Kuwait University Physics Department

جامعة الكويت
KUWAIT UNIVERSITY

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
Pts	3	3	3	3	3	3	3	5	5	5	1	1	1	1	40

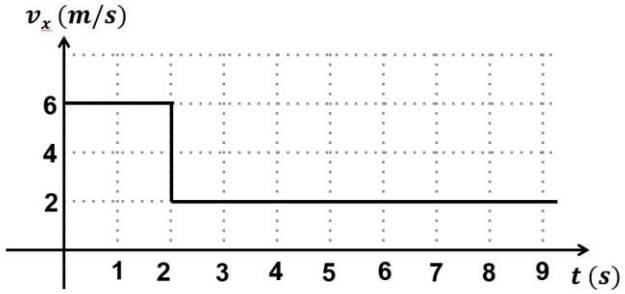
Important:

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 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

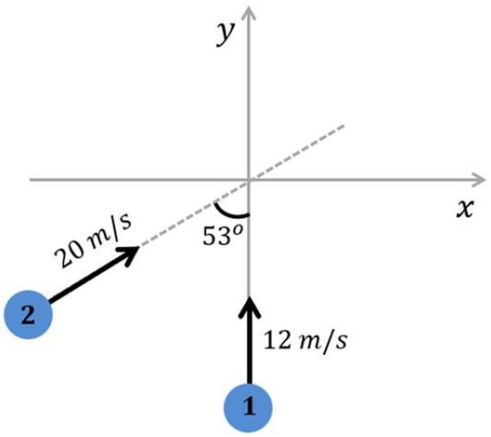
Part I: Short Problems (3 points each)

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 $t = 6\ s$.**

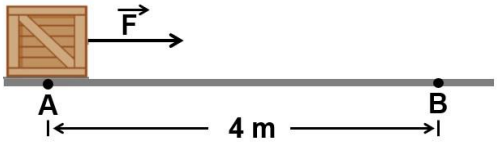


SP2. A disc initially rotates with an angular speed of **20 rad/s**. It slows down with a **constant angular acceleration** and comes to rest after $40\ s$. **How many radians does the disc make during this period?**

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**.**



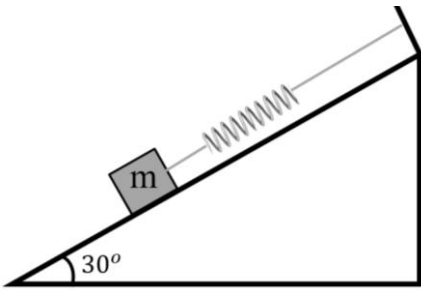
SP4. A 6 kg box, initially at **rest** at point A, is pulled 4 m along **a rough** horizontal surface by a constant force $F = 21\ N$, as shown. The coefficient of kinetic friction between the box and the surface is $\mu_k = 0.3$. **Find the speed of the box at point B**.



SP5. A block of mass $m = 15\ kg$ **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**.

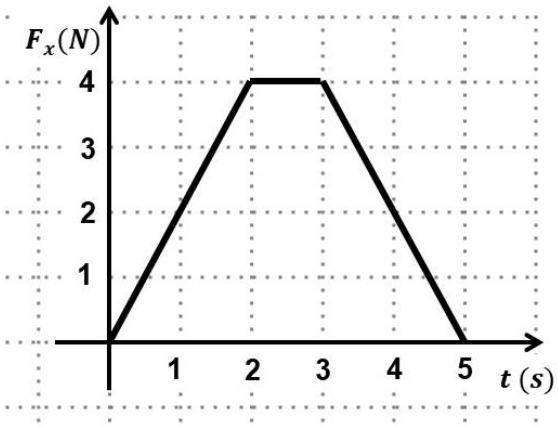
a) **Draw the free-body diagram of the block**

b) **Determine the force constant of the spring *k*.**



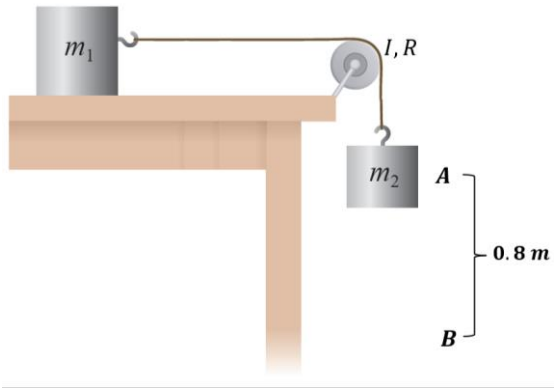
SP6. An elevator carrying passengers has a combined mass of 600 kg. **What power must the motor deliver** when the elevator is moving **upward** at a speed of 2 m/s and **speeding up** with an acceleration of magnitude 1 m/s^2?

SP7. A 2 kg object moves to the right with an initial speed of 2 m/s at $t = 0$. The time-dependent net force $F_x(t)$ acting on the object along the $x - axis$ is shown in the figure. **Find the object's speed at $t = 5$ s.**



Part II: Long Problems (5 points each)

LP1. Block 1, of mass $m_1 = 4\ kg$, rests on **a frictionless** horizontal table and is connected by a light rope passing over a pulley to block 2, of mass $m_2 = 6\ kg$, as shown. The pulley has radius $R = 0.2\ m$ 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.



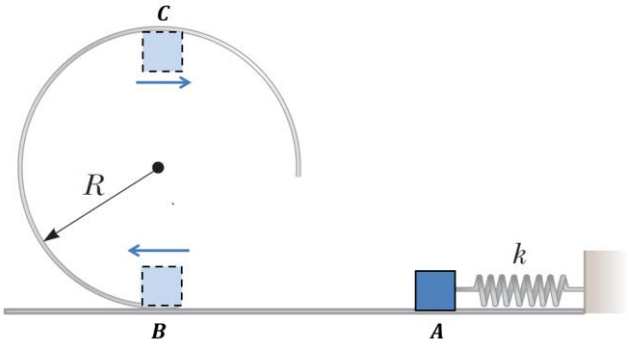
a) **Find the angular speed of the pulley when block 2 reaches point B.**

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



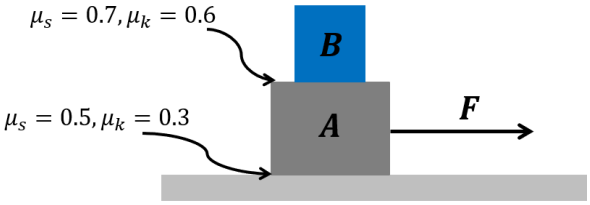
a) Find the speed of the block at point B.

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 $m_A = 25\ kg$ and $m_B = 15\ kg$. 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.**

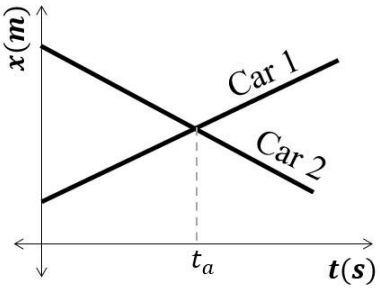
c) If the applied force is increased to $F = 220\ N$, find the magnitude of the acceleration of the system.

d) **If the applied force is $F = 220\ N$, find the magnitude and direction of the frictional force acting on block B.**

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

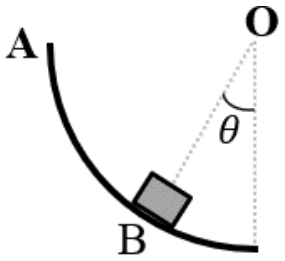
Q1. The position-versus-time graph for two cars moving along the x-axis in two parallel lanes is shown.

At time t_a, the two cars have:



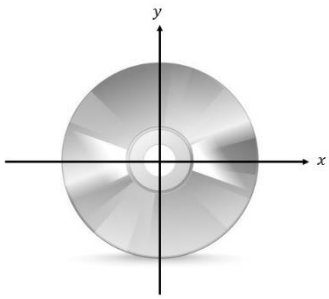
* different velocities, and the same acceleration.
* the same velocity, and different accelerations.
* the same velocity, and the same acceleration.
* different velocities, and different accelerations.

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***?



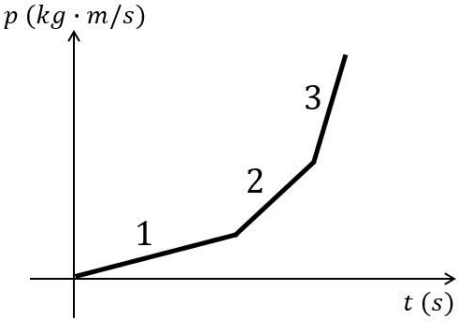
* $n = mg\ cos\ \theta$
* $n < mg \cos\theta$
* $n > mg\ cos\ \theta$
* $n = 0$

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