ACADEMIC DISHONESTY POLICY

Academic honesty is one of the foundations of the educational mission and Catholic commitment of this University. Academic dishonesty, including such practices as cheating, plagiarism and fabrication, undermines the learning experience, and, as it involves fraud and deceit, is corrosive of the intellectual principles and is inconsistent with the ethical standards of this University. Academic dishonesty damages the sense of trust and community among students, faculty and administrators.

Types of Academic Dishonesty

Plagiarism is the act of presenting the work or methodology of another as if it were one's own. It includes quoting, paraphrasing, summarizing or utilizing the published work of others without proper acknowledgment, and, where appropriate, quotation marks. Improper use of one's own work is the unauthorized act of submitting work for a course that includes work done for previous courses and/or projects as though the work in question were newly done for the present course/project. Fabrication is the act of artificially contriving or making up material, data or other information and submitting this as fact. Cheating is the act of deceiving, which includes such acts as receiving or communicating or receiving information from another during an examination, looking at another's examination (during the exam), using notes when prohibited during examinations, using electronic equipment to receive or communicate information during examinations, using any unauthorized electronic equipment during examinations, obtaining information about the questions or answers for an examination prior to the administering of the examination or whatever else is deemed contrary to the rules of fairness, including special rules designated by the professor in the course.

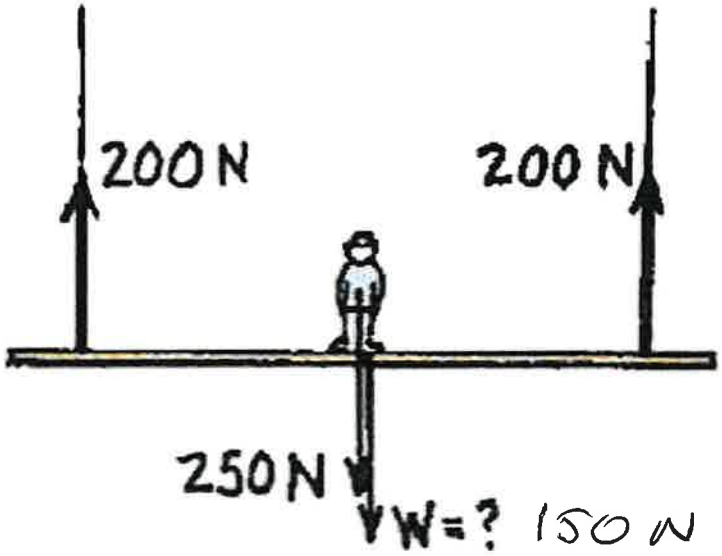
By Signing below, I verify that I have taken this test honestly and have neither cheated nor helped anyone else cheat; this is a mark of academic integrity.

Student Name (Please Print): CARLOS YERO (SOLUTIONS)

Student Signature: _____ Date: Feb 13, 2025

Student ID #: _____ Course Title/Number: PHYS 101

1) **(5 pts)** The sketch shows a painter's staging in mechanical *equilibrium*. The person in the middle weighs 250 N, and the tension in each rope is 200 N. What is the weight of the staging ?

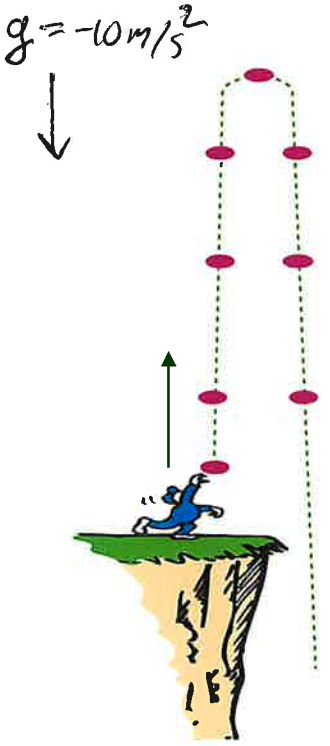


$F_{net} = 0 \Rightarrow 200N + 200N = 250N + W$

$W = 400N - 250N$

$\boxed{W = 150N}$

2) **(25 pts)** You toss a ball straight up with an initial speed of $v_0 = 40$ m/s (take the upward direction as "+" positive)



a) **(5 pts)** What is the *speed* of the ball at its highest point ?

$$v_{highest} = 0 \text{ m/s}$$

b) **(5 pts)** What is the *acceleration* of the ball at its highest point ? (specify its magnitude and direction)

$$a \Rightarrow g = -10 \text{ m/s}^2$$

c) **(5 pts)** *How long* did it take the ball to reach its highest point?

$$v = v_0 + at, \quad a = -g$$

$$\Rightarrow v = v_0 - gt \rightarrow t = \frac{v - v_0}{-g}$$

$$t = \frac{0 - 40 \text{ m/s}}{-10 \text{ m/s}^2} = 4 \text{ s} \qquad \boxed{t = 4 \text{ s}}$$

d) **(5 pts)** Calculate the *distance* the ball travelled from the moment it was released up until reaching its highest point?

$$d = v_0 t + \frac{1}{2} a t^2 = (40 \text{ m/s})(4 \text{ s}) + \frac{1}{2}(-10 \text{ m/s}^2)(4 \text{ s})^2$$

$$= 160 \text{ m} - 80 \text{ m} = 80 \text{ m}$$

$$\boxed{d = 80 \text{ m}}$$

e) **(5 pts)** What is the *velocity* of the ball 1 sec after reaching its highest point?

$$v = v_0 + at$$

$$v = 0 \text{ m/s} - (10 \text{ m/s}^2) \cdot 1 \text{ s}$$

$$\boxed{v = -10 \text{ m/s}}$$

3) **(20 pts)** Nelly Newton, who has a mass of m = 30 kg, sky-dives from a high-flying helicopter (take the downward direction as "+" positive)

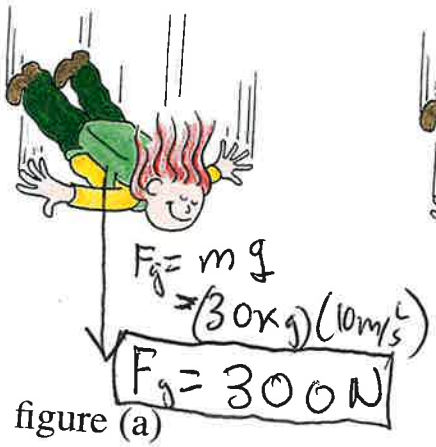


figure (a)

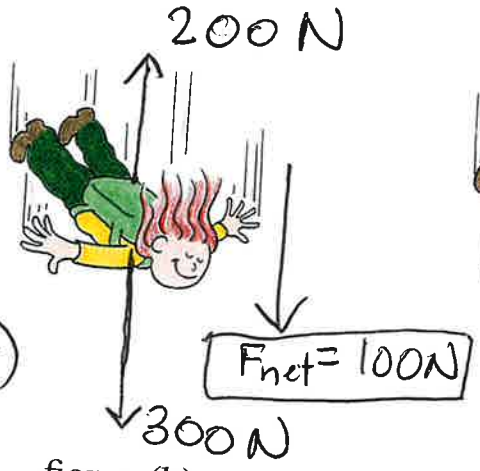


figure (b)

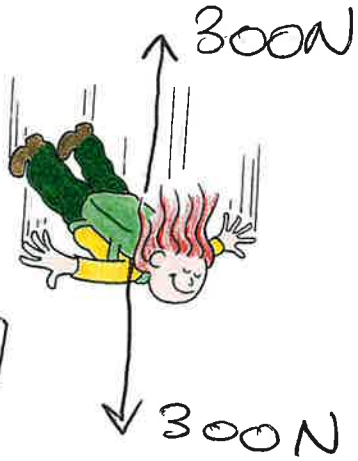


figure (c)

a) **(5 pts)** Draw all forces (magnitude+direction) acting on Nelly initially during her fall, assuming no air resistance (e.g., *free-fall*) in **figure (a)**

b) **(5 pts)** After Nelly has gained enough speed, the air resistance now becomes 200 N. Draw all forces (magnitude+direction) acting on the Nelly and calculate net force, $\mathbf{F}_{net}$, in **figure (b)**

$$F_{net} = 300N - 200N = 100\,N$$

c) **(5 pts)** Calculate the acceleration of Nelly in **figure (b)**

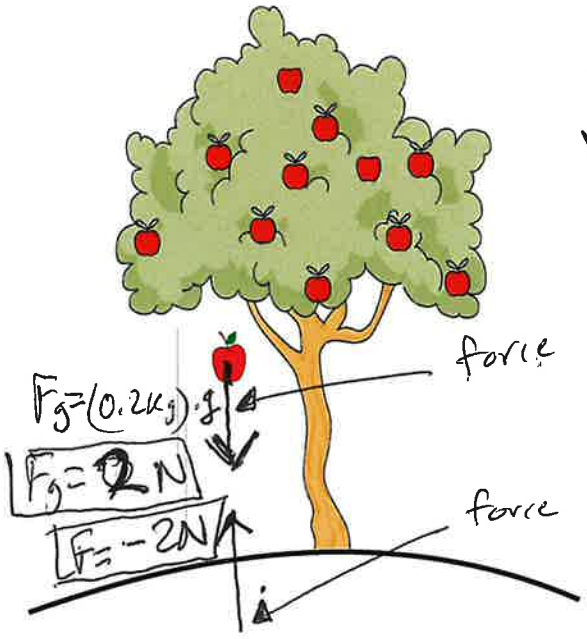
$$a = \frac{F_{net}}{m} = \frac{100N}{30kg} \Rightarrow \boxed{a = 3.33\,m/s^2}$$

d) **(5 pts)** Nelly's air resistance has now increased to 300 N in **figure (c)** Draw all forces (magnitude+direction) acting on her and calculate the net force $\mathbf{F}_{net}$, and acceleration.

$$F_{net} = 300 - 300 = \boxed{0\,N}$$

$$a = \frac{F_{net}}{m} = \frac{0}{m} = \boxed{0\,m/s^2}$$

4) **(15 pts)** An apple of mass m = 0.2 kg falls (assume negligible air resistance) from an apple tree due to the gravitational pull from the Earth



a) **(5 pts)** What is the gravitational force that the *Earth exerts on the apple*. (Draw magnitude and direction)

$$F_g = (0.2kg)(10\ m/s^2) = \boxed{2N}$$

b) **(5 pts)** Does the apple exert a force on the Earth ? If so, what is the force that the *apple exerts on the Earth*. (Draw magnitude and direction of this force.)

Yes. By Newton's 3rd LAW, $F_{12} = -F_{21}$

$$\Rightarrow \boxed{F = -2N}$$

c) **(5 pts)** If the mass of the Earth is $M_e = 5.97 \times 10^{24}$ kg, what is the acceleration of the Earth towards the apple ? (*hint:* apply Newton's 2nd law $F_{net} = ma$; use the result of part (b) as the net force, and the mass of Earth to solve for the acceleration.)

$$F_{net} = ma \rightarrow a = \frac{F_{net}}{m} = -\frac{2N}{5.97 \times 10^{24} kg}$$

$$\boxed{a = 3.35 \times 10^{-25}\ m/s^2}$$

basically negligible acceleration of Earth due to apple.