. If the spring constant, k = 9.48 N/m, and the mass m is 0.035 kg, calculate,

(i) The initial acceleration, a of the mass.
(ii) The magnitude of force, F when the mass starts released.

(6 marks)

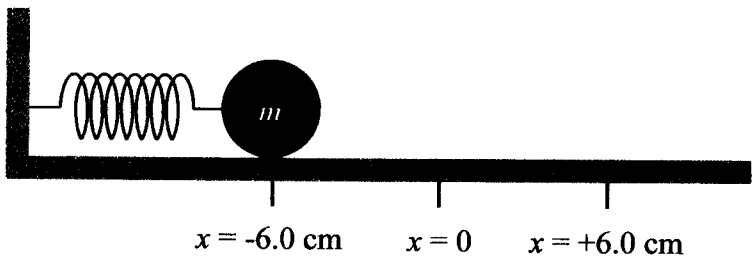


Figure Q2 (a)

(b) A body vibrates back and forth, and the displacement, x (in meter) of the body as a function of time, t (in second) as illustrated in **Figure Q2(b)**.

(i) Find the amplitude of the motion, A.
(ii) Find the period, T of the motion.
(iii) Calculate the frequency, f of the motion.
(iv) Write an appropriate equation for the body's displacement, x as a function of time, t.
(v) At which point will give the highest velocity and then calculate the magnitude of the velocity.

(14 marks)

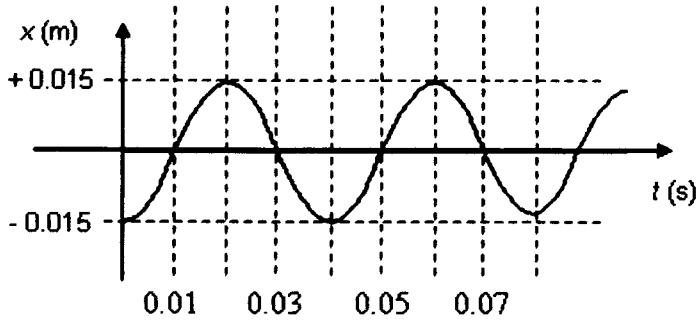


Figure Q2(b)

PART B

Q3 (a) Write the following values in an appropriate form of scientific notation. Give your answers in three significant figures.

(i) 3208000 W
(ii) 40×10^{-4} m

(4 marks)

(b) The volume of a wallet is 8.50 in^3. Convert this value to m^3, using the definition 1 in = 2.54 cm. (1 m = 100 cm)

(4 marks)

(c) The position of a particle, s moving under uniform acceleration is some function of acceleration, a and the time, t. Suppose we write this position, $s = ka^m t^n$, where k is a dimensionless constant. Show by dimensional analysis that this expression is satisfied if $m = 1$ and $n = 2$.

(4 marks)

(d) Compute algebraically the vector resultant (magnitude and direction) of the following coplanar displacements, 20 m at 30°, 40 m at 45° and 100 m at 240°.

(8 marks)

Q4 (a) A truck accelerates from rest at point **A** with constant acceleration of magnitude a and, subsequently, passes points **B** and **C** as shown in the **Figure Q4(a)**. The distance between points **B** and **C** is x, and the time required for the truck to travel from **B** to **C** is t. Express the average speed of the truck between points **B** and **C.**

(2 marks)

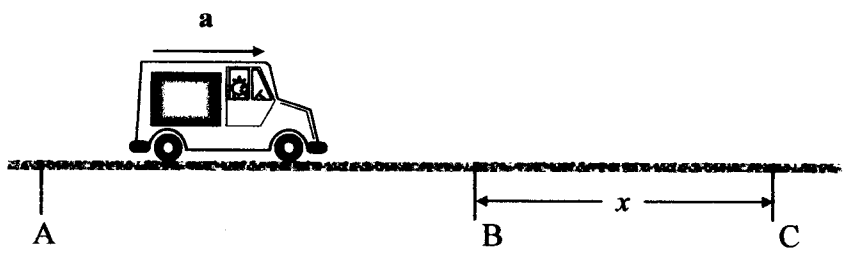


Figure Q4(a)

(b) A car is initially traveling at 50.0 km/h. The brakes are applied and the car stops over a distance of 35 m. What was the magnitude of the car's acceleration while it was braking?

(6 marks)

(c) Ahmad throws a tennis ball vertically upward. The ball returns to the point of release after 3.5 s. What is the speed of the ball as it is released?

(6 marks)

(d) A tennis ball is thrown upward at an angle from point *A* as illustrated in **Figure Q4(d)**. It follows a parabolic trajectory and hits the ground at point *D*. At the instant shown, the ball is at point *B*. Point *C* represents the highest position of the ball above the ground.

(i) While in flight, how do the *x* and *y* components of the velocity vector of the ball compare at the points *B* and *C*?
(ii) While in flight, how do the *x* and *y* components of the velocity vector of the ball compare at the points *A* and *D*?
(iii) Explain the velocity of *x* and *y*-components at point C.

(6 marks)

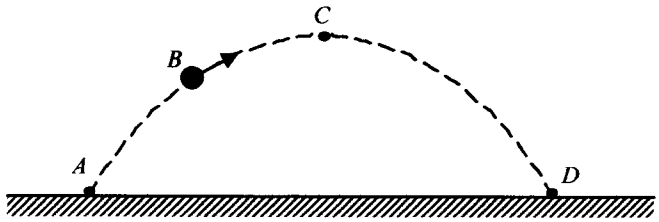


Figure Q4(d)

Q5 (a) Mr Ali is pushing a steel cupboard sliding up on an incline plane at an angle of 30° to the horizontal. The mass of the steel cupboard is 95 kg and the force of friction between the steel cupboards with incline plane is 5N.

(i) Draw the free body diagram of all forces acting on the steel cupboard.
(ii) What is the normal force, N acting on the steel cupboard?
(iii) If the acceleration of the steel cupboard is 0.25 ms^{-2}, how much force is required by Mr. Ali to pull up the steel cupboard?

(10 marks)

(b) **Figure Q5(b)** shows a smooth pulley with the mass of m_1 and m_2 suspended on a rope through the pulleys. Given the mass $m_1 = 5$ kg and $m_2 = 3$ kg. Determine,

(i) An acceleration of the system, a.
(ii) The tension on the rope, T.

(10 marks)

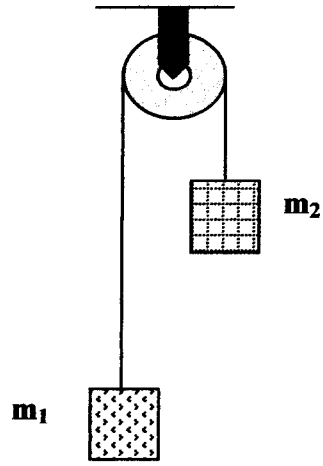


Figure Q5(b)

Q6 (a) Describe briefly a uniform circular motion.

(3 marks)

(b) If $a = \omega^2 r$, show that $a = \frac{v^2}{r}$.

(4 marks)

(c) A wheel has a radius of 0.40 m and makes one complete turn every 8.0 s. How long does the wheel take to roll 36 m?

(7 marks)

(d) Consider a nylon cord of 0.23 m length that whirls about an axle at 660 rad/s. What is the linear speed of the tip of the nylon cord?

(6 marks)

BAHAGIAN A

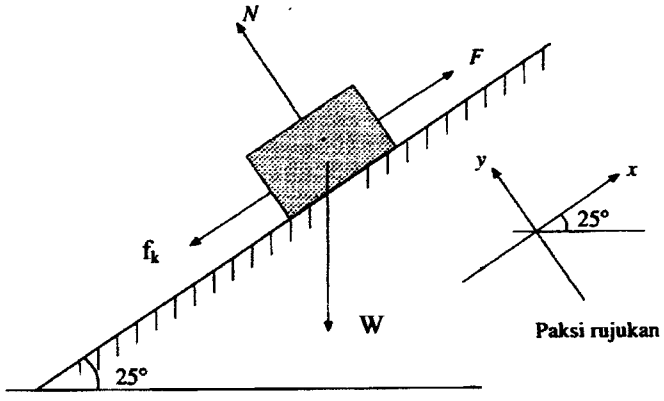
S1 (a) Apakah perbezaan di antara "kerja" dan "tenaga"?

(3 markah)

(b) **Rajah S1(b)** memperihalkan sebuah pepejal berjisim 15 kg ditarik sepanjang 30 m diatas satah yang bersudut 25° terhadap garis melintang. Sejumlah 140 N daya bertindak selari dengan satah condong itu. Jika daya geseran di antara bongkah dan satah itu adalah sebanyak 44N dan pecutan graviti g = 9.81 ms^{-2},

(i) Berapakah nilai kerja yang terhasil daripada daya itu?
(ii) Berapakah nilai kerja yang terhasil daripada daya geseran?
(iii) Berapakah jumlah daya yang bertindak pada bongkah itu?

(7 markah)



Rajah S1(b)

(c) Baca kenyataan di bawah dengan teliti:

Motor stim - Menggunakan kaedah pembakaran arang batu dan haba yang terhasil daripada pembakaran itu menukarkan air kepada stim dan seterusnya menghasilkan daya pada omboh motor, lalu mengerakkan keretapi.

Penjanakuasa hidroelektrik – Di jana kuasa ini, air daripada kolam dialirkan ke tubin yang diletakkan di aras rendah dan turbin ini di sambungkan kepada linkaran penjana arus ulang alik.

Daripada kenyataan di atas, apakah prinsip fizik yang terlibat di dalam kedua-dua kenyataan itu?

(3 markah)

(d) Berapa pantas seorang lelaki berjisim 50 kg berlari, supaya tenaga kinetik lelaki itu bernilai 625 J?

(3 markah)

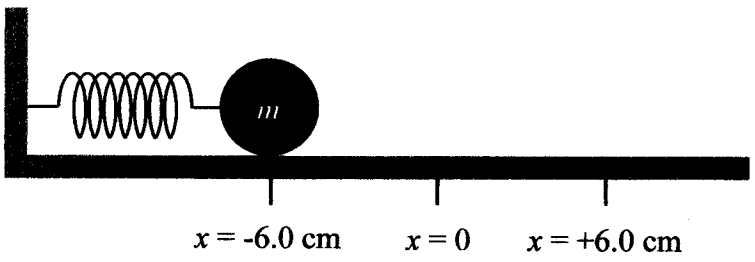
(e) Seorang budak lelaki mengeluarkan 800 J tenaga semasa mengangkat jasad yang berjisim 40 kg daripada sebuah perigi. Hitungkan kedalaman perigi itu. Diberi $g = 9.81\ m/s^2$.

(4 markah)

S2 (a) **Rajah S2(a)** memperihalkan sebuah sistem spring-jisim di permukaan garis melintang yang tidak mempunyai geseran. Spring dimampatkan pada kedudukan x = - 6.0 cm daripada keseimbangan dan dilepaskan di titik itu. Jika pemalar spring, k = 9.48 N/m, dan jisim m adalah 0.035 kg, hitung,

(i) Pecutan awal, *a* jisim itu.
(ii) Nilai daya, *F* semasa jisim itu dilepaskan.

(6 markah)

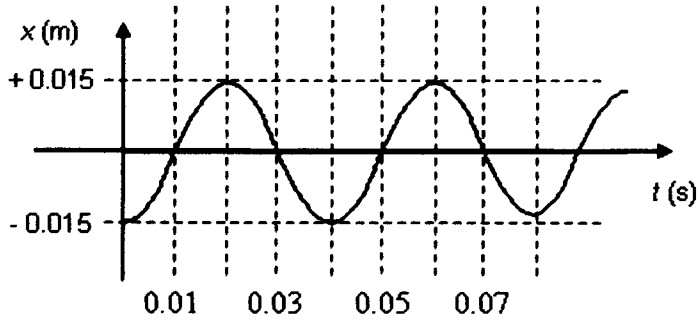


Rajah S2(a)

(b) Sebuah jasad bergetar ke belakang dan keluar, dan sesaran, x (dalam meter) jasad itu bergantung pada masa, t (dalam saat) diperihalkan oleh **Rajah S2(b)**.

(i) Nyatakan amplitud gerakan, A.
(ii) Nyatakan tempoh, T gerakan itu.
(iii)Hitung frekuensi, f gerakan itu.
(iv)Tulis persamaan yang sesuai dan bergantung pada masa, *t* untuk sesaran, *x* jasad itu.
(v) Pada titik manakah nilai halaju yang tertinggi dan hitung nilai halajunya.

(14 markah)



Rajah S2(b)

BAHAGIAN B

S3 (a) Tulis nilai-nilai berikut dengan mengunakan sistem menulis angka saintifik yang sesuai. Berikan jawapan supaya mematuhi tiga angka bererti.

(i) 3208000 W
(ii) 40×10^{-4} m

(4 markah)

(b) Isipadu sebuah dompet ialah 8.50 in^3. Tukarkan nilai ini kepada m^3, dengan mengunakan takrifan 1 in = 2.54 cm. (1 m = 100 cm)

(4 markah)

(c) Kedudukan suatu zarah, s bergerak dengan pecutan seragam adalah suatu fungsi peranan pecutan, a dan masa, t. Andaikan kedudukan, $s = ka^m t^n$, dimana k tidak mempunyai dimensi. Dengan menggunakan analisis dimensi, buktikan persamaan ini sesuai jika $m = 1$ dan $n = 2$.

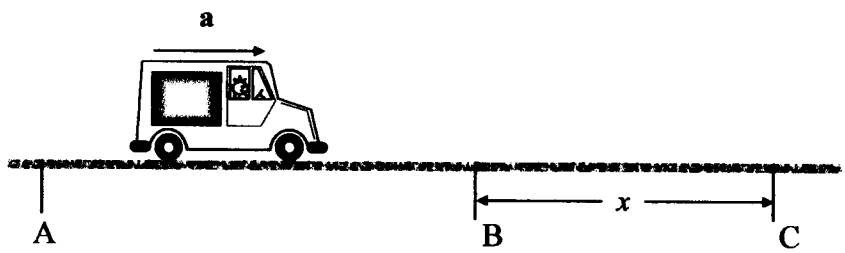
(4 markah)

(d) Hitungkan secara algebra paduan vektor (nilai dan arah) beberapa sesaran ko-planar berikut, 20 m pada 30°, 40 m pada 45° dan 100 m pada 240°.

(8 markah)

S4 (a) Sebuah lori memecut daripada keadaan rehat di titik **A** dengan pecutan seragam bernilai a dan, kemudian, melalui titik **B** dan **C** seperti di **Rajah S4(a)**. Jarak di antara titik **B** dan **C** ialah x, dan masa yang diperlukan oleh lori itu untuk bergerak dari titik **B** ke **C** ialah t. Ungkapkan laju purata lori itu di antara titik **B** dan **C**.

(2 markah)



Rajah S4(a)

(b) Sebuah kereta pada mulanya bergerak pada 50.0 km/h. Apabila brek digunakan, kereta itu berhenti pada jarak 35 m. Apakah nilai pecutan kerata itu semasa ia membrek?

(6 markah)

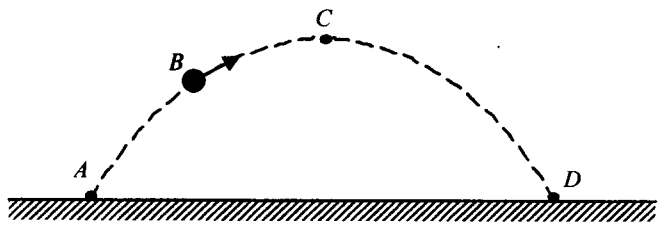
(c) Ahmad membaling sebiji bola tenis secara mencancang keatas. Bola itu kembali pada titik asal setelah 3.5 s. Berapakah laju bola itu semasa ia dilepaskan?

(6 markah)

(d) Sebiji bola tenis dibaling ke atas pada suatu sudut dari titik *A* seperti di **Rajah S4(d)**. Ia mengikut lintasan parabola dan jatuh ke dasar pada titik *D*. Sekilas pandangan, bola itu berada di titik *B*. Titik *C* menggambarkan kedudukan tertinggi bola itu daripada dasar.

(i) Semasa penerbangan, bagaimanakah halaju komponen x dan y bagi vektor itu jika dibandingkan pada titik *B* dan *C*?
(ii) Semasa penerbangan, bagaimanakah halaju komponen x dan y bagi vektor itu jika dibandingkan pada titik *A* dan *D*?
(iii) Jelaskan halaju komponen x dan y pada titik *C*.

(6 markah)



Rajah S4(d)

S5 (a) En. Ali menolak sebuah almari besi secara menggelongsor ke atas pada suatu satah condong bersudut 30° daripada garis ufuk. Jisim almari besi itu ialah 95 kg dan daya geseran di antara permukaan almari dan satah condong ialah 5N.

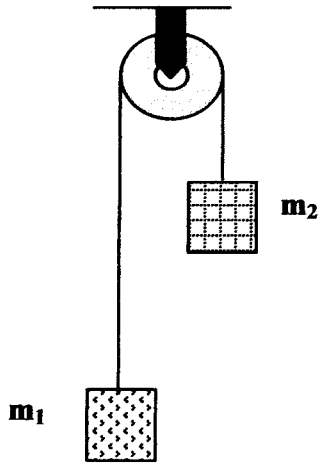
(i) Lukiskan rajah jasad bebas bagi semua daya-daya yang terlibat pada almari besi itu.
(ii) Apakah daya normal, N yang bertindak keatas almari besi itu?
(iii) Jika pecutan almari besi itu ialah 0.25 ms^{-2}, Berapakah daya yang diperlukan oleh En. Ali untuk menarik almari besi itu keatas?

(10 markah)

(b) **Rajah S5(b)** menunjukkan sebuah takal lancar dengan jisim m_1 dan m_2 tergantung pada tali dan terus ke takal. Diberi jisim $m_1 = 5$ kg dan $m_2 = 3$ kg. Tentukan,

(i) Pecutan sistem ini, *a*.
(ii) Ketegangan pada tali, *T*.

(10 markah)



Rajah S5(b)

S6 (a) Terangkan dengan ringkas tentang pergerakan membulat seragam.

(3 markah)

(b) Jika $a = \omega^2 r$, buktikan bahawa $a = \frac{v^2}{r}$.

(4 markah)

(c) Sebuah roda mempunyai jejari sepanjang 0.40 m dan membuat satu pusingan lengkap setiap 8 s. Berapakah masa yang diambil roda itu untuk berputar sepanjang 36 m?

(7 markah)

(d) Pertimbangkan tali nilon dari panjang 0.23 m yang berputar pada satu gandar roda dengan 660 rad /s. Berapa laju linear dari hujung kabel nilon?

(6 markah)

LIST OF CONSTANT AND FORMULAS

Gravity acceleration, $g = 9.81\ m/s^2$	$E_u = \frac{1}{2}kx^2 = \frac{1}{2}m\omega^2x^2$	$s = r\theta$
$K = \frac{1}{2}mv^2$	$E_J = E_k + E_u = \frac{1}{2}m\omega^2A^2$	$v = r\omega$
$U = mgh$	$R = \sqrt{R_x^2 + R_y^2}$	$a = r\alpha$
$E_k = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2 - x^2)$	$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$	$\omega = \frac{d\theta}{dt}$
$W = F \cdot s = Fs\ kos\theta$	$v = u + at$	$\alpha = \frac{d\omega}{dt}$
$\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = -(mgh_2 - mgh_1)$	$s = ut + \frac{1}{2}at^2$	$a_c = \frac{v^2}{r} = \omega^2 r$
$a = -\omega^2 \cdot x$	$v^2 = u^2 + 2as$	$a = r\sqrt{\omega^4 + \alpha^2}$
$f = \frac{1}{T} = \frac{\omega}{2\pi}$	$\sum F = ma$	$\omega = \omega_o + \alpha t$
$v = \omega\sqrt{A^2 - x^2}$	$W = mg$	$\theta = \omega_o t + \frac{1}{2}\alpha \cdot t^2$
$\Delta K = -\Delta U$	$f_k = \mu_k . N$	$\omega^2 = \omega_o^2 + 2\alpha \cdot \Delta\theta$
$W_n = \Delta K$	$f_s = \mu_s . N$	$P = m \cdot v$