YTU Physics Department 2025-2026 Fall Semester			
FIZ1001 PHYSICS-1 Midterm 1			
Question Sheet	**AAAAAA**	17/11/2025 17.00-18.40	100 m

Name		The 9th article of Student Disciplinary Regulations of YÖK Law No.2547 states "Cheating or helping to cheat or attempt to cheat in exams" de facto perpetrators take one or two semesters suspension penalty. Students are NOT permitted to bring calculators, mobile phones, smart watches and/or any other unauthorized electronic devices into the exam room.
Surname		
Student No		
Group/Saloon		
Signature		

θ	0^0	30^0	37^0	45^0	53^0	60^0	90^0	
sin	0	1/2	3/5	$\sqrt{2}/2$	4/5	$\sqrt{3}/2$	1	$g = 10\, m/s^2$
cos	1	$\sqrt{3}/2$	4/5	$\sqrt{2}/2$	3/5	1/2	0	$\pi = 3$

$\vec v = \frac{\Delta \vec r}{\Delta t}$; $\vec{\bar a} = \frac{\Delta \vec v}{\Delta t}$; $\vec v = \frac{d\vec r}{dt}$; $\vec a = \frac{d\vec v}{dt}$; $\vec v = \vec v_0 + \vec a t$; $\vec r = \vec r_0 + \vec v_0 t + \frac{1}{2}\vec a t^2$; $v^2 = v_0^2 + 2\vec a\cdot(\vec r - \vec r_0)$; $F_r = m\frac{v^2}{r}$; $F_s = -kx$

$f_s \le \mu_s N$; $f_k = \mu_k N$; $P = \vec F\cdot\vec v$; $W = \Delta K$; $W = \int \vec F \cdot d\vec r$; $\bar P = \frac{\Delta W}{\Delta t}$; $\vec F_{con} = -\frac{dU}{dr}\hat r$; $W_{con} = -\Delta U$; $W = \Delta U + \Delta K$;

$U = mgy$; $U = \frac{1}{2}kx^2$; $\vec F = \frac{d\vec p}{dt}$; $\vec p = m\vec v$; $\vec I = \Delta \vec p = \vec{\bar F}\Delta t$; $\vec r_{cm} = \frac{\sum m_i \vec r_i}{\sum m_i}$; $\vec r_{cm} = \frac{\int \vec r\, dm}{\int dm}$; $\vec{\bar\omega} = \frac{\Delta\vec\theta}{\Delta t}$; $\vec{\bar\alpha} = \frac{\Delta\vec\omega}{\Delta t}$; $\vec\omega = \frac{d\vec\theta}{dt}$; $\vec\alpha = \frac{d\vec\omega}{dt}$;

$\vec\omega = \vec\omega_0 + \vec\alpha t$; $\vec\theta = \vec\theta_0 + \vec\omega_0 t + \frac{1}{2}\vec\alpha t^2$; $\omega^2 = \omega_0^2 + 2\alpha(\theta-\theta_0)$; $a_t = r\alpha$; $\vec\tau = \vec r\times\vec F$; $\vec\tau_0 = I_0\vec\alpha$; $K_{rot} = \frac{1}{2}I\omega^2$; $I = \int r^2 dm$

$I = I_{cm} + MD^2$; $I_{disc=cylinder} = \frac{1}{2}mr^2$; $I_{sphere} = \frac{2}{5}mr^2$; $P = \vec\tau\cdot\vec\omega$; $W = \int\vec\tau\cdot d\vec\theta$; $\vec L = \vec r\times\vec p$; $\vec L = I\vec\omega$; $\vec\tau = \frac{d\vec L}{dt}$; $\vec{\bar\tau} = \frac{\Delta\vec L}{\Delta t}$

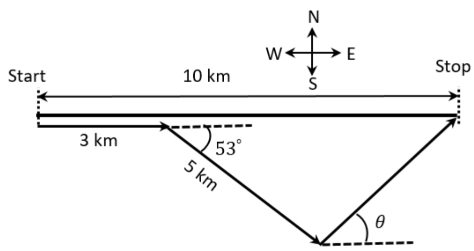
$v_{cm} = R\omega$; $x(t) = A\cos(\omega t+\varphi)$; $T = \frac{1}{f}$; $\omega = 2\pi f$; $E = \frac{1}{2}kA^2$; $T = 2\pi\sqrt{l/g}$; $T = 2\pi\sqrt{m/k}$; $T = 2\pi\sqrt{I/mgh}$

1) The period of vibration T of a piano string depends on the mass m of the string, its length l, and the tension force F. If a dimensional analysis is performed on the equation that can be written for the period, $T = k\, m^u\, l^v\, F^w$, which of the following are found for the numbers u, v, and w, respectively? Here, k is a dimensionless number.

A) $-\frac{1}{2}, -\frac{1}{2}, \frac{1}{2}$ B) $-\frac{1}{2}, \frac{1}{2}, -\frac{1}{2}$ C) $\frac{1}{2}, -\frac{1}{2}, -\frac{1}{2}$ D) $\frac{1}{2}, -\frac{1}{2}, \frac{1}{2}$ E) $\frac{1}{2}, \frac{1}{2}, -\frac{1}{2}$

2-3)

A sailor sets sail in a boat. As shown in the diagram, he first travels 3 km east, then turns 53^0 degrees south and travels 5 km. He then turns θ degrees north of east and travels a short distance, reaching a point 10 km east of the starting point. Accordingly;



2) How many kilometres did the sailor travel in his last manoeuvre?

A) $3\sqrt{2}$ B) 4   C) $4\sqrt{2}$ D) 5   E) $5\sqrt{2}$

3) In his last manoeuvre, how many degrees (θ) did the sailor turn north relative to east?

A) 30°   B) 37°   C) 45°   D) 53°   E) 60°

4-5)

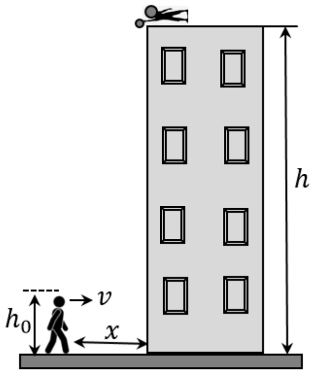
4) An object moving along the x -axis with acceleration $a = (2 - 6t)m/s^2$ is at t = 3. seconds at its initial position at t = 0 seconds. What is its initial velocity v_0 in m/s?

A) 12   B) 6   C) 0   D) −6   E) −12

5) At what time t does the instantaneous velocity of the object become $-\frac{1}{3}v_0$?

A) 5 B) 4 C) 3 D) 2 E) 1

6-7) Two physics students want to conduct a free-fall experiment. One of the students waits at the top of a building with a height of $h = 46.7$ metres, holding an egg, while the other student, who is $h_0 = 1.7$ metres tall, walks in front of the building at a constant speed of $v = 1.2\ m/s$. Assume that the egg, released from the edge of the building's top, is dropped from a point where it could hit the walking student's head and that there is no air resistance.



6) At what distance x from the ground will the egg hit the student at the top if released?

A) 3.6 B) 3.7 C) 7.5 D) 10.7 E) 18

7) When the student on the ground reaches the same distance x, if the student increases his speed by 50% relative to his initial speed, what initial speed v_0 must the student at the top use to throw the egg downwards so that it hits the target again?

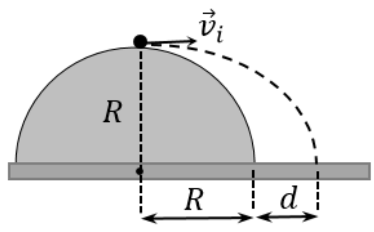
A) 32.5 m/s B) 25 m/s C) 14.2 m/s D) 12.5 m/s E) 5 m/s

8) The time-dependent coordinates of an object moving in the xy-plane are given in metres by $x(t) = 2t^2 + 2$ and $y(t) = 3t + 4$. Here, t is in seconds. At what time t are the position vector and the velocity vector parallel?

A) 1/3 B) 2/3 C) 3/2 D) 3/4 E) 1

9-10)

An object standing on the top of a spherical rock with radius R is thrown with an initial horizontal velocity $\vec{v}_i$.



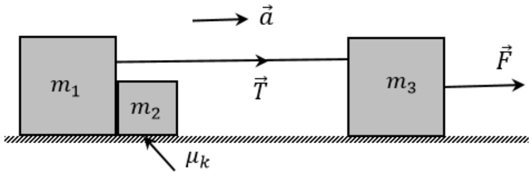
9) What should be the minimum initial velocity to prevent the object from hitting the rock after it is thrown?

A) $\sqrt{\frac{gR}{2}}$ B) $\sqrt{gR}$ C) $\sqrt{2gR}$ D) $(R+d)\sqrt{\frac{g}{2R}}$ E) $(R-d)\sqrt{\frac{g}{2R}}$

10) When the ball is thrown at this initial speed, how far (d) does it fall from the rock base? (horizontal distance to edge of the rock that makes contact with the ground)

A) 0 B) $R/\sqrt{2}$ C) $(\sqrt{2}-1)R$ D) $\sqrt{2R}$ E) $\sqrt{2}R$

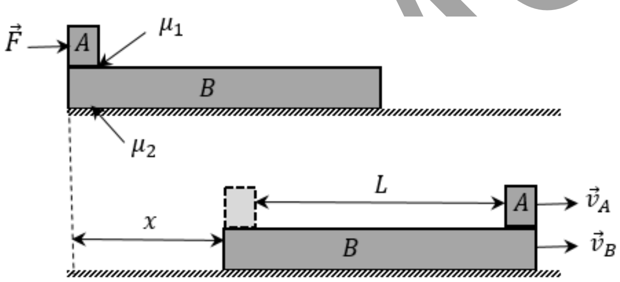
11-12)
A system consisting of three blocks with masses $m_1 = 4\,kg$, $m_2 = 2\,kg$, and $m_3 = 6\,kg$ is moving horizontally to the right with a constant acceleration of $a = 2\,m/s^2$ under the influence of a horizontal and constant external force $\vec{F}$ on a surface with kinetic friction, as shown in the figure. The mass m_3 is connected to the mass m_1 by a string whose weight is negligible. The block with mass m_2 is placed in front of the block with mass m_1. The blocks and the ground have the same coefficient of friction μ_k.



11) If the reaction force applied by mass m_1 to mass m_2 is $P = 8\,N$, then what is μ_k?
A) 0.1 B) 0.2 C) 0.3 D) 0.4 E) 0.5

12) What is the $\frac{F}{T}$ ratio?
A) 1/2 B) 1 C) 3/2 D) 2 E) 2/3

13-14-15)
A block with mass $m_A = 1\,kg$ is resting on the left end of another long block with mass $m_B = 2\,kg$. The coefficient of kinetic friction between the two blocks is $\mu_1 = 0.4$, while the coefficient of kinetic friction between block B and the horizontal ground is $\mu_2 = 0.1$. A horizontal and constant force of $F = 6\,N$ is applied to block A, moving it a distance $L = 3m$ as shown in the diagram and bringing it to the right end of block B.

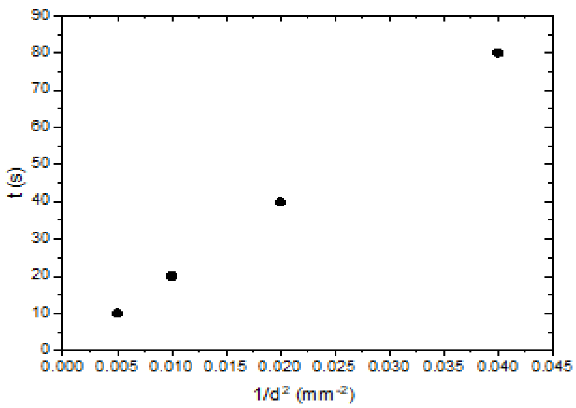


13) How many seconds does it take for block A to reach the right end of block B?
A) 0.5 B) 1.0 C) 1.5 D) 2.0 E) 2.5

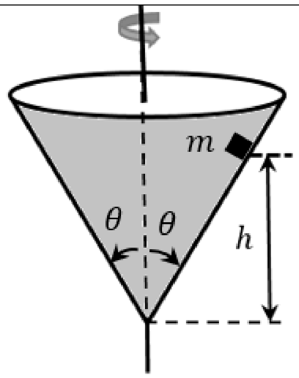
14) During this time, how many metres (x) does Block B travel on the ground?
A) 1 B) 2 C) 3 D) 4 E) 5

15) When block A reaches the right end of block B, if the velocity of block A relative to the ground is $\vec{v}_A$ and the velocity of block B relative to the ground is $\vec{v}_B$, what is the velocity of block B relative to block ?
A) $1m/s$ to the rigth B) $1m/s$ to the left C) $2m/s$ to the rigth D) $2m/s$ to the left E) $3\,m/s$ to the left

16) Four identical cylindrical containers each containing an equal amount of water. To determine the relationship between the drainage time and the hole diameter, holes of different diameters were drilled at the bottom of each container. The resulting experiment yielded the graph $t = f\,(1/d^2)$, where t represents time and d represents the hole diameter. Based on this graph, determine the drainage time for a hole diameter of $d = 2cm$.
A) 1 B) 5 C) 10 D) 500 E) 1000



17) A small block of mass m is placed on the inner surface of a cone. The cone can be freely rotated about its axis. The angle between the cone surface and the cone axis is θ, and the static friction coefficient between the block and the cone surface is μ_s. What is the maximum velocity (v_{max}) at which the block can remain stationary without sliding upwards from a height h above the base of the cone?



A) $\sqrt{g\ h\ tan\theta}$ B) $\sqrt{2g\ h\ tan\theta}$ C) $\sqrt{g\ h\ tan\theta(\ Sin\theta - \mu_s Cos\theta)}$

D) $\sqrt{g\ h\ tan\theta(\ Cos\theta + \mu_s Sin\theta)}$ E) $\sqrt{g\ h\ tan\theta\ \frac{Cos\theta+\mu_s Sin\theta}{Sin\theta-\mu_s Cos\theta}}$

18-19) A body with mass $m = 1\ kg$ is moved from point $x_i = 2m$ to point $x_f = 4m$ along the horizontal frictionless x-axis under the influence of a conservative force $F_x = (3x + a)\ N$, which depends on position. Here, a has the dimension of force.

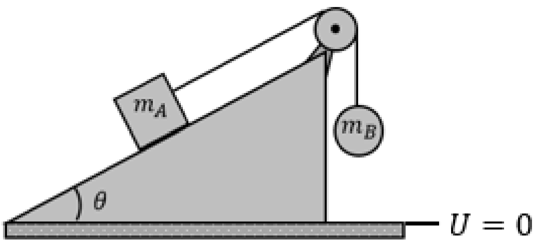
18) Given that the work done by the force is $W = 10\ J$, what is the value of a in N?

A) -4 B) -2 C) 0 D) 2 E) 4

19) If the potential energy of the object at the point $x = 0\ m$ is $U(0) = 0$, what is the potential energy at the point $x = 3\ m$ in joules?

A) 0 B) -1.5 C) -2 D) -2.5 E) -3

20) A block of mass $m_A = 1.0\ kg$ is placed on a frictionless inclined plane with an angle of inclination $\theta = 30^o$, as shown. The block on the inclined plane is attached to one end of a light string. The other end of the string passes through a pulley of negligible mass and is attached to another block with a mass $m_B = 2.0\ kg$. The system is initially at rest and the string is stretched. After the system is released, what is the total kinetic energy of the system in joules when the block with mass m_B has fallen 40 cm?



A) 2.0 B) 3.0 C) 4.0 D) 5.0 E) 6.0