KOLEJ MATRIKULASI NEGERI SEMBILAN
UJIAN SELARAS 2
SP015 FIZIK (2 JAM)

NAMA : _____

PRAKTIKUM : _____

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.

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Untuk Kegunaan Pemeriksa		
NO. SOALAN	**MARKAH PENUH**	**MARKAH DIPEROLEH**
1	2	
2	10	
3	13	
4	8	
5	5	
6	23	
7	8	
8	11	
JUMLAH	**80**	

LIST OF SELECTED CONSTANT VALUES
SENARAI NILAI PEMALAR TERPILIH

Speed of light in vacuum *Laju cahaya dalam vakum*	c	$= 3.00 \times 10^{8}$ m s^{-1}
Permeability of free space *Ketelapan ruang bebas*	μ_o	$= 4\pi \times 10^{-7}$ H m^{-1}
Permittivity of free space *Ketelusan ruang bebas*	ε_o	$= 8.85 \times 10^{-12}$ F m^{-1}
Electron charge magnitude *Magnitud cas elektron*	e	$= 1.60 \times 10^{-19}$ C
Planck constant *Pemalar Planck*	h	$= 6.63 \times 10^{-34}$ J s

LIST OF SELECTED CONSTANT VALUES
SENARAI NILAI PEMALAR TERPILIH

Electron mass *Jisim elektron*	m_e	$= 9.11 \times 10^{-31}$ kg $= 5.49 \times 10^{-4}$ u
Neutron mass *Jisim neutron*	m_n	$= 1.674 \times 10^{-27}$ kg $= 1.008665$ u
Proton mass *Jisim proton*	m_p	$= 1.672 \times 10^{-27}$ kg $= 1.007277$ u
Deuteron mass *Jisim deuteron*	m_d	$= 3.34 \times 10^{-27}$ kg $= 2.014102$ u
Molar gas constant *Pemalar gas molar*	R	$= 8.31$ J K^{-1} mol^{-1}
Rydberg constant *Pemalar Rydberg*	R_H	$= 1.097 \times 10^{7}$ m^{-1}
Avogadro constant *Pemalar Avogadro*	N_A	$= 6.02 \times 10^{23}$ mol^{-1}
Boltzmann constant *Pemalar Boltzmann*	k	$= 1.38 \times 10^{-23}$ J K^{-1}
Gravitational constant *Pemalar graviti*	G	$= 6.67 \times 10^{-11}$ N m^2 kg^{-2}
Free-fall acceleration *Pecutan jatuh bebas*	g	$= 9.81$ m s^{-2}
Atomic mass unit *Unit jisim atom*	1 u	$= 1.66 \times 10^{-27}$ kg $= 931.5 \frac{\text{MeV}}{c^2}$
Electron volt *Elektron volt*	1 *e*V	$= 1.6 \times 10^{-19}$ J
Constant of proportionality for Coulomb's law *Pemalar hukum Coulomb*	$k = \frac{1}{4\pi\varepsilon_o}$	$= 9.0 \times 10^{9}$ N m^2 C^{-2}
Atmospheric pressure *Tekanan atmosfera*	1 atm	$= 1.013 \times 10^{5}$ Pa
Density of water *Ketumpatan air*	ρ_w	$= 1000$ kg m^{-3}

LIST OF SELECTED FORMULAE
SENARAI RUMUS TERPILIH

1. $v = u + at$
2. $s = ut + \frac{1}{2}at^2$
3. $v^2 = u^2 + 2as$
4. $s = \frac{1}{2}(u + v)t$
5. $p = mv$
6. $J = F\Delta t$
7. $J = \Delta p = mv - mu$
8. $f = \mu N$
9. $W = \vec{F}.\vec{s} = Fs\cos\theta$
10. $K = \frac{1}{2}mv^2$
11. $U = mgh$
12. $U_s = \frac{1}{2}kx^2 = \frac{1}{2}Fx$
13. $W = \Delta K$
14. $P_{av} = \frac{\Delta W}{\Delta t}$
15. $P = \vec{F}.\vec{v} = Fv\cos\theta$
16. $a_c = \frac{v^2}{r} = r\omega^2 = v\omega$
17. $F_c = \frac{mv^2}{r} = mr\omega^2 = mv\omega$
18. $s = r\theta$
19. $v = r\omega$
20. $a_t = r\alpha$
21. $\omega = \omega_o + \alpha t$
22. $\theta = \omega_o t + \frac{1}{2}\alpha t^2$
23. $\theta = \frac{1}{2}(\omega_o + \omega)t$
24. $\omega^2 = \omega_o^2 + 2\alpha\theta$
25. $\tau = rF\sin\theta$
26. $I = \sum mr^2$
27. $I_{\text{solid sphere}} = \frac{2}{5}MR^2$
28. $I_{\text{solid cylinder/disc}} = \frac{1}{2}MR^2$
29. $I_{\text{ring}} = MR^2$
30. $I_{\text{rod}} = \frac{1}{12}ML^2$
31. $\sum \tau = I\alpha$
32. $L = I\omega$
33. $y = A\sin\omega t$
34. $v = \omega A\cos\omega t = \pm\omega\sqrt{A^2 - y^2}$
35. $a = -\omega^2 A\sin\omega t = -\omega^2 y$
36. $K = \frac{1}{2}m\omega^2(A^2 - y^2)$
37. $U = \frac{1}{2}m\omega^2 y^2$
38. $E = \frac{1}{2}m\omega^2 A^2$
39. $\omega = \frac{2\pi}{T} = 2\pi f$
40. $T = 2\pi\sqrt{\frac{l}{g}}$
41. $T = 2\pi\sqrt{\frac{m}{k}}$
42. $k = \frac{2\pi}{\lambda}$
43. $v = f\lambda$
44. $y(x,t) = A\sin(\omega t \pm kx)$

LIST OF SELECTED FORMULAE
SENARAI RUMUS TERPILIH

45. $v_y = A\omega\cos(\omega t \pm kx)$
46. $y = 2A\cos kx \sin \omega t$
47. $f_n = \dfrac{nv}{2L}$
48. $f_n = \dfrac{n}{2L}\sqrt{\dfrac{T}{\mu}}$
49. $f_n = \dfrac{nv}{4L}$
50. $v = \sqrt{\dfrac{T}{\mu}}$
51. $\mu = \dfrac{m}{L}$
52. $f_a = \left(\dfrac{v \pm v_o}{v \mp v_s}\right) f$
53. $\sigma = \dfrac{F}{A}$
54. $\varepsilon = \dfrac{\Delta L}{L_o}$
55. $Y = \dfrac{\sigma}{\varepsilon}$
56. $U = \dfrac{1}{2} F\Delta L$
57. $\dfrac{U}{V} = \dfrac{1}{2}\sigma\varepsilon$
58. $\dfrac{Q}{t} = -kA\left(\dfrac{\Delta T}{L}\right)$
59. $\Delta L = \alpha L_o \Delta T$
60. $\Delta A = \beta A_o \Delta T$
61. $\Delta V = \gamma V_o \Delta T$
62. $\beta = 2\alpha$
63. $\gamma = 3\alpha$
64. $n = \dfrac{m}{M} = \dfrac{N}{N_A}$
65. $v_{rms} = \sqrt{\langle v^2 \rangle}$
66. $v_{rms} = \sqrt{\dfrac{3kT}{m}} = \sqrt{\dfrac{3RT}{M}}$
67. $pV = \dfrac{1}{3} N m {v_{rms}}^2$
68. $p = \dfrac{1}{3}\rho {v_{rms}}^2$
69. $K_{\text{tr}} = \dfrac{3}{2}\left(\dfrac{R}{N_A}\right) T = \dfrac{3}{2} kT$
70. $U = \dfrac{1}{2} fNkT = \dfrac{1}{2} fnRT$
71. $\Delta U = Q - W$
72. $W = nRT \ln \dfrac{v_f}{v_i} = nRT \ln \dfrac{p_i}{p_f}$
73. $W = \int p\, dV = p(v_f - v_i)$
74. $W = \int p\, dV = 0$

*Answer **all** questions.*

1 A force F is given by $F = at + bt^2$, where t is the time. Find the dimension of *'a'*.

[2 *marks*]

2 (a)

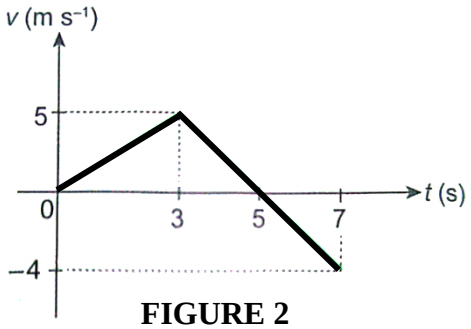

FIGURE 2

FIGURE 2 shows the velocity-time graph of the motion for a particle moving in a straight line. Determine the acceleration of the particle for the whole journey.

[3 *marks*]

(b) An arrow is launched with a velocity 23 m s^{-1} at an angle of 30° to the horizontal from the roof of a building of height 40 m. Determine

(i) the maximum height reach by an arrow from the ground
(ii) the time taken for it to hit the ground.
(iii) the horizontal distance travelled.

[7 *marks*]

3 (a)

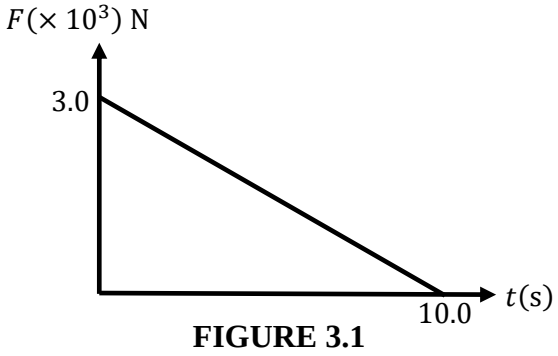

FIGURE 3.1

FIGURE 3.1 shows a car of mass 1500 kg is travelling at 16 m s^{-1} before the brake is applied. When the brake is applied, the retarding force on the car varies with time. Calculate the change in momentum.

[3 *marks*]

(b) An object of mass 400 kg moves at a speed of 300 m s^{-1} to the right. It breaks up into two parts, one having a mass of 50 kg moving at a speed of 120 m s^{-1} in the opposite direction. Determine the magnitude and direction of the velocity for the second part.

[4 *marks*]

(c)

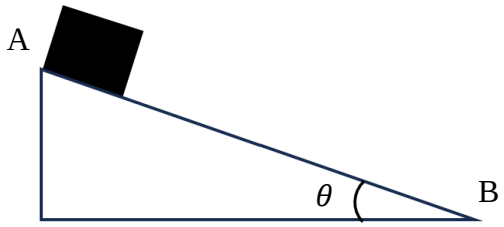

FIGURE 3.2

FIGURE 3.2 shows the block has a mass, m =8.0 kg lies on a smooth frictionless plane tilted at an angle, $\theta = 23°$ to the horizontal.

(i) Sketch a free body diagram which show all the forces act on the block.
(ii) Determine the acceleration of the block as it slides down the plane.
(iii) If the block starts from rest 12.0 m from point A to B, by **using linear motion's equation**, calculate the block's speed when it reaches the bottom of the incline plane.

[6 *marks*]

4 (a)

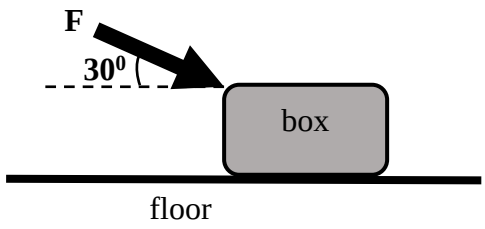

FIGURE 4

FIGURE 4 shows a box being pushed by a constant force, F of 25 N, at an angle of 30° with the horizontal. The kinetic frictional force between the box and the floor is 10 N. How much total work is done if the box is pushed through a distance of 6 m?

[4 *marks*]

(b) A 2000 kg ball is released at a height of 10 m from the ground. By **using the principle of conservation of energy**, determine the kinetic energy of the ball just before it hits the ground.

[2 *marks*]

(c) A 10 kg box is lifted through a vertical distance of 15 m in 5 s with constant velocity. Calculate the applied power to lift the box.

[2 *marks*]

5

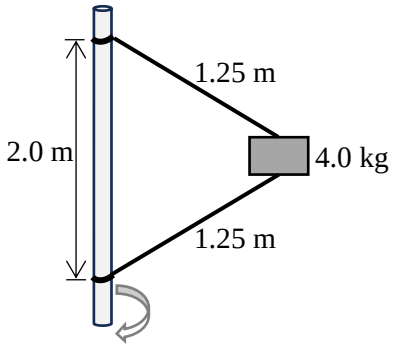

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FIGURE 5

FIGURE 5 shows a 4.0 kg block is attached to a vertical rod by two strings. When the system rotates about the axis of the rod, the strings are extended as shown in the diagram and the tension in the upper string is 80.0 N. Calculate the

(a) tension in the lower string.
(b) centripetal acceleration.

[5 *marks*]

6 (a) A body of mass 3.0 kg moves in simple harmonic motion. The displacement *y* from the equilibrium position at time *t* is given by

$$y = 5 \sin 2(\pi t)$$

where *y* is in centimetres and *t* is in seconds. Determine the

(i) amplitude **and** period of the SHM.
(ii) magnitude of maximum acceleration of the motion.
(iii) kinetic **and** potential energies of the body at time *t* = 5 s.

[9 *marks*]

(b) A progressive wave with a velocity 100 m s^{-1}, frequency 50 Hz and amplitude 50 cm propagates from left to right. Write the equation for the wave.

[3 *marks*]

(c) A copper wire of mass 300 g and length 3.5 m has one of its ends fixed to a wall and the other end is forced to vibrate transversely with a frequency of 200 Hz. If the tension of the wire is 135 N, calculate

(i) the speed and wavelength of the progressive wave produced.
(ii) the number of harmonics for stationary wave produced.

[6 *marks*]

(d) A train that has a 150 Hz horn is moving at 35 m s^{-1} in still air on a day when the speed of sound is 340 m s^{-1}. Calculate the

(i) frequencies observed by a stationary person at the side of the tracks as the train approaches and after it passes.
(ii) frequency observed by the train's engineer traveling on the train.

[5 *marks*]

7 (a) A 3.0 m length of copper wire with a diameter of 0.4 mm is suspended from the ceiling. When a 5.0 N load is suspended from the bottom of the wire, it extends by 0.9 mm. Calculate the

(i) stress on the wire.
(ii) strain energy stored in the wire.

[4 *marks*]

(b) A steel rod has a length L = 0.5 m and a radius r = 1.5 cm when the temperature is 20 °C. Take $\alpha = 11 \times 10^{-6}\ K^{-1}$ and Young's modulus of the rod to be $Y = 200 \times 10^{9}\ N\ m^{-2}$.

(i) What is its change in length on a hot day when the temperature is 50 °C?
(ii) If the rod's ends were originally fixed, then determine the compression force on the rod.

[4 *marks*]

8 (a) The root mean square speed of helium gas is 1420 m s^{-1}. The pressure of the gas is tripled, while the volume and the number of moles of the gas are kept constant. Calculate the

(i) new root mean square speed of the gas.
(ii) new temperature of the gas if the molar mass of helium gas is 4 g mol^{-1}.

[5 *marks*]

(b)

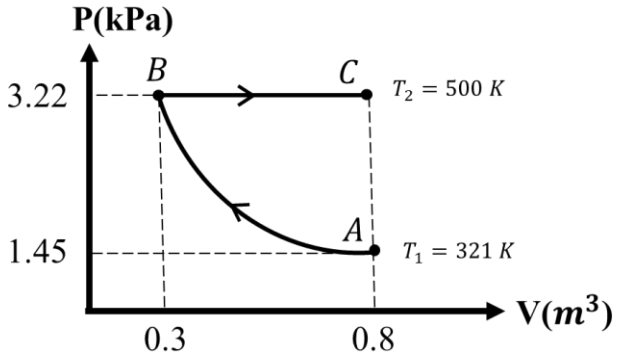

FIGURE 8

FIGURE 8 shows a 1.5 mole diatomic gas is filled in a 0.8 m^3 container at 321 K and pressure of 1.45 kPa. The gas is isothermally compressed to a volume of 0.3 m^3 and a pressure of 3.22 kPa. Then the gas expands isobarically to its original volume, and the final temperature of the gas is 500 K. Calculate the

(i) total work done in the whole process.
(ii) change in the internal energy of the gas for the isobaric process.

[6 *marks*]

END OF QUESTIONS PAPER
KERTAS SOALAN TAMAT