YTU Physics Department 2023-2024 Fall Semester			
FIZ1001 PHYSICS-1 Midterm 1			
Question Sheet	**AAAAAA**	**23/11/2024 10.00-11.40**	**100 min**

Name	
Surname	
Student No	
Group/Saloon	
Signature	

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.

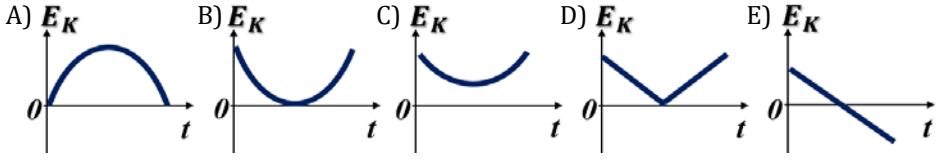
θ	0^0	30^0	37^0	45^0	53^0	60^0	90^0	
sin	0	$1/2$	$3/5$	$\sqrt{2}/2$	$4/5$	$\sqrt{3}/2$	1	$g = 10\ m/s^2$
cos	1	$\sqrt{3}/2$	$4/5$	$\sqrt{2}/2$	$3/5$	$1/2$	0	$\pi = 3$

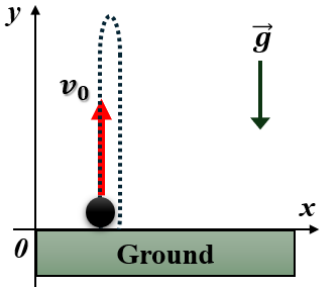
$$\vec{v}_{ave} = \frac{\Delta\vec{r}}{\Delta t};\ \vec{v} = \frac{d\vec{r}}{dt};\ \vec{a}_{ave} = \frac{\Delta\vec{v}}{\Delta t};\ \vec{a} = \frac{d\vec{v}}{dt};\ a_t = \frac{dv}{dt};\ a_r = \frac{v^2}{r};\ a = cons \Rightarrow\ v_f = v_i + at;$$

$$x_f = x_i + v_i t + \frac{1}{2}at^2;\ v_f^2 = v_i^2 + 2a\Delta x;\ \sum \vec{F} = m\vec{a};\ f_k = \mu_k N;\ \ f_s \le \mu_s N;\ F_r = \frac{mv^2}{r};\ F_x = -kx;$$

$$W = \int \vec{F}.d\vec{l};\ K = \frac{1}{2}mv^2;\ \ W_T = \Delta K;\ W = -\Delta U;\ \bar{P} = \frac{\Delta W}{\Delta t};\ U = mgy;\ \ U = \frac{1}{2}kx^2$$

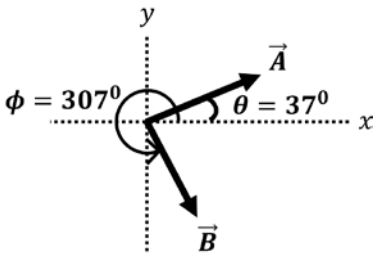
1) Which of the following represents the graphic of the kinetic energy of an object thrown vertically upward from the ground with an initial speed v_o as a function of time? (All frictional forces in the system are neglected.)





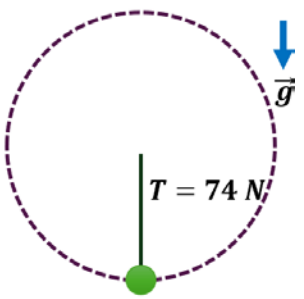
2) As shown in the figure, vectors $\vec{A}$ and $\vec{B}$, with magnitudes of 10 units, make angles of $\theta = 37^0$ and $\phi = 307^0$ with the positive x-axis, respectively, and are located in the xy plane. Which of the following options gives the **magnitude** and **ratio of the components** (C_y/C_x) of vector $\vec{C}$ that **satisfies the equation** $\vec{A} + \vec{B} + \vec{C} = \vec{0}$?

A) $|\vec{C}| = \sqrt{200}\ units;\ C_y/C_x = -\frac{1}{7}$
B) $|\vec{C}| = \sqrt{200}\ units;\ C_y/C_x = 7$
C) $|\vec{C}| = \sqrt{394}\ units;\ C_y/C_x = \frac{13}{15}$
D) $|\vec{C}| = \sqrt{394}\ units;\ C_y/C_x = -\frac{13}{15}$
E) $|\vec{C}| = \sqrt{394}\ units;\ C_y/C_x = -7$



3) A mass $m = 1\ kg$ is rotating vertically at the end of a string of length $L = 25\ cm$. If the tension force in the rope is determined to be 74 N at the lowest point, what is the speed of the object at this point in m/s.

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

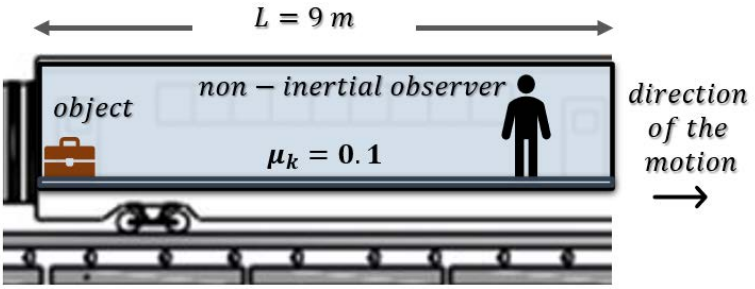


4) A jet plane can accelerate at 4 m/s^2during takeoff and can lift off when it reaches a speed of 80 m/s. If the pilot decides to abort takeoff, the plane can decelerate at 5 m/s^2 to come to a stop. Given that the pilot decides to abort flight at the takeoff speed, what is the **minimum** runway length required for the plane to come to a complete stop? (All frictional forces in the system are neglected.)

A) 1400 B) 1420 C) 1440 D) 1460 E) 1480

Questions 5-6

On a horizontal road where friction is negligible, a wagon of length $L = 9\ m$ is moving at a constant speed, with a bag resting at the rear end on the floor of the wagon. The coefficient of kinetic friction between the bag and the wagon is 0.1. The wagon begins to decelerate with an acceleration of $a = 3\ m/s^2$.



5) What is the acceleration of the bag in m/s^2 relative to the wagon (from the perspective of an observer moving with the wagon)?

A) 5 B) 2 C) 1 D) 0.5 E) 0.25

6) How many seconds later will the bag hit the front wall of the wagon?

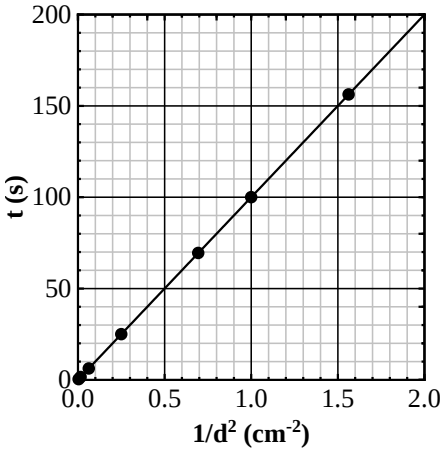
A) 8 B) 6 C) 3 D) 2 E) 1

7) An elevator is being pulled upwards at a constant speed with the help of cables attached to it. Which of the following correctly represents the net work done by the cables and gravity on the elevator?

A) Cannot be determined B) Is negative C) Is negative D) Is zero E) Depends on the number of cables

8) Laboratory Question:

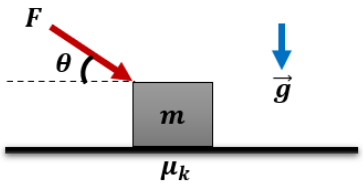
The discharge times t of four identical cylindrical containers filled with liquid to the same height have been measured using a chronometer, based on the hole diameter d. The relationship between the hole diameters of the containers and the measured discharge times is shown in the graph $t = f(1/d^2)$. If the hole diameter is 0.005 m, what is the discharge time of the liquid in seconds?



A) 50
B) 32
C) 75
D) 80
E) 400

Questions 9-11

A force of $F = 20\ N$ is applied to a wood object with a weight of 20 N on a frictional surface at an angle of $\theta = 53^0$ with the horizontal, as shown in the figure. The coefficient of kinetic friction between the object and the surface is $\mu_k = 0.25$.



9) Which of the following represents the frictional force acting on the object in Newtons?

A) 5 B) 8 C) 9 D) 10 E) 12

10) If the object is moved 10 m along the surface, what is the net work done in Joules?

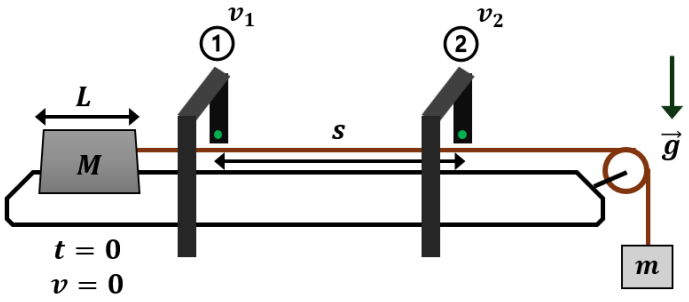
A) 10 B) 30 C) 50 D) 70 E) 90

11) What will the final speed of the box be in m/s?

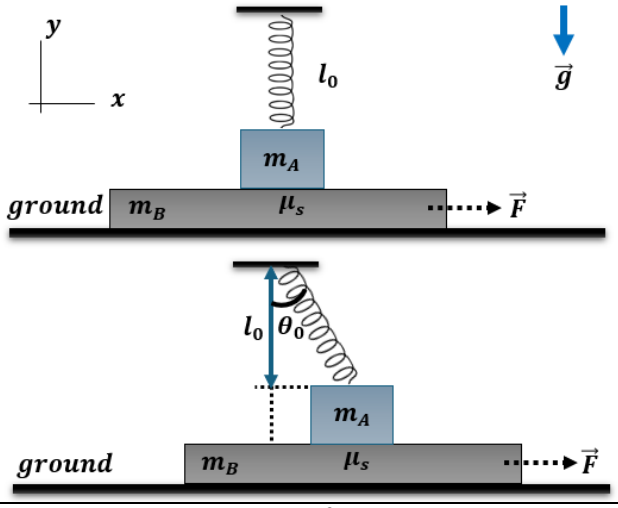
A) $\sqrt{30}$ B) $\sqrt{40/3}$ C) $\sqrt{50}$ D) $\sqrt{50/3}$ E) $\sqrt{60}$

12) Laboratory Question:
In the Newton's laws experiment, a mass of m is attached to a car with a mass of $M = 900\ g$ and length of L. When the system is released, the car starts moving from rest on a frictionless air track due to the effect of the mass m passed over the pulley. It has been observed that the car passes the first optical gate at 10 cm/s and the second optical gate at 40 cm/s. If the distance between the optical gates is $s = 7.5\ cm$, what is the mass m that initiates the movement of the system?

A) 10 g
B) 0.15 kg
C) 0.01 kg
D) 15 g
E) 0.1 kg



Questions 13-15
In the setup shown, there is a block A with a mass of 2.2 kg and a block B with a mass of m_B. The coefficient of static friction between blocks A and B is $\mu_s = 0.5$. The spring attached to block A is in its unextended state with a length of $l_0 = 1.2\ m$. Block B is being pulled on a frictionless surface ($\mu = 0$) by a horizontal force $\vec{F}$. Block A moves on top of block B **without slipping** until the spring makes an angle of $\theta_0 = 53^0$ with the vertical. Sliding motion begins after reaching the angle $\theta_0 = 53^0$.



13) What is the magnitude of the restoring force of the spring in Newtons when $\theta_0 = 53^0$?

A) 5 B) 10 C) 15 D) 20 E) 25

14) What is the spring constant k in N/m?

A) 8.5 B) 15 C) 12.5 D) 14.5 E) 16.5

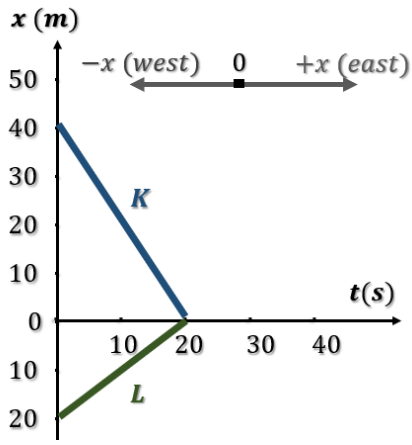
15) How much work is done by the F_{spring} in Joules until sliding motion begins at $\theta_0 = 53^0$?

A) 10/3 B) 20/3 C) 30 D) 4 E) 7

16) The average speed (v) of satellites in circular orbits around the Earth is determined by the radius (r) of their orbit and the gravitational acceleration (g) in the orbit. If the average speed of a satellite is proportional to r^x and g^y, which of the following options gives the correct values for x and y?

A) $x = -1; y = -1/2$ B) $x = 1/2; y = -1$ C) $x = 1/2; y = 1/2$ D) $x = -2; y = -1$ E) $x = 1; y = 1$

17) The position-time graphics of vehicles K and L, moving on an east-west linear path, are given in the figure. What is the velocity vector of vehicle K relative to vehicle L?



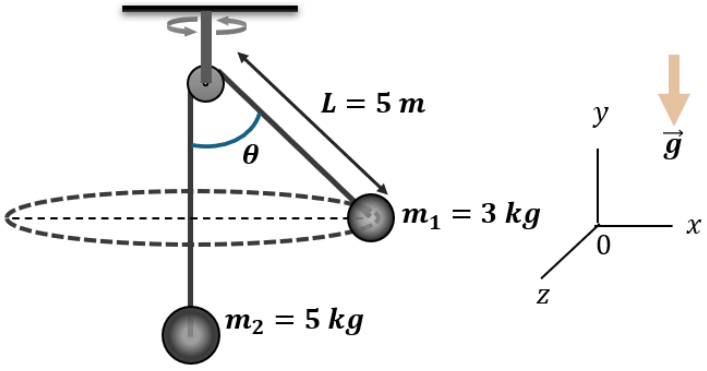
A) 10.8 km/h $(-\hat{\imath})$
B) 30 km/h $(\hat{\imath})$
C) 108 km/h $(-\hat{\imath})$
D) 12 km/h $(\hat{\imath})$
E) 12 km/h $(-\hat{\imath})$

18) An object released from rest hits the ground after 3 seconds. If all frictional forces in the system are neglected, which of the following statements is <u>incorrect</u>?

A) Its speed is 20 m/s after 2 seconds.
B) Its speed upon hitting the ground is 30 m/s.
C) The distance it covers in the 2nd second is 15 m.
D) The distance it covers during the first two seconds is 20 m.
E) The distance it covers during the last one second is 45 m.

Questions 19-20

Two blocks with masses $m_1 = 3\ kg$ and $m_2 = 5\ kg$ are connected by a rope that passes over a frictionless, massless pulley, which can freely rotate around the y-axis. **<u>The block with mass m_2 remains stationary in the y direction,</u>** while the block with mass m_1 rotates in a circular path in the xz plane with the help of the pulley.



19) What is the tension in the rope in N?

A) 20 B) 30 C) 40 D) 50 E) 60

20) What is the speed of the particle with mass m_1 in m/s?

A) $4\sqrt{10/3}$ B) $\sqrt{16/3}$ C) $4\sqrt{2/3}$ D) $\sqrt{8/3}$ E) $2\sqrt{10/3}$

ANSWER KEY	
1- B	11- A
2- A	12- E
3- E	13- B
4- C	14- C
5- B	15- D
6- C	16- C
7- D	17- A
8- E	18- E
9- C	19- D
10- B	20- A