

Physics 101

Summer Semester

Final Exam

Monday, July 27, 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 Qattan, Al Smadi, Askar, Salameh,
Zaman

For Instructors use only

Grades:

#	SP1	SP2	SP3	SP4	SP5	SP6	SP7	LP1	LP2	LP3	Q	Total
	3	3	3	3	3	3	3	5	5	5	4	40
Pts												

Important:

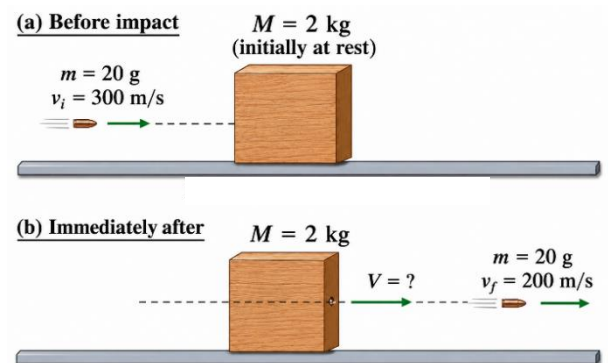
1. Answer all questions and problems (No solution = no points).
2. Full mark = 40 points as arranged in the above table.
3. **Give your final answer in the correct units.**
4. Assume $g = 10 \text{ m/s}^2$.
5. Mobiles are **strictly prohibited** during the exam.
6. Programmable calculators, which can 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. A 0.6 kg ball initially moves with velocity $\vec{v}_i = (6\hat{i} + 7\hat{j}) \text{ m/s}$. After being struck, its velocity becomes $\vec{v}_f = (2\hat{i} - 4\hat{j}) \text{ m/s}$. Find the **impulse** exerted on the ball **in unit vector notation**.

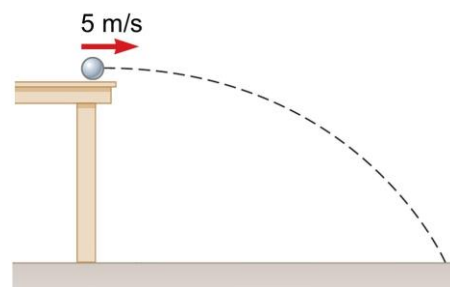
SP2. A bullet of mass $m = 0.02 \text{ kg}$ travels **horizontally** at a speed of 300 m/s . It strikes a block of mass $M = 2 \text{ kg}$, initially at **rest** on a frictionless horizontal surface. The bullet passes through the block and exits with a speed of 200 m/s . Find the **speed** of the block **immediately after the bullet exits**.



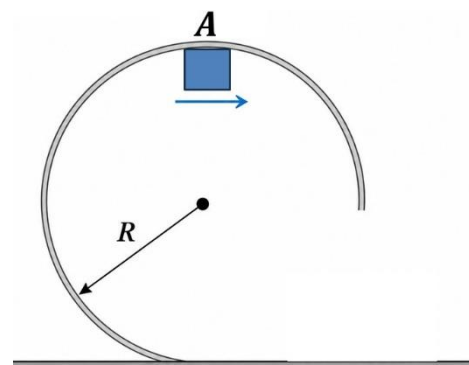
SP3. A wheel rotates through 24 rad in 2 s as it is **uniformly** brought to **rest**. Find the **initial angular velocity** (in rad/s) of the wheel before breaking began.



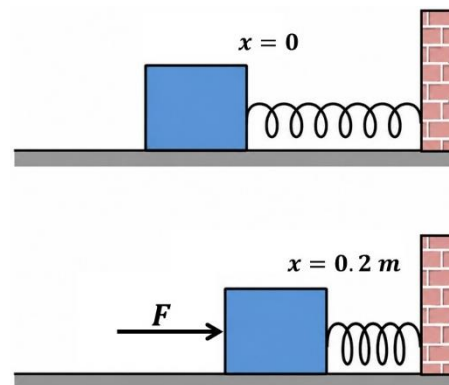
SP4. A ball is **projected horizontally** from the edge of a table with a speed of 5 m/s and reaches the ground after $t = 1.2\text{ s}$, as shown. Find the **speed** of the ball (in m/s) **just before it hits the ground**.



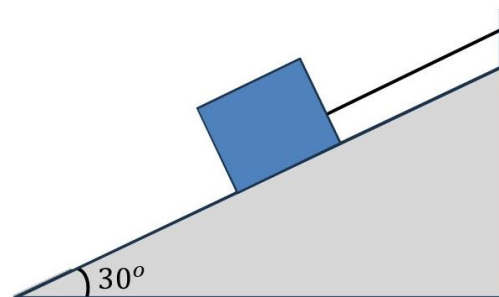
SP5. A small block ($m = 0.2\text{ kg}$) moves inside a **frictionless** circular track of radius $R = 0.8\text{ m}$, as shown. At the top of the track (point A), the **normal force** exerted on the block is 20 N . Find the **speed of the block at point A**.



SP6. A block is attached to a spring ($k = 600 \text{ N/m}$) on a horizontal **frictionless** surface. Initially, the spring is **unstretched** ($x = 0$), and the block is **at rest**. A constant horizontal force $|\vec{F}| = 200 \text{ N}$ is applied to the block, causing the spring to compress. Find the **kinetic energy (in J)** of the block when the spring is compressed by $x = 0.2 \text{ m}$.



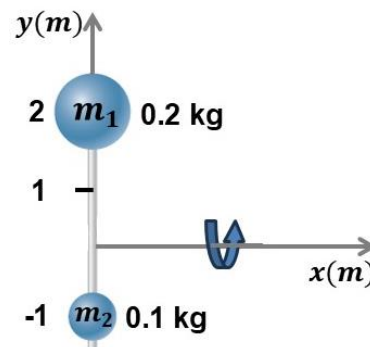
SP7. A 90 kg block is **held at rest** on a **rough** inclined ramp by a light cable, as shown. If the tension in the cable is $T = 400 \text{ N}$. Find the **magnitude of the friction force** acting on the block.



Part II: Long Problems (5 points each)

LP1. Two small balls are connected by a thin, massless rod aligned along the y-axis. The system rotates about the x – axis, as shown. The angular position is given by $\theta(t) = 10t^2 - 2t^3$, where θ is in radians and t is in seconds.

a) Find the moment of inertia of the system about the x-axis.



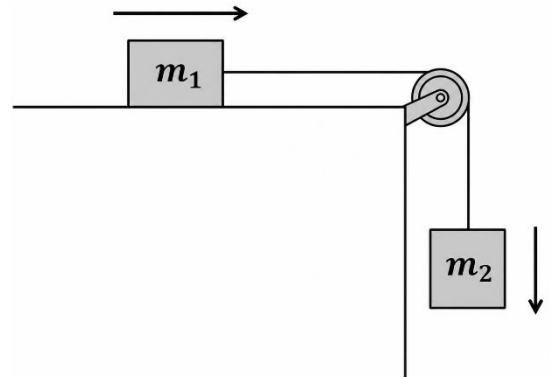
b) Find the angular speed of the system at $t = 2s$.

c) Find the rotational kinetic energy of the system at $t = 2s$.

d) Find the linear speed (in m/s) of the 0.2 kg ball at $t = 2s$.

LP2. Two blocks, ($m_1 = 3\text{ kg}$ and $m_2 = 2\text{ kg}$), are connected by a light rope passing over a frictionless, massless pulley, as shown. **The surface is rough**, with $\mu_k = 0.5$. The blocks are **released from rest** and move in the directions shown in the figure.

a) Find the acceleration of the two blocks.

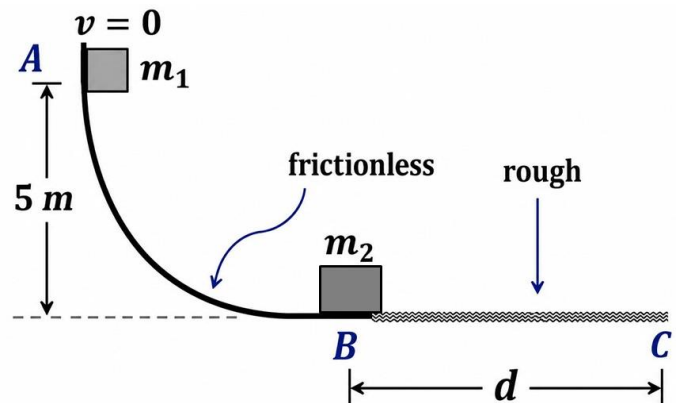


b) Find the tension in the rope.

c) Find the speed of m_2 after it has moved 3 m .

LP3. Block 1 ($m_1 = 8\text{ kg}$) is **released from rest** at a height of 5 m , as shown. It collides with block 2 ($m_2 = 12\text{ kg}$), which is initially at **rest**. The two blocks, made of the same material, **stick together** after the collision. The combined blocks then slide a distance ($d = 2\text{ m}$) along a **rough** horizontal surface before coming to **rest at point C**.

- a) Find the speed of block m_1 immediately before the collision (at point B) using the conservation of energy.

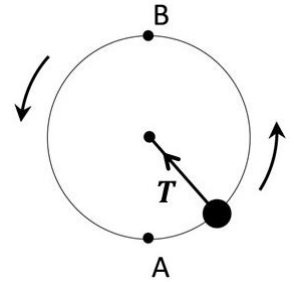


- b) Find the speed of the combined blocks immediately after the collision.
- c) Find the coefficient of kinetic friction (μ_k) between the blocks and the horizontal rough surface.

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

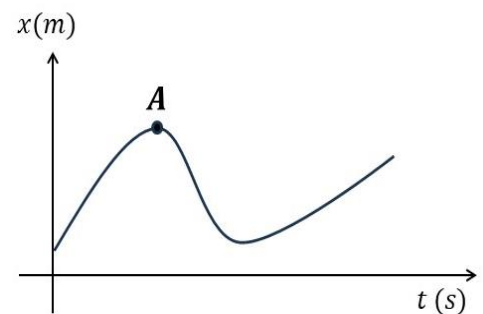
Q1. An object of mass m is attached to a string and moves along a **vertical circular path** of radius R , as shown. **The work done by the tension force (T)** as the object moves from point A to point B is:

- * πRT
- * $\pi R mg$
- * $2R mg$
- * zero



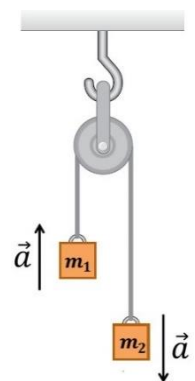
Q2. The graph shows the position of a particle moving along the $x - axis$ as a function of time. Which of the following statements is **correct** for the particle at point A?

- * $v_x = 0$ and $a_x = 0$
- * $v_x = 0$ and $a_x < 0$
- * $v_x = 0$ and $a_x > 0$
- * $v_x > 0$ and $a_x = 0$



Q3. Two blocks are connected by a light rope passing over a **massless** pulley, as shown. Block m_1 **accelerates upward**. Which of the following statements about the tension (T) in the rope is **correct**?

- * $m_1 g > T > m_2 g$
- * $m_2 g > T > m_1 g$
- * $m_1 g = T = m_2 g$



Q4. A solid disc rotates about its centre with angular velocity ω . Points A and B are located at different distances from the centre, as shown. **Which one of the following statements is correct?**

- * $\omega_A = \omega_B$
- * $v_A = v_B$
- * $\omega_A > \omega_B$
- * $v_A < v_B$

