Kuwait University Physics Department

جامعة الكويت
KUWAIT UNIVERSITY

Physics 101

Spring Semester
Second Midterm Exam
Monday, April 21, 2025
6:30 PM – 08:00 PM

Student's Name: …… Serial Number: ……

Student's Number: ……Section: ……

Choose your Instructor's Name:

Instructors: Drs. Al Dosari, Alkurtass, Al Qattan, Al Refai, Al Smadi, Askar, Demir, Salameh, Zaman

For Instructors use only

Grades:

#	SP1	SP2	SP3	SP4	SP5	LP1	LP2	Q1	Q2	Q3	Q4	Total
Pts	2	2	2	2	2	3	3	1	1	1	1	20

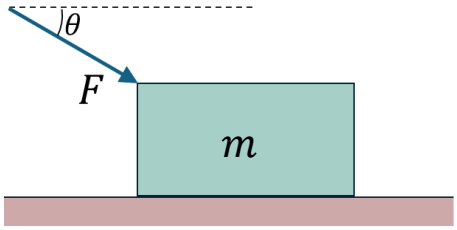
Important:

1. Answer all questions and problems (No solution = no points).
2. Full mark = 20 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. **Cheating incidents will be processed according to the university rules.**

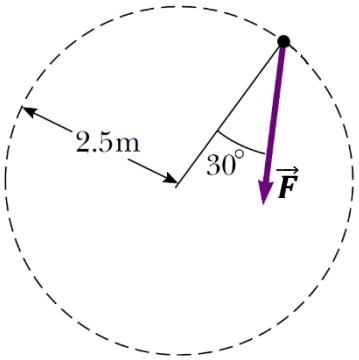
GOOD LUCK

Part I: Short Problems (2 points each)

SP1. A block ($m = 8\ kg$) is pushed along a horizontal **frictionless** floor by a force $|\vec{F}| = 24\ N$ at an angle $\theta = 30°$ with the horizontal, as shown**. Find the magnitude of the block's acceleration**.



SP2. The figure shows the **net force** $\vec{F}$ at a given instant on an object ($m = 0.6\ kg$) moving in a **vertical circle** of radius ($R = 2.5\ m$). If $|\vec{F}| = 12\ N$, **find the speed of the particle at that instant.**

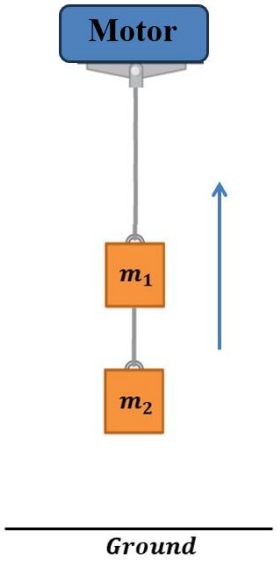


SP3. The only force acting on an object ($m = 5\ kg$) moving along the x-axis is given by:

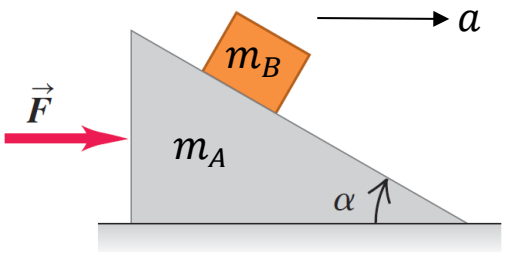
$$F(x) = (18 - 0.5x)\ N,$$

where x is given in $meters$. If the object is initially **at rest at $x = 0$, what is its speed at $x = 11m$?**

SP4. Two masses ($m_1 = 160\ kg$ and $m_2 = 190\ kg$) are connected by a light rope, as shown. A motor is used to lift these masses **upward** from the ground**. What power delivered by the motor is required to lift these masses at <u>a constant speed</u> of 4 m/s?**

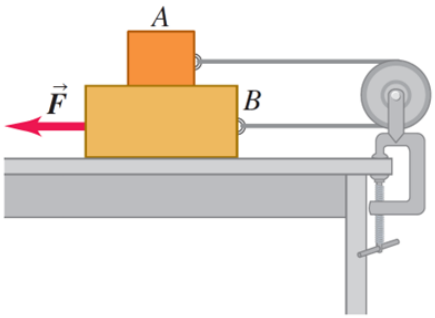


SP5. A body ($m_A = 9\ kg$) rests on a horizontal table, as shown. Another body ($m_B = 5\ kg$) is placed on body A and a horizontal force ($F = 100\ N$) is applied to body A. If all surfaces are **frictionless, find the angle α that allows both bodies to move with the <u>same acceleration</u>**.



Part II: Long Problems (3 points each)

LP1. Two blocks are placed on top of each other on a **frictionless** table, as shown. The surface between block A and block B is **rough**. They are connected by a light string that passes around a fixed frictionless, and massless pulley. A horizontal force $|\vec{F}| = 10\ N$ is applied to **block B**, causing it to **move to the left at a constant speed**.



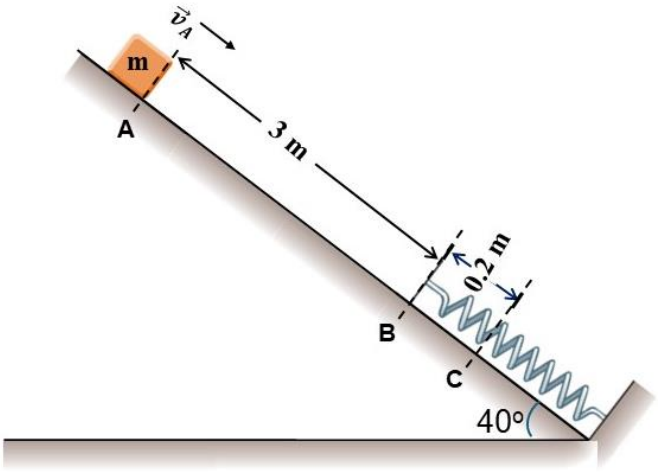
a) Find the magnitude of the friction force acting on block A.

b) After block B has moved a distance $s = 0.2\ m$, **find the work done by the friction force on block A.**

c) What is the correct relation between the total work done on block A ($W_{\text{tot A}}$) and on block B ($W_{\text{tot B}}$)?

* $W_{\text{tot A}} = W_{\text{tot B}}$
* $W_{\text{tot A}} > W_{\text{tot B}}$
* $W_{\text{tot A}} < W_{\text{tot B}}$

LP2. A block of mass ($m = 1.4\ kg$) is projected with a speed v_A from point **A** on **a frictionless** incline toward a spring, as shown. The spring ($k = 1450\ N/m$) is compressed a maximum distance ($x = 0.2\ m$) before coming to **rest momentarily** at point **C**.



a) Calculate the work done by gravity as the block moves from point A to point C.

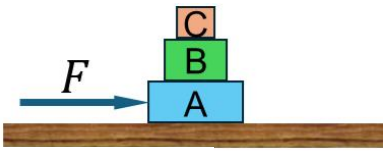
b) Use the work-energy theorem to calculate the block's speed at point A.

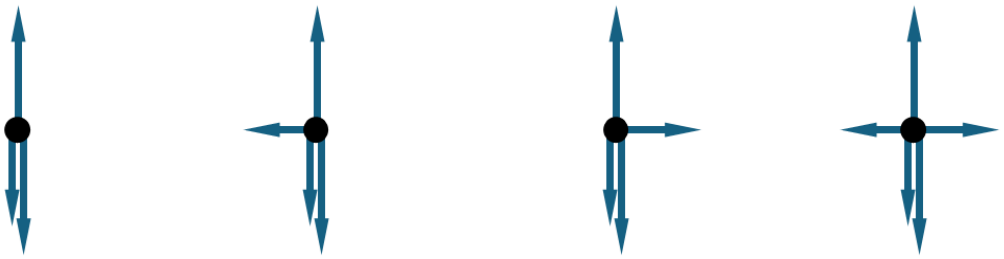
c) What is the direction of the block's acceleration at point C?

***** Down the incline * Up the incline * Zero

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

Q1. Three boxes are stacked on top of each other on a horizontal table, as shown. A horizontal force ($\vec{F}$) is applied to box A, causing all the boxes to move with the **same acceleration**. Which of the following correctly represents **the free-body diagram of box B?**





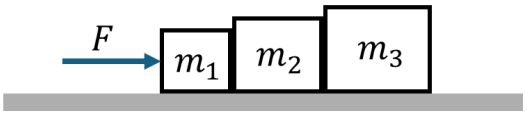
* * * *

Q2. A woman with mass (m) stands on a bathroom scale in an elevator. While the elevator is **slowing down as it goes downward, the scale (n) reads**

* $n > mg$ * $n = mg$

* $n < mg$ * $n = 0$

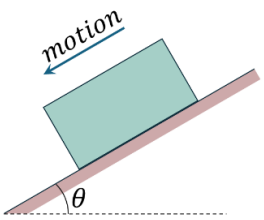
Q3. Three boxes ($m_1 < m_2 < m_3$) are in contact on a **rough** horizontal surface, as shown. A constant horizontal force acts on box 1, and the system moves to the right **at a constant acceleration**. **Which box has the lowest net force?**



* box 1 * box 2

* box 3 * all the same

Q4. A block is sliding down a **rough** incline, as shown. If the **total work done on the block is zero**, which of the following is correct about the weight (mg) and the magnitude of friction (f_k)?



* $mg < f_k$ * $mg > f_k$ * $mg = f_k = 0$ * $mg = f_k \neq 0$