

Physics 101

Spring Semester

Final Exam

Monday, May 11, 2026

12:00 PM - 2:00 PM

Student's Name: Serial Number:

Student's Number:Section:

Choose your Instructor's Name:

Instructors: Drs. Al Dosari, Al Jassar, Al kurtass, Al Qattan, Al Smadi, Askar,
Demir, Salameh, Zaman

For Instructors use only

Grades:

#	SP1	SP2	SP3	SP4	SP5	SP6	SP7	LP1	LP2	LP3	Q1	Q2	Q3	Q4	Total
	3	3	3	3	3	3	3	5	5	5	1	1	1	1	40
Pts															

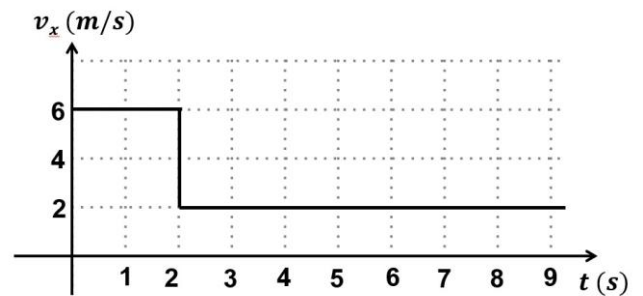
Important:

1. Answer all questions and problems (No solution = no points).
2. Full mark = 40 points as arranged in the above table.
3. **Give your final answer in the correct units.**
4. Assume $g = 10 \text{ m/s}^2$.
5. Mobiles are **strictly prohibited** during the exam.
6. Programmable calculators, which can store equations, are not allowed.
7. Please box your answers.
8. **Cheating incidents will be processed according to the university rules.**

GOOD LUCK

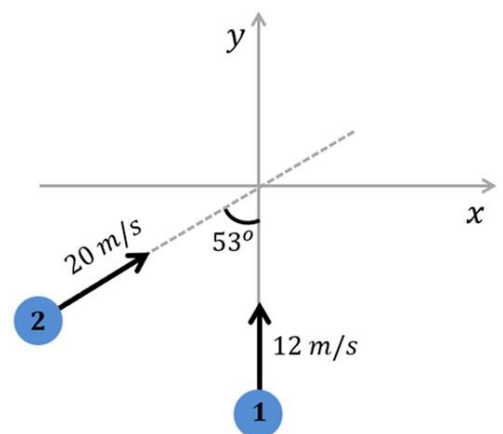
Part I: Short Problems (3 points each)

SP1. The velocity of an object moving along the x-axis varies with time as shown. Find the **average acceleration** during the time interval from $t = 0$ s to $t = 6$ s.



SP2. A disc initially rotates with an angular speed of **20 rad/s**. It slows down with a **constant angular acceleration** and comes to rest after **40 s**. How many **radians** does the disc make during this period?

SP3. Two **identical** point masses ($m_1 = m_2 = 2$ kg) move in the xy -plane with initial velocities, as shown. The masses collide at the origin and **stick together** after the collision. Find their final common velocity **in unit vector notation** immediately after the collision.



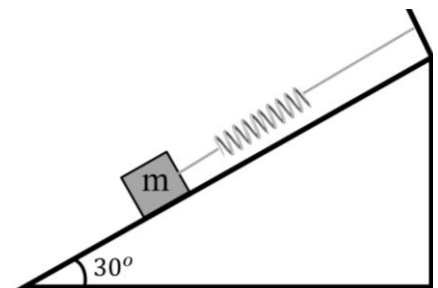
SP4. A 6 kg box, initially at **rest** at point A, is pulled 4 m along a **rough** horizontal surface by a constant force $F = 21\text{ N}$, as shown. The coefficient of kinetic friction between the box and the surface is $\mu_k = 0.3$.

Find the speed of the box at point B.

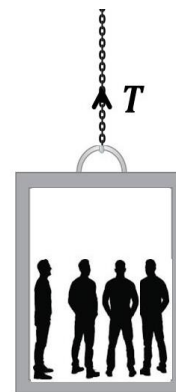


SP5. A block of mass $m = 15\text{ kg}$ **rests** on a **frictionless** incline and is attached to a spring, as shown. The spring is stretched by 0.3 m when the **system is in equilibrium**.

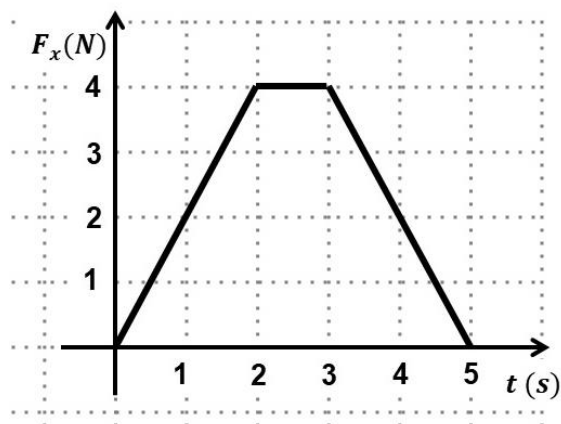
- Draw the **free-body diagram** of the block
- Determine the force constant of the spring k .



SP6. An elevator carrying passengers has a combined mass of 600 kg . **What power must the motor deliver** when the elevator is moving **upward** at a speed of 2 m/s and **speeding up** with an acceleration of magnitude 1 m/s^2 ?

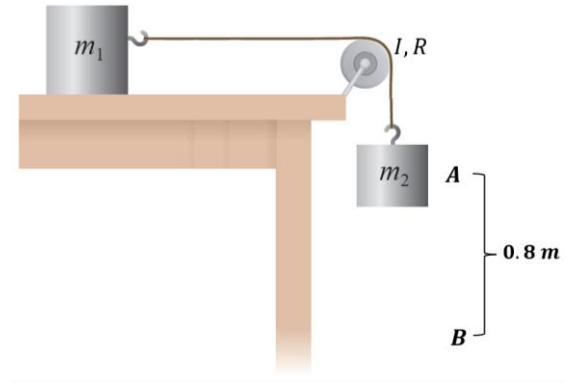


SP7. A 2 kg object starts from **rest** at $t = 0$ and moves along the $x - \text{axis}$. The time-dependent net force $F_x(t)$ acting on the object is shown in the figure. **Find the object's speed at $t = 5\text{ s}$.**



Part II: Long Problems (5 points each)

LP1. Block 1, of mass $m_1 = 4 \text{ kg}$, rests on a **frictionless** horizontal table and is connected by a light rope passing over a pulley to block 2, of mass $m_2 = 6 \text{ kg}$, as shown. The pulley has radius $R = 0.2 \text{ m}$ and a moment of inertia I . The system is **released from rest** when block 2 is at point A, and its speed becomes 3 m/s when it reaches point B.



- a) Find the angular speed of the pulley when block 2 reaches point B.

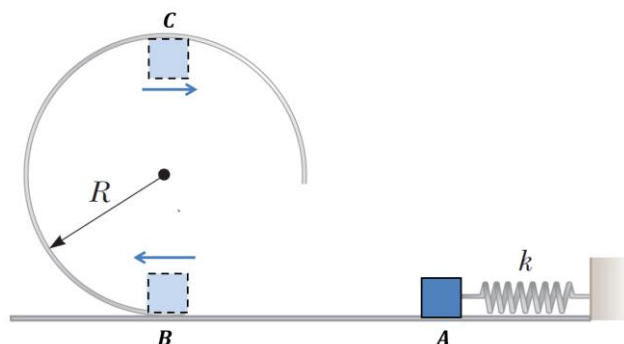
- b) Find the moment of inertia of the pulley.

- c) If the pulley was massless, then the speed of block 2 at point B would be:

- * more than 3 m/s
- * less than 3 m/s
- * equal to 3 m/s

LP2. A block of mass $m = 0.5 \text{ kg}$ is released from **rest** when the spring ($k = 450 \text{ N/m}$) was compressed a distance of $x = 0.3 \text{ m}$ at point A. It moves along a **frictionless** horizontal surface to point B, and then continues up a **vertical frictionless circular track** of radius $R = 1.4 \text{ m}$, as shown.

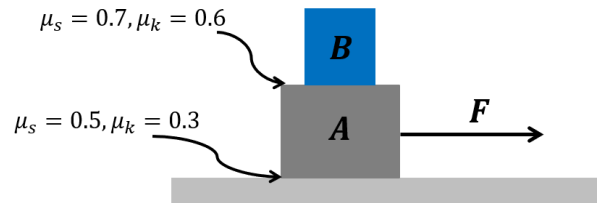
a) Find the speed of the block at point B.



b) Find the speed of the block at point C.

c) Find the magnitude of the normal force exerted on the block at point C.

LP3. Two blocks have masses $m_A = 25 \text{ kg}$ and $m_B = 15 \text{ kg}$. Block B rests on top of block A. A constant force is applied to block A as shown, and the two blocks move to the right. **Block B does not slide on block A.**



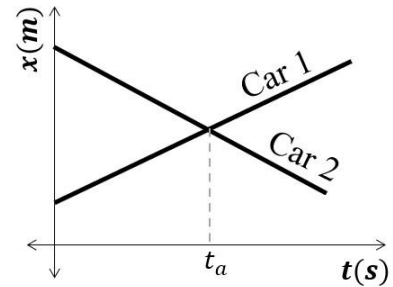
- a) Find the magnitude and direction of the frictional force acting on block A, when the system moves with constant velocity.
- b) Find the magnitude and direction of the frictional force acting on block B, when the system moves with constant velocity.
- c) If the applied force is increased to $F = 220 \text{ N}$, find the magnitude of the acceleration of the system.
- d) If the applied force is $F = 220 \text{ N}$, find the magnitude and direction of the frictional force acting on block B.

Part III: Questions (Choose the correct answer, one point each)

Q1. The position-versus-time graph for two cars moving along the x-axis in two parallel lanes is shown.

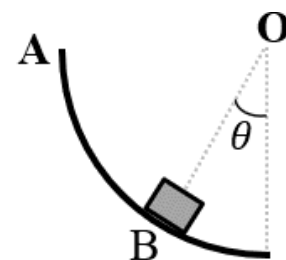
At time t_a , the two cars have:

- * different velocities, and the same acceleration.
- * the same velocity, and different accelerations.
- * the same velocity, and the same acceleration.
- * different velocities, and different accelerations.



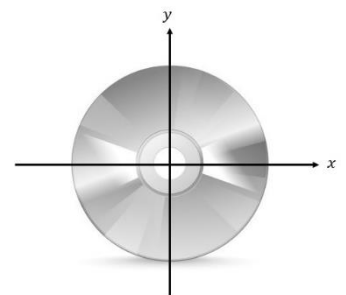
Q2. A block of mass m is released from rest at point A and slides down a frictionless quarter-circular surface, as shown. As the block passes point B, which of the following is correct about the magnitude of the normal force on the block, n ?

- * $n = mg \cos \theta$
- * $n < mg \cos \theta$
- * $n > mg \cos \theta$
- * $n = 0$



Q3. A disc rotates about an axis passing through its center. If both its angular velocity and angular acceleration are negative, then which of the following statements is correct?

- * The disc is rotating clockwise and slowing down.
- * The disc is rotating clockwise and speeding up.
- * The disc is rotating counterclockwise and slowing down.
- * The disc is rotating counterclockwise and speeding up.



Q4. A particle moves along the x-axis. Its linear momentum varies with time as shown. Rank the numbered regions according to the magnitude of the net force acting on the particle, from smallest to greatest.

- * 1-2-3
- * 2-3-1
- * 3-2-1
- * 2-1-3

