

## Homework No. 05 (Spring 2026)

### PHYS 205A-001: UNIVERSITY PHYSICS

*School of Physics and Applied Physics, Southern Illinois University–Carbondale*

Due date: Monday, 2026 Feb 16, Noon, on D2L

### Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.
- Links to solutions are provided.
- Practice problems are available at [Binapani Academy](#). It is a free service and requires a one-time registration. (Code: SIUC2025)
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments). You can replace your PDF file as many times as you like. Only the last file is graded. The deadline has an (undisclosed) buffer period, so do not hesitate to try submissions after the deadline.

### Problems

1. (**10 points.**) A vinyl record on a turntable rotates at  $33\frac{1}{3}$  revolutions per minute.
  - (a) What is its angular speed in radians per second?
  - (b) What is the linear speed of a point on the record at the needle when the needle is 15 cm from the turntable axis?
  - (c) What is the linear speed of a point on the record at the needle when the needle is 7.4 cm from the turntable axis?

[[Solution](#)]

2. (**10 points.**) Earth rotates about its axis once in 24 hours. Radius of Earth is 6400 km. Earth is spherical to a good approximation.
  - (a) Compute the magnitude and direction of the centripetal acceleration at the equator, due to rotation of Earth.

- (b) Compute the magnitude and direction of the centripetal acceleration at the North pole, due to rotation of Earth.
- (c) Compute the magnitude and direction of the centripetal acceleration at Carbondale (at a latitude of  $38^\circ$  N) due to rotation of Earth.

[Solution] Erratum: Unit of acceleration  $a$  should be  $\text{m/s}^2$ , not  $\text{rad/s}^2$ , everywhere.

3. (10 points.) The International Space Station (ISS) orbits Earth with a time period of 93 minutes at an altitude of 420 km. Radius of Earth is 6400 km.

- (a) Compute the frequency of ISS. Or, how many times does the ISS orbit Earth in a day?
- (b) Compute the angular frequency of ISS.
- (c) Compute the orbital speed of ISS.
- (d) Compute the centripetal acceleration of ISS. How will a crew member perceive this acceleration? Compare this number to the acceleration due to gravity on the surface of Earth ( $g = 9.8 \text{ m/s}^2$ ).

[Solution]