UNIVERSITI TEKNOLOGI MALAYSIA

Sekolah Pendidikan Profesional dan Pendidikan Berterusan (SPACE)

FINAL EXAMINATION / *PEPERIKSAAN AKHIR*
SEMESTER I – SESSION 2020/ 2021 / *SEMESTER I – SESI 2020/2021*
PROGRAM KERJASAMA

COURSE CODE *KOD KURSUS*	: DDWS 1713
COURSE NAME *NAMA KURSUS*	: PHYSICS *FIZIK*
YEAR / PROGRAMME *TAHUN / PROGRAM*	:1 / DDWA / DDWJ *1 / DDWA / DDWJ*
DURATION *TEMPOH*	: 3 HOURS (INCLUDING SUBMISSION HOUR) *3 JAM (TERMASUK MASA PENGHANTARAN)*
DATE *TARIKH*	:NOVEMBER 2020 *NOVEMBER 2020*

INSTRUCTION / *ARAHAN:*

1. The question paper consists of **2 PARTS**: A and B.
   *Kertas soalan terdiri daripada**2 BAHAGIAN**: A dan B.*

2. Answer **ALL** questions and write your answers on the answer sheet.
   *Jawab **SEMUA** soalan dan tulis jawapan anda pada kertas jawapan.*

3. Write your name, matric no., identity card no., course code, course name, section no. and lecturer's name on the first page (in the upper left corner) and every page thereafter on the answer sheet.
   Tulis nama anda, no.matrik, no.kad pengenalan, kod kursus, nama kursus, no. seksyen dan nama pensyarah pada muka surat pertama (penjuru kiri atas) kertas jawapan dan pada setiap muka surat jawapan.

4. Each answer sheet must have a page number written at the bottom right corner.
   Setiap helai kertas jawapan mesti ditulis nombor muka surat pada bahagian bawah penjuru kanan.

5. Answers should be handwritten, neat and clear.
   Jawapan hendaklah ditulis tangan, kemas dan jelas menggunakan huruf cerai.

WARNING / *AMARAN*

Students caught copying / cheating during the examination will be liable for disciplinary actions and the faculty may recommend the student to be expelled from sitting for exam.
Pelajar yang ditangkap meniru / menipu semasa peperiksaan akan dikenakan tindakan disiplin dan pihak fakulti boleh mengesyorkan pelajar diusir dari menduduki peperiksaan.

This examination paper consists of **13** pages including the cover.
*Kertas soalan ini mengandungi **13** muka surat termasuk kulit hadapan.*

ONLINE EXAMINATION RULES AND REGULATIONS
PERATURAN PEPERIKSAAN SECARA DALAM TALIAN

1. Student must carefully listen and follow instructions provided by invigilator.
   Pelajar mesti mendengar dan mengikuti arahan yang diberikan oleh pengawas peperiksaan dengan teliti.

2. Student is allowed to start examination only after confirmation of invigilator if all needed conditions are implemented.
   Pelajar dibenarkan memulakan peperiksaan hanya setelah pengesahan pengawas peperiksaan sekiranya semua syarat yang diperlukan telah dilaksanakan.

3. During all examination session student has to ensure, that he is alone in the room.
   Semasa semua sesi peperiksaan pelajar harus memastikan bahawa dia bersendirian di dalam bilik.

4. During all examination session student is not allowed to use any other devices, applications except other sites permitted by course lecturer.
   Sepanjang sesi peperiksaan pelajar tidak dibenarkan menggunakan peranti dan aplikasi lain kecuali yang dibenarkan oleh pensyarah kursus.

5. After completing the exam student must inform invigilator via the set communication platform (eg. WhatsApp etc.) about completion of exam and after invigilatorôs confirmation leave examination session.
   Selepas peperiksaan selesai, pelajar mesti memaklumkan kepada pengawas peperiksaan melalui platform komunikasi yang ditetapkan (contoh: Whatsapp dan lain-lain) mengenai peperiksaan yang telah selesai dan meninggalkan sesi peperiksaan selepas mendapat pengesahan daripada pengawas peperiksaan.

6. Any technical issues in submitting answers online have to be informed to respective lecturer within the given 30 minutes. Request for re-examination or appeal will not be entertain if complains are not made by students to their lecturers within the given 30 minutes.
   Sebarang masalah teknikal dalam menghantar jawapan secara dalam talian perlu dimaklumkan kepada pensyarah masing-masing dalam masa 30 minit yang diberikan. Permintaan untuk pemeriksaan semula atau rayuan tidak akan dilayan sekiranya aduan tidak dibuat oleh pelajar kepada pensyarah mereka dalam masa 30 minit yang diberikan.

7. During online examination, the integrity and honesty of the student is also tested. At any circumstances student is not allowed to cheat during examination session. If any kind of cheating behaviour is observed, UTM have a right to follow related terms and provisions stated in the respective Academic Regulations and apply needed measures.
   Semasa peperiksaan dalam talian, integriti dan kejujuran pelajar juga diuji. Walau apa pun keadaan pelajar tidak dibenarkan menipu semasa sesi peperiksaan. Sekiranya terdapat sebarang salah laku, UTM berhak untuk mengikuti terma yang dinyatakan dalam Peraturan Akademik.

SECTION A/ BAHAGIAN A *(20 marks / markah)*

Answer all questions in this section. / *Jawab semua soalan dalam bahagian ini.*

1. **The diameter of Milky Way galaxy is about 100,000 light-years across. 1 light-year is the distance travelled by light in one year. Given that speed of light is 3 x 10^8m/s and 1 year is 364.25 days, determine**
   (a) distance of 1 light-year in meter.
   (b) diameter of Milky Way Galaxy galaxy in meters.

   Diameter galaksi Bima Sakti adalah merentas jarak 100,000 tahun-cahaya. 1 tahun-cahaya adalah jarak yang dilalui oleh cahaya dalam masa setahun. Diberi laju cahaya adalah 3 x 10^8m/s dan 1 tahun bersamaan dengan 364.25 hari, tentukan
   (a) jarak 1 tahun cahaya dalam meter
   (b) diameter galaksi Bima Sakti dalam unit meter

2. **Astrounauts in a space shuttle orbiting the Earth experience weightlessness because they are beyond the pull of Earth's gravity. Explain why this statement is wrong.**
   Angkasawan yang berada dalam kapal angkasa mengorbit Bumi mengalami ketiadaan berat kerana mereka berada diluar tarikan daya medan graviti. Terangkan mengapa kenyataan ini salah.

3. **Explain why the following statements are wrong.**
   (a) When an object is not moving, then there is no force acts on it.
   (b) A less massive object can never have more momentum than a more massive object.

   Terangkan mengapa kenyataan-kenyataan berikut adalah salah.
   (a) Apabila sebuah jasad tidak bergerak, maka tidak ada daya bertindak keatasnya.
   (b) Objek yang lebih ringan tidak mungkin mempunyai momentum yang lebih besar dari objek yang lebih berat

4. **If we spin a bucket filled with water fast enough in a vertical cycle, the water stays in the bucket and will not spilt. Explain why.**

Jika kita pusingkan baldi yang penuh air dengan cukup laju, air akan tetap dalam baldi dan tidak tumpah. Terangkan mengapa.

5. Two cannons are fired with two different initial velocity and at two different angles to a same target as shown in Figure 1. Without doing any calculation, estimate which cannon has

(a) higher initial velocity, and

(b) longer time of flight.

Explain your reason with the help of specific formula.

Dua meriam ditembak dengan halaju awal yang berbeza dan sudut dongak yang berbeza pada satu target yang sama seperti yang di tunjukkan dalam Rajah 1. Tampa melakukan sebarang kiraan, anggarkan meriam yang manakah yang mempunyai

(a) halaju awal yang lebih besar

(b) masa penerbangan yang lebih besar

Terangkan alasan anda dengan pertolongan rumus tertentu.

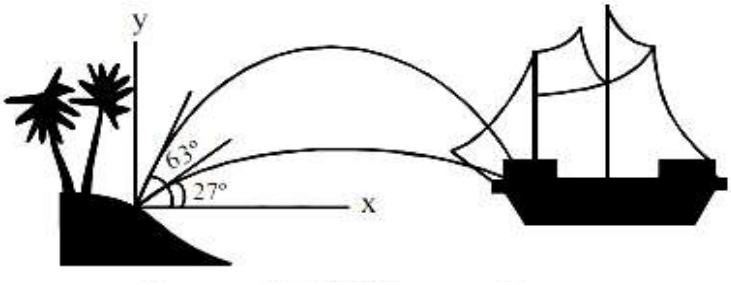


Figure 1 / *Rajah 1*

6. A boat with velocity 5m/s is crossing a river 40m wide straight to A as seen in Figure 2. Unfortunately, a river current at velocity 2m/s is flowing downstream at velocity 2m/s. The boat drift which ends up at B instead of A. Determine

(a) the drift velocity

(b) the drift angle θ_{drift}

(c) the drift distance of AB

Sebuah bot dengan halaju 5m/s menyeberang sungai selebar 40m tegak ke A seperti ditunjukkan dalam Rajah 2. Malangnya, arus sungai mengalir ke arah muara sungai selaju 2m/s. Bot hanyut dan akhirnya sampai di B dan bukannya di A.

Tentukan

(a) halaju hanyut

(b) sudut hanyut θ_{drift}

(c) jarak hanyut AB

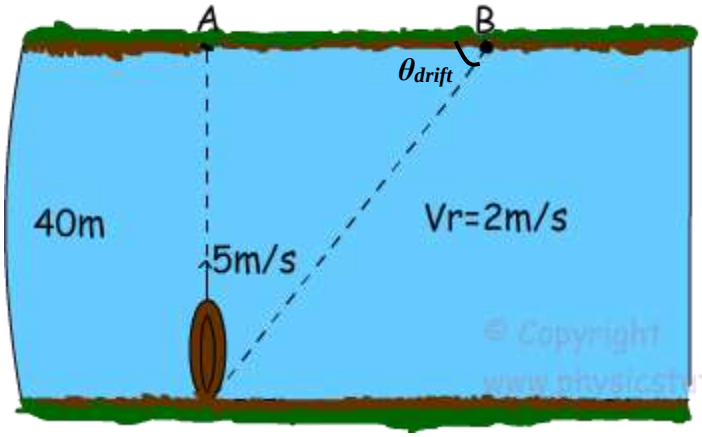


Figure 2/*Rajah 2*

7. Refer the graph in Figure 3 and answer the following questions.

(a) What are the two points that are in phase?

(b) **What are the two points that are out of phase?**

Rujuk kepada graf dalam Rajah 3 dan jawab soalan dibawah.

(a) Manakah dua titik-titik yang sama fasa?

(b) Manakah dua titik-titik yang bertentangan fasa?

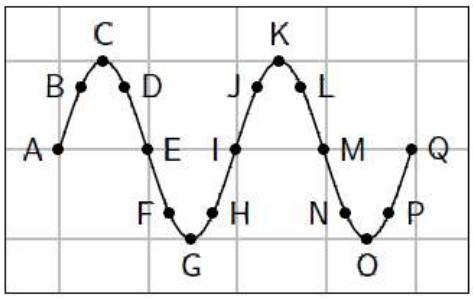


Figure 3/ *Rajah 3*

8. **Four billion years from now, our galaxy, the Milky Way, will collide and combined with our neighboring galaxy, Andromeda. Refer to Figure 4. Before that happen, both galaxies will orbits around each other. Assume that the mass of each galaxy is 800solar masses and their centers are separated by 2.5million light years, what would their velocity and their orbital period would be? Given that 1 solar mass is 1.898 x 10^{30} kg = mass of our sun and 1ly =9.46 x 10^{15}m.**

   Empat billion tahun dari sekarang, galaksi kita Bima Sakti akan berlanggar dan bersatu dengan galaksi jiran Andromeda. Rujuk Rajah 4. Sebelum itu berlaku, kedua-dua galaksi akan mengorbit satu sama lain. Anggapkan bahawa jisim tiap satu galaksi adalah 800 million jisim matahari, apakah laju dan tempoh mengorbit mereka? Diberi jisim matahari adalah1.898 x 10^{30} kg dan 1 tahun cahaya=9.46 x 10^{15}m.

Figure 4 / *Rajah 4*

9. **Explain the meaning of phase difference between 2 particles oscillating with a tranverse wave. What are the meaning of in-phase and out of phase?**

   Terangkan maksud beza fasa diantara 2 zarah-zarah dalam gelombang melintang. Apakah maksud fasa sama dan fasa bertentangan.

10. **If the cart has the speed of 2m/s at A in Figure 5, determine how high, H_{max} it can go before stops at D. Explain why it doesn't go higher. Assume the track is frictionless. Use the method of conservation of mechanical energy.**

Jika troli mempunyai laju 2m/s di A dalam Rajah 5, tentukan berapa tinggi maksima, H_{max} yang boleh dicapainya sebelum berhenti di titik D. Terangkan mengapa troli tidak boleh memanjat lebih tinggi. Anggapkan trek adalah licin. Gunakan kaedah keabadian tenaga mekanikal.

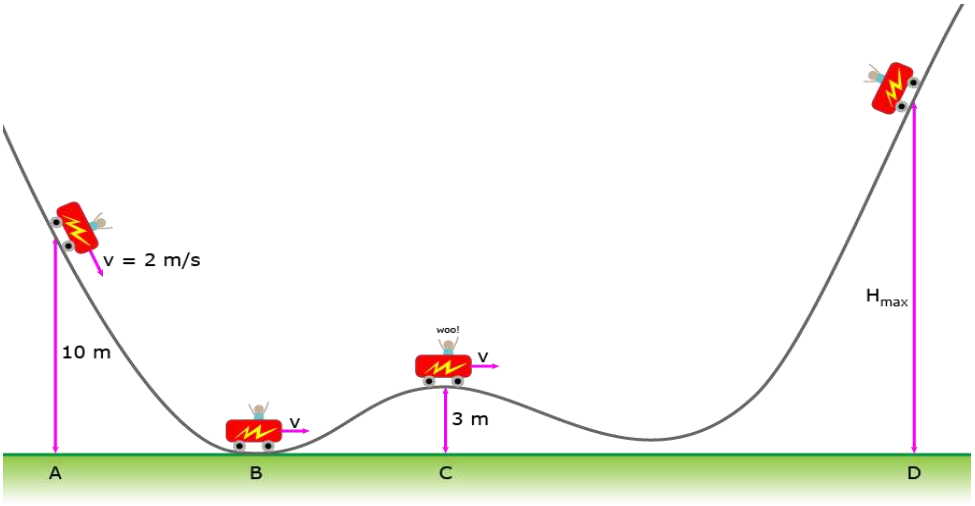


Figure 5 / *Rajah 5*

END OF SECTION A/ *BAHAGIAN A TAMAT*

SECTION B / *BAHAGIAN B* (30 marks / *markah*)

Answer ALL question / *Jawab SEMUA soalan.*

1. A small airplane flies to the north with a speed of v_p = 300 mph (miles per hour). There is wind blowing in the direction of θ = 30° southwest at the speed v_w = 40mph as shown in Figure 6. Given that 1 mile = 1609 m.

(a) Change 300mph and 40mph into km/h

(b) Find the relative velocity v_{tot}, (magnitude and direction) in unit of km/h.

(c) The wind will throw the airplane off-course and arrived at different point. How far is this point from the intended destination if the intended destination is 1500km from the starting point?

Sebuah kapalterbang terbang ke arah utara dengan kelajuan v_p = 300bsj (batu se jam). Terdapat angin bertiup ke arah barat daya, θ =30° dengan kelajuan v_w = 40bsj seperti Rajah 6. Diberi 1 batu = 1609m

(a) Tukarkan 300bsj dan 40bsj kepada km/j

(b) Dapatkan halaju relatif v_{tot} (arah dan magnitud) kapalterbang dalam unit km/j

(c) Angin menyebabkan kapalterbang tersasar daripada destinasi asal dan sampai lewat. Berapa jauhkan kapalterbang tersasar dan masa terlewat sekiranya destinasi asal adalah 1500km dari titik permulaan?

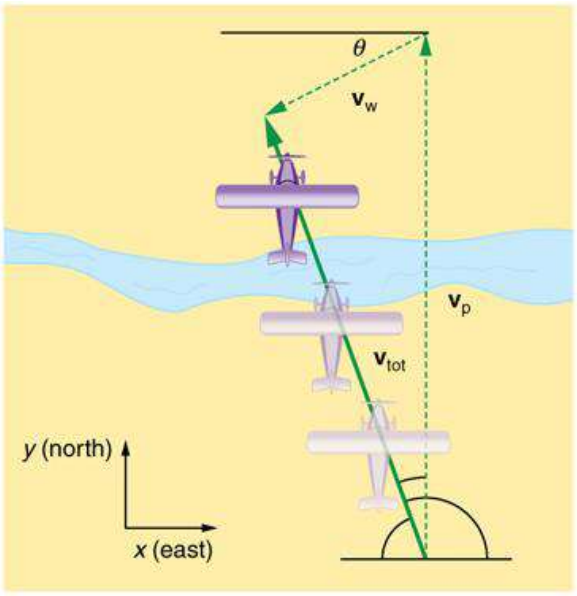


Figure 6 / *Rajah 6*

2. **A cannon is fired horizontally from a cliff 22m high and landed 300m from the base of the cliff as shown in Figure 7. Determine**

   (a) the velocity of cannon when it is fired,

   (b) time of flight,

   (c) velocity at which the ball hit the ground.

   Sebuah meriam ditembak secara mendatar dari atas sebuah cerun setinggi 22m dan bola menghentam bumi pada jarak 300m dari kaki cerun seperti yang ditunjukkan dalam Rajah 7. Tentukan,

   (a) halaju meriam ditembak

   (b) masa penerbangan dan

   (c) halaju ketika bola menghentam bumi.

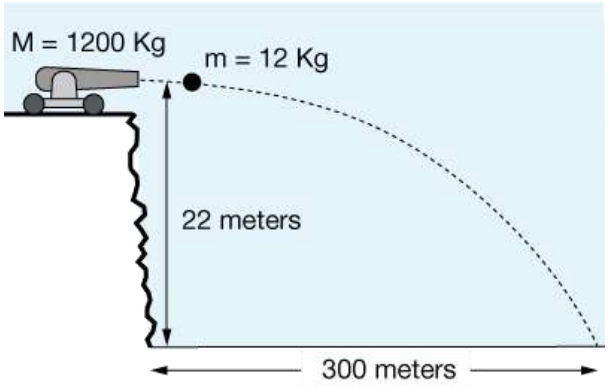


Figure 7 / *Rajah 7*

3. **An astronaut connected via a tether to a space shuttle is assigned to fix a minor malfunction outside the spaceship. Suddenly, tether broke loose and he is thrown away from the space shuttle. Refer to Figure 8. To get back to the shuttle he has to throw away a big to create a recoiled velocity or a repulsion. Given that the mass of the astronaut and the wrench is 100.0kg and 2.0kg respectively and the wrench is thrown at speed of 5.0m/s.**

   (a) In what direction the wrench has to be thrown?

   (b) What is the astronaut's recoil velocity?

   (c) What is the impulse of the wrench?

   (d) Is this an elastic repulsion?

Seorang angkasawan tertambat kepada kapal angkasa dengan penambat yang membolehkannya membaiki kerosakkan kecil di luar kapal angkasa. Tiba-tiba penambat putus dan angkasawan tercampak jauh dari kapal angkasa. Rujuk kepada Rajah 8. Untuk balik semula ke kapal angkasa, dia mesti mencampakkan spana besar yang di tangannya untuk mencipta halaju mundur atau tolakan. Diberi bahawa jisim angkasawan dan spana masing-masing adalah 100.0kg dan 2.0kg, dan spana dicampak dengan kelajuan 5.0m/s.

(a) Kearah manakah spana itu mesti dicampakkan?

(b) Apakah halaju mundur angkasawan?

(c) Apakah impulse spana?

(d) Adakah tolakkan ini elastik?

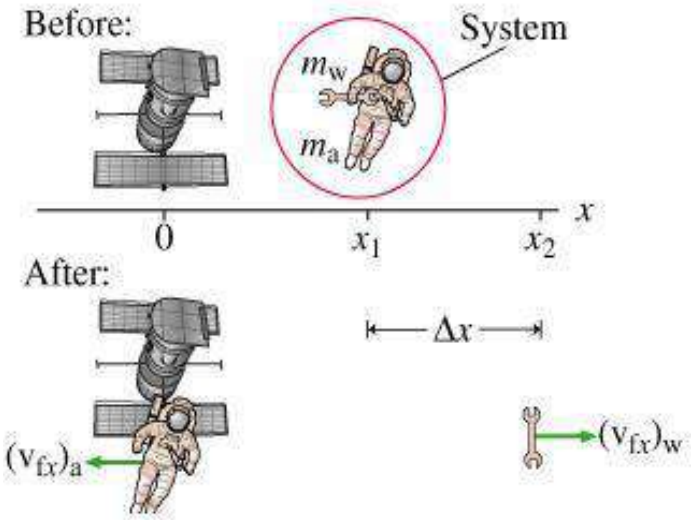


Figure 8 / *Rajah 8*

4. (a) What must be the coefficient of friction between the tires and the level roadway to allow a car weight 1000kg to make a turn at a curve road of radius r = 200 m at a speed of 60 km/h safely? Refer to Figure 9.

(b) If instead the road is banked, so that now component of weight will supply the centripetal force (replacing the friction) what is the angle θ of the bankedment?

(a) Apakah pemalar geseran antara tayar kereta dan jalan datar untuk membolehkan sebuah kereta berjisim 1000kg membuat belokkan pada suatu selekoh jalan berjejari r = 200m pada kelajuan 60km/j dengan selamat? Rujuk kepada Rajah 9.

(b) Sekiranya jalan di sengetkan supaya komponen berat dapat membekalkan daya memusat (mengantikan daya geseran) untuk membelok, berapakah sudut sendeng θ?

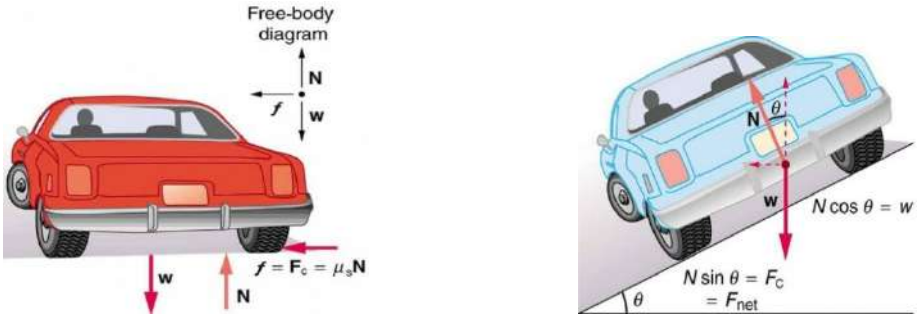


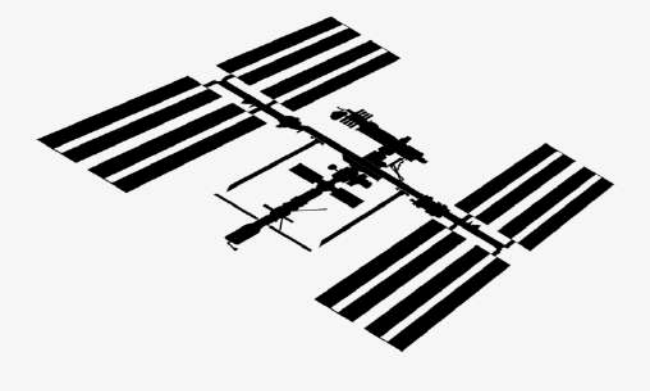
Figure 9 / *Rajah 9*

5. (a) Determine the orbital speed and period for the International Space Station (ISS) that orbits 4.00 x 10^2 km above Earth's surface. Refer to Figure 10.

(b) Satellite named Soyuz is sent to ISS from the Earth's surface. What is the change in potential energy of Sayuz? Given that the mass of Soyuz is 380,000kg and G = 6.67 x 10^{-11} Nm^2/kg^2, calculate the kinetic energy of Soyuz in orbit.

(a) Tentukan laju dan tempoh Stesen Angkasa Antarabangsa (ISS) yang mengorbit 4.00 x 10^2km dari permukaan Bumi. Rujuk Rajah 10.

(b) Roket Russia, Sayuz dihantar ke ISS dari permukaan bumi. Kirakan perubahan tenaga potensi Soyuz. Di beri jisim soyuz adalah 380,000kg dan G = 6.67 x 10^{-11} Nm^2/kg^2, kirakan tenaga kinetik Soyuz dalam orbit.



INTERNATIONAL SPACE STATION (ISS) /

STESEN ANGKASA ANTARABANGSA (SAA)

Figure 10 / *Rajah 10*

6. Object with mass 0.5kg is attached to a string with spring constant k = 50N/m. At time t = 0, the displacement from center of equilibrium is x = - 0.2m and velocity, v = + 0.5m/s. Assuming that x = A sin ($\omega t + \phi$) find,

(a) the angular velocity, ω

(b) the amplitude

(c) phase constant ϕ

Write the equation of SHM x = A sin ($\omega t + \phi$)

When did it happen (t?) that x = -0.2cm and velocity v =+0.5cm for the first time?

Objek berjisim 0.5kg disambung kepada satu spring dengan pemalar spring k = 50N/m. Pada masa t = 0, sesaran dari titik keseimbangan daya adalah x = -0.2mdan halaju v = +0.5m/s. Anggap bahawa x = A sin ($\omega t + \phi$) carikan,

(a) halaju angular ω

(b) amplitude

(c) fasa malar ϕ

Tulis persamaan SHM x = A sin ($\omega t + \phi$) di atas

Bilakah (t=?) berlakunya x =-0.2m dan halaju v = +0.5m/s untuk kali pertamanya?

END OF QUESTIONS / *SOALAN-SOALAN TAMAT*

SELECTED FORMULA

KINEMATICS

$$v = u + at$$

$$v^2 = u^2 + 2aS$$

$$S = ut + \frac{1}{2}at^2$$

$$S = \frac{1}{2}(u + v)t$$

FREE FALL

$$v = u + gt$$

$$v^2 = u^2 + 2gH$$

$$H = ut + \frac{1}{2}gt^2$$

$$H = \frac{1}{2}(u + v)t$$

MOMENTUM

$$F = \frac{m(v - u)}{t} = ma$$

$$P = mv$$

$$I = Ft = mv - mu$$

PROJECTILE

$$v_y = u_y + at$$

$$v_y{}^2 = u_y{}^2 + 2gY$$

$$Y = u_y t + \frac{1}{2}gt^2$$

$$Y = \frac{1}{2}(u_y + v_y)t$$

$$X = u_x t$$

$$u_x = v_x$$

SATELLITE

$$E = \frac{GM}{r^2}$$

$$F = \frac{Gm_1m_2}{r^2}$$

$$M = \frac{r^3}{G}\left(\frac{2\pi}{T}\right)^2$$

$$T = 2\pi\sqrt{\frac{r^3}{GM}}$$

$$r = \sqrt[3]{\frac{GM}{\omega}} = \sqrt[3]{\frac{T^2GM}{4\pi^2}}$$

$$r_{altitude} = r - R_{Earth}$$

CIRCULAR MOTION AND SHM

$$s = r\theta$$

$$v = r\omega = \frac{2\pi r}{t}$$

$$a_c = r\omega^2 = \frac{v^2}{r}$$

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$$W = mg$$

$$V_{\max} = \pm\omega A$$

$$a_{\max} = \pm\omega^2 A$$

$$KE_{maz} = \frac{1}{2}m\omega^2 A^2$$

$$a = -\omega^2 x$$

$$f = \frac{1}{T}, T = 2\pi\sqrt{\frac{k}{m}} = 2\pi\sqrt{\frac{l}{g}}$$

$$v = \pm\omega\sqrt{A^2 - x^2}$$

$$x = A\sin(\omega t \pm \Phi)$$

$$v = A\omega\cos(wt \pm \Phi)$$

$$a = -A\omega^2\sin(\omega t \pm \Phi)$$

$$E_{total} = \frac{1}{2}m\omega^2 A^2$$

$$KE = \frac{1}{2}m\omega^2(A^2 - x^2)$$

$$PE = \frac{1}{2}m\omega^2 x^2$$

WORK & ENERGIES

$$KE = \frac{1}{2}mv^2$$

$$GPE = mgh$$

$$EPE = \frac{1}{2}kx^2$$

$$work = F \times d \times \cos\theta$$

$$power = \frac{energy}{time}$$

$$power = \frac{work}{time} = \frac{Fd\cos}{t}$$

$$power = Fv\cos\theta$$

WAVES

$$v = f\lambda$$

$$k = \frac{2\pi}{\lambda}$$

$$\Phi = \frac{2\pi x}{\lambda}$$

$$x = A\sin(\omega t \pm kx \pm \Phi)$$

$$v = A\omega\cos(wt \pm kx \pm \Phi)$$

$$a = -A\omega^2\sin(\omega t \pm kx \pm \Phi)$$

$$v_d = \frac{I}{neA}$$

ELECTROSTATICS

$$F = \frac{kq_1q_2}{r^2} = qE$$

$$E = \frac{kq_1}{r^2} \text{.....} U = \frac{W}{q} = \frac{kq}{r}$$

$$C = \frac{Q}{V} = \frac{\varepsilon A}{d} = \frac{\varepsilon_r\varepsilon_0 A}{d}$$

$$Energy = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C}$$

$$R = \frac{\rho l}{A}, V = IR,$$

$$Power = I^2R = \frac{V^2}{R} = IV$$