Lect's Copy
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KEMENTERIAN PENDIDIKAN

BAHAGIAN MATRIKULASI
MATRICULATION DIVISION

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI
MATRICULATION PROGRAMME EXAMINATION

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

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Kertas soalan ini mengandungi **18** halaman bercetak.
This question paper consists of **18** *printed pages.*

INSTRUCTIONS TO CANDIDATE:

This question paper consists of **8** questions.

Answer **all** questions.

All answers must be written in the answer booklet provided. Use a new page for each question.

The use of non-programmable scientific calculator is permitted.

***ARAHAN KEPADA CALON*:**

Kertas soalan ini mengandungi **8** *soalan.*

Jawab ***semua*** *soalan.*

Semua jawapan hendaklah ditulis pada buku jawapan yang disediakan. Gunakan muka surat baharu bagi nombor soalan yang berbeza.

Penggunaan kalkulator saintifik yang tidak boleh diprogramkan dibenarkan.

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
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
Hydrogen mass *Jisim hidrogen*	m_H	$= 1.673 \times 10^{-27}$ kg $= 1.007825$ 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}
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}
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 $= 931.5 \frac{MeV}{c^2}$

LIST OF SELECTED CONSTANT VALUES
SENARAI NILAI PEMALAR TERPILIH

Electron volt *Elektron volt*	1 eV	$= 1.6 \times 10^{-19}$ 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. $W = \vec{F} \cdot \vec{s} = Fs\cos\theta$
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. $P = \vec{F} \cdot \vec{v} = Fv\cos\theta$
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. $k = \frac{2\pi}{\lambda}$

LIST OF SELECTED FORMULAE
SENARAI RUMUS TERPILIH

43. $v = f\lambda$

44. $y(x,t) = A\sin(\omega t \pm kx)$

45. $v_y = A\omega\cos(\omega t \pm kx)$

46. $y = 2A\ \cos kx \sin \omega t$

47. $f_n = \frac{nv}{2L}$

48. $f_n = \frac{n}{2L}\sqrt{\frac{T}{\mu}}$

49. $f_n = \frac{nv}{4L}$

50. $v = \sqrt{\frac{T}{\mu}}$

51. $\mu = \frac{m}{L}$

52. $f_a = \left(\frac{v \pm v_o}{v \mp v_s}\right) f$

53. $\sigma = \frac{F}{A}$

54. $\varepsilon = \frac{\Delta L}{L_o}$

55. $Y = \frac{\sigma}{\varepsilon}$

56. $U = \frac{1}{2}F\Delta L$

57. $\frac{U}{V} = \frac{1}{2}\sigma\varepsilon$

58. $\frac{Q}{t} = -kA\left(\frac{\Delta T}{L}\right)$

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. $n = \frac{m}{M} = \frac{N}{N_A}$

65. $v_{rms} = \sqrt{\langle v^2 \rangle}$

66. $v_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$

67. $PV = \frac{1}{3}Nm{v_{rms}}^2$

68. $P = \frac{1}{3}\rho{v_{rms}}^2$

69. $K_{\text{tr}} = \frac{3}{2}\left(\frac{R}{N_A}\right)T = \frac{3}{2}kT$

70. $U = \frac{1}{2}fNkT = \frac{1}{2}fnRT$

71. $\Delta U = Q - W$

72. $W = nRT\ln\frac{V_f}{V_i} = nRT\ln\frac{P_i}{P_f}$

73. $W = \int PdV = P(V_f - V_i)$

74. $W = \int PdV = 0$

1 A boy runs 400 m to the west and then runs 600 m to the south. Determine the magnitude and direction of his displacement.

Seorang kanak-kanak lelaki berlari sejauh 400 m *ke arah barat dan kemudian berlari sejauh* 600 m *ke arah selatan. Tentukan magnitud dan arah sesarannya.*

[2 *marks*]
[2 *markah*]

2 (a)

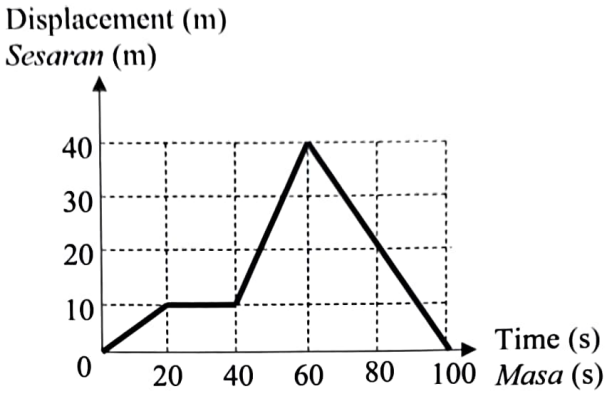

FIGURE 2
RAJAH 2

FIGURE 2 shows a displacement-time graph as an object travels. Calculate the

RAJAH 2 *menunjukkan graf sesaran-masa bagi satu objek yang bergerak. Hitung*

(i) distance travelled at $t = 60$ s.
jarak dilalui pada $t = 60$ s.

(ii) average velocity between $t = 40$ s and $t = 100$ s.
purata halaju antara $t = 40$ s dan $t = 100$ s.

[4 *marks*]
[4 *markah*]

(b) A ball rolls on a floor of a 60 m tall building with a speed 35 m s^{-1} and then falls to the ground. Calculate the

Sebiji bola bergolek di atas lantai bangunan ketinggian 60 m *dengan laju* 35 m s^{-1} *dan kemudian jatuh ke tanah. Hitung*

(i) time for the ball to reach the ground.

masa untuk bola mencecah tanah.

(ii) maximum range reached by the ball.

julat maksimum yang dicapai oleh bola.

(iii) vertical velocity of the ball just before it reaches the ground.

halaju menegak bola sejurus sebelum mencecah tanah.

[6 *marks*]
[6 *markah*]

3 (a)

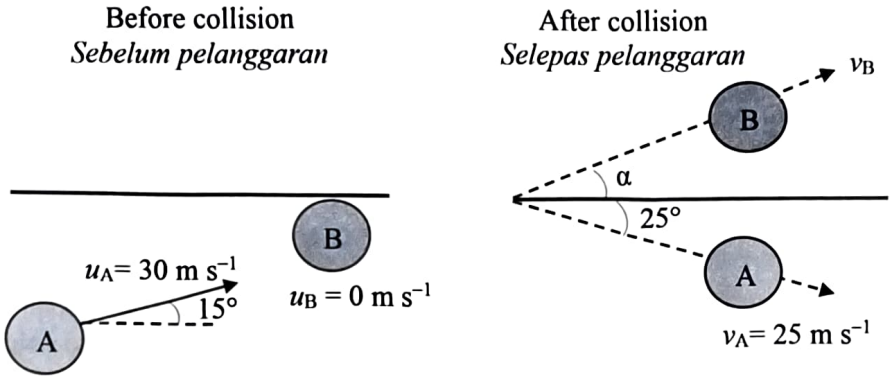

FIGURE 3.1
***RAJAH* 3.1**

FIGURE 3.1 shows a 0.9 kg ball A, travels with a constant velocity of 30 m s^{-1} at an angle 15° above horizontal axis and collides with a 0.5 kg ball B which is at rest. After the collision, ball A and ball B move at a velocity of v_A and v_B respectively. Determine the velocity of ball B and angle α after the collision if the velocity of ball A is 25 m s^{-1} at 25° below horizontal axis.

***RAJAH* 3.1** *menunjukkan sebiji bola* A *berjisim* 0.9 kg, *bergerak dengan halaju malar* 30 m s^{-1} *pada sudut* 15° *di atas paksi mengufuk dan berlanggar dengan bola* B *berjisim* 0.5 kg *yang berada dalam keadaan pegun. Selepas perlanggaran, bola* A *dan bola* B *masing-masing bergerak pada halaju* v_A *dan* v_B. *Tentukan halaju bola* B *dan sudut* α *selepas perlanggaran jika halaju bola* A *ialah* 25 m s^{-1} *pada* 25° *di bawah paksi mengufuk.*

[6 *marks*]
[6 *markah*]

(b)

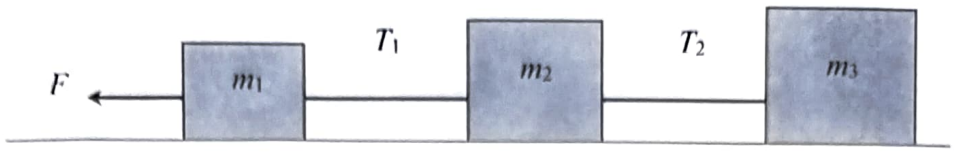

FIGURE 3.2
***RAJAH* 3.2**

FIGURE 3.2 shows a force $F = 2000$ N acting on three wooden blocks $m_1 = 5$ kg, $m_2 = 12$ kg and $m_3 = x$ kg, which are connected to strings. If the acceleration of the system is 22 m s^{-2}, determine the
(Neglect the friction between the floor and the wooden blocks)

***RAJAH* 3.2** *menunjukkan satu daya* $F = 2000$ N *bertindak ke atas tiga bongkah kayu,* $m_1 = 5$ kg, $m_2 = 12$ kg dan $m_3 = x$ kg, *yang disambungkan dengan tali jika pecutan sistem bongkah ialah* 22 m s^{-2}, *tentukan*
(*Abaikan geseran antara lantai dan bongkah kayu*)

(i) tension of T_1 and T_2.
ketegangan T_1 and T_2.

(ii) mass of block m_3.
jisim bongkah m_3.

[7 *marks*]
[7 *markah*]

4 (a)

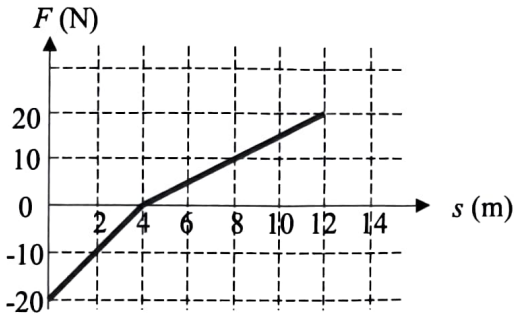

FIGURE 4.1
***RAJAH* 4.1**

FIGURE 4.1 shows a net force, F acting on an object that varies with the displacement, s. Calculate the total work done by the net force.

***RAJAH* 4.1** *menunjukkan satu daya bersih, F bertindak ke atas satu objek berubah terhadap sesaran, s. Hitung jumlah kerja yang dilakukan oleh daya bersih.*

[3 *marks*]
[3 *markah*]

(b)

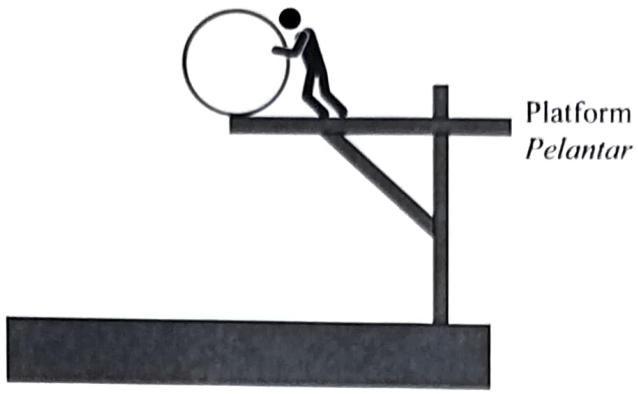

FIGURE 4.2
***RAJAH* 4.2**

FIGURE 4.2 shows a man of mass 64 kg standing on a 7.0 m high platform dropping a boulder of mass 256 kg off the edge of the platform. Determine the

***RAJAH* 4.2** *menunjukkan seorang lelaki berjisim* 64 kg *berdiri di atas satu pelantar berketinggian* 7.0 m *sedang menjatuhkan batu besar berjisim* 256 kg *ke hujung pelantar. Tentukan*

(i) mechanical energy of the boulder when it is on the platform.
tenaga mekanikal batu tersebut ketika berada di atas pelantar.

(ii) speed of the boulder when it is 4.0 m below the platform.
laju batu ketika berada 4.0 m *dari bawah pelantar.*

[5 *marks*]
[5 *markah*]

5 (a) An object of mass 0.2 kg is tied to a string of length 20 cm and whirled horizontally with a speed of 1.4 m s^{-1}. Determine the tension of the string.

Satu objek berjisim 0.2 kg *diikat dengan seutas tali* 20 cm *dan dipusingkan secara mengufuk dengan laju* 1.4 m s^{-1}. *Tentukan ketegangan tali.*

[2 *marks*]
[2 *markah*]

(b) A car is travelling at a speed of 40 m s^{-1} on a roundabout of radius 280 m. Determine the value of the coefficient of static friction between the tires and the road to prevent the car from skidding.

Sebuah kereta sedang bergerak dengan laju 40 m s^{-1} *pada bulatan berjejari* 280 m. *Tentukan nilai pekali geseran statik antara permukaan tayar dan jalan untuk mengelakkan kereta daripada terbabas.*

[3 *marks*]
[3 *markah*]

6 (a) A body moves in a simple harmonic motion, $y = 0.5 \sin 4\pi t$, where y and t are displacement in meters and time in seconds, respectively. Calculate the

Satu jasad bergerak dengan gerakan harmonik ringkas, $y = 0.5 \sin 4\pi t$, *di mana y dan t masing-masing sesaran dalam meter dan masa dalam saat. Hitung*

(i) displacement of the body at $t = 1.4$ s.

sesaran jasad pada $t = 1.4$ s.

(ii) minimum time required by the body to move from the equilibrium position to point 0.25 m.

masa minimum yang diperlukan oleh jasad untuk bergerak dari kedudukan keseimbangan ke titik 0.25 m.

(iii) velocity **and** acceleration of the body at a distance of 0.04 m from the equilibrium position.

halaju ***dan*** *pecutan jasad pada jarak* 0.04 m *dari kedudukan keseimbangan.*

[8 *marks*]
[8 *markah*]

(b) Experiment of simple pendulum is conducted in the Physics laboratory on the earth. The period of oscillation is given by

Eksperimen bandul ringkas dijalankan di makmal Fizik di bumi. Tempoh ayunan diberi oleh

$$T = 2\pi\sqrt{\frac{l}{g}}$$

where l and g are the length of the pendulum and gravitational acceleration respectively. Explain the change in the period of the oscillation when the experiment is conducted on the moon.

di mana l dan g ialah masing-masing panjang bandul dan pecutan graviti. Terangkan perubahan tempoh ayunan apabila eksperimen dijalankan di atas bulan.

[4 *marks*]
[4 *markah*]

(c) A progressive wave is represented by the equation
Satu gelombang progresif diwakili oleh persamaan

$$y(x, t) = 2 \sin (4\pi t - 5\pi x)$$

where y and x are in centimetres and t in seconds, respectively. Determine the
di mana y dan x masing-masing dalam sentimeter dan t dalam saat. Tentukan

(i) angular frequency.
frekuensi sudut.

(ii) wavelength.
panjang gelombang.

(iii) period.
tempoh.

(iv) frequency.
frekuensi.

(v) speed of wave.
laju gelombang.

[6 *marks*]
[6 *markah*]

(d)

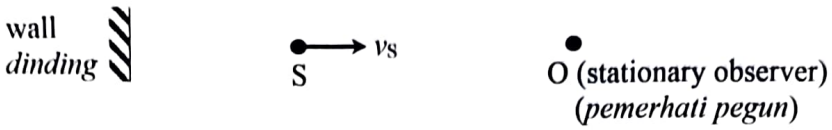

FIGURE 6
RAJAH 6

FIGURE 6 shows O as a stationary observer. Source S is moving towards the observer O at a speed of 30 m s^{-1} and away from the wall. The frequency of the source is 1000 Hz. Calculate the apparent frequency heard by the observer O
(Given the speed of sound is 330 m s^{-1})

RAJAH 6 *menunjukkan* O *sebagai pemerhati pegun. Sumber* S *sedang bergerak ke arah pemerhati* O *pada laju* 30 m s^{-1} *dan menjauhi dinding. Frekuensi sumber ialah* 1000 Hz. *Hitung frekuensi ketara yang didengar oleh pemerhati* O
(*Diberi laju bunyi ialah* 330 m s^{-1})

(i) directly from the source.
terus daripada sumber.

(ii) due to reflection by the wall.
hasil daripada pantulan dinding.

[5 *marks*]
[5 *markah*]

7 (a) A steel rod of length 1.5 m and diameter 4.0 mm is supporting a 36 kN load vertically. Given that the Young's modulus of steel is 2.0×10^{11} N m^{-2}, calculate the

Satu rod keluli dengan panjang 1.5 m *dan diameter* 4.0 mm *menyokong satu beban* 36 kN *secara menegak. Diberi modulus Young bagi keluli ialah* 2.0×10^{11} N m^{-2}, *hitung*

(i) stress in the steel rod.
tekanan dalam rod keluli.

(ii) original length of the steel rod.
panjang asal rod keluli.

[6 *marks*]
[6 *markah*]

(b)

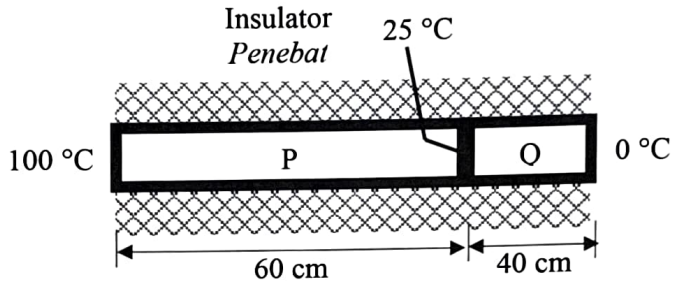

FIGURE 7
***RAJAH* 7**

FIGURE 7 shows the joining of two metal rods P and Q of the same cross-sectional area. The thermal conductivity of metal rods P and Q are k_P and k_Q respectively. Both rods are well insulated. Determine the value $\frac{k_P}{k_Q}$.

***RAJAH* 7** *menunjukkan cantuman dua rod logam* P *dan* Q *dengan keratan rentas yang sama. Kekonduksian haba bagi rod logam* P *dan* Q *masing-masing adalah* k_P *dan* k_Q. *Kedua-dua rod ditebat sepenuhnya. Tentukan nilai* $\frac{k_P}{k_Q}$.

[2 *marks*]
[2 *markah*]

8 (a) A tank contains nitrogen gas at temperature of 27 °C is heated to 352 °C. Given the molar mass of nitrogen gas is 28 g mol^{-1}, calculate the change in root mean square speed (v_{rms}) of the nitrogen gas molecules.

Sebuah tangki mengandungi gas nitrogen pada suhu 27 °C *dipanaskan ke* 352 °C. *Diberi jisim molar gas nitrogen ialah* 28 g mol^{-1}, *hitung perubahan laju punca min kuasa dua* (v_{pmkd}) *bagi molekul gas nitrogen.*

[4 *marks*]
[4 *markah*]

(b) Neon is a monoatomic gas and it has a molar mass of 20 g mol^{-1}. At 300 K, calculate the

Neon ialah gas monoatomik dan ia mempunyai jisim molar 20 g mol^{-1}. *Pada* 300 K, *hitung*

(i) translational kinetic energy of a neon atom.

tenaga kinetik translasi bagi satu atom neon.

(ii) internal energy for 1 kg of neon gas.

tenaga dalam bagi 1 kg *gas neon.*

[5 *marks*]
[5 *markah*]

(c) Seven moles of gas of temperature 290 K is expanded isothermally from 1.5 litres to 5.0 litres. Calculate the work done by the gas.

Tujuh mol gas bersuhu 290 K *dikembangkan secara isoterma daripada* 1.5 *liter kepada* 5.0 *liter. Hitung kerja yang dilakukan oleh gas.*

[2 *marks*]
[2 *markah*]

END OF QUESTION PAPER
KERTAS SOALAN TAMAT