

# PHY131 F Fall 2020

## Class 8



### Midterm Assessment 1

Today:

- Finishing Chapter 3
- Review and Practice Problems
- Tomorrow: Midterm Assessment #1:
  - 30 minutes
  - 10 multiple choice questions on Chapters 1, 2 and 3.
  - the whole class does the quiz synchronously in real-time!

Question 1 10 pts

Here is a motion diagram of a car moving along a straight road. Which velocity-versus-time graph matches this motion diagram?

Available from Sep 29 at 8:10pm Until Sep 29 at 8:45pm

Time Running: [Hide](#)  
29 Minutes, 27 Seconds

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Poll

## Last day at the end of class I asked:

- “After having been thrown upward, a 100-g apple falls back into your hand and you catch it. While you are catching it, the force that you exert on the apple is
  - A. more than
  - B. less than
  - C. the same as
- the force that you exert on the apple when you are holding it at rest.”

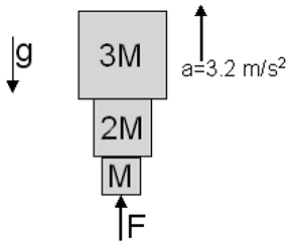


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### Example

Three blocks are being accelerated upward at  $3.2 \text{ m/s}^2$  by a force  $\vec{F}$  applied to the bottom block as shown in the diagram. The mass of the bottom block is  $7.0 \text{ kg}$ , the mass of the middle block is  $14 \text{ kg}$ , and that of the top block is  $21 \text{ kg}$ .

(a) Find the magnitude of  $F$ .

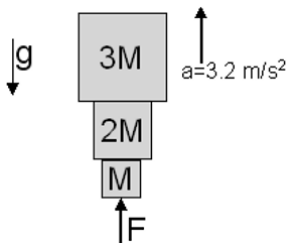


3

### Example

Three blocks are being accelerated upward at  $3.2 \text{ m/s}^2$  by a force  $\vec{F}$  applied to the bottom block as shown in the diagram. The mass of the bottom block is  $7.0 \text{ kg}$ , the mass of the middle block is  $14 \text{ kg}$ , and that of the top block is  $21 \text{ kg}$ .

(b) What is the magnitude of the normal force that the top block exerts on the middle block?



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Example



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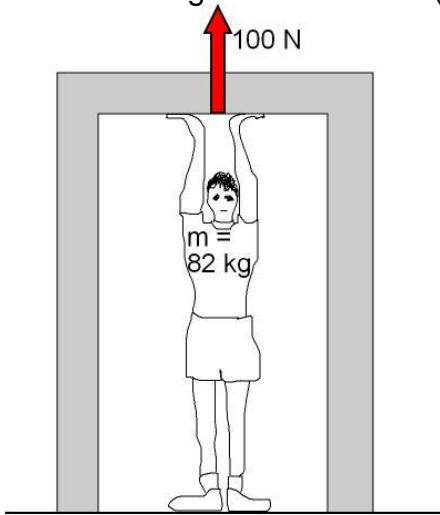
## Self-adjusting forces

- The force of gravity,  $F_{\text{E on obj}}$ , has an equation for it which predicts the correct magnitude (it's always  $mg$  here on Earth).
- Normal force, Tension and Static friction are all self-adjusting forces: ***there are no equations for these!!***
- **Normal force** is whatever is needed to keep the object from crashing through the surface.
- **Tension** is whatever is needed to keep the string or rope from breaking.
- **Static friction** is whatever is needed to keep the object from slipping along the surface.
- In all these cases, you must draw a free-body diagram and figure out by using equilibrium and Newton's 2<sup>nd</sup> law what the needed force is.

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Poll Question

Bob stands under a low concrete arch, and presses upwards on it with a force of 100 N. Bob's mass is 82 kg. He is in equilibrium. What is the total **normal force** of the ground on Bob? (Note that  $82 \times 9.8 = 800$ .)

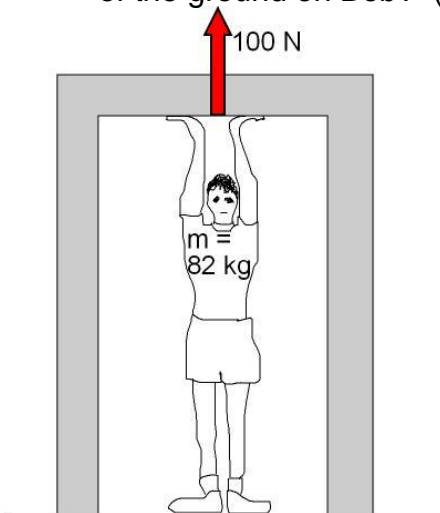


- A. 800 N, upward
- B. 800 N, downward
- C. 900 N, upward
- D. 700 N, upward
- E. 900 N, downward

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Poll Question

Bob stands under a low concrete arch, and presses upwards on it with a force of 100 N. Bob's mass is 82 kg. He is in equilibrium. What is the total **normal force** of the ground on Bob? (Note that  $82 \times 9.8 = 800$ .)



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## Fictitious Forces and Airbags

- If you are riding in a car that makes a sudden stop, you may feel as if a force “throws” you **forward** toward the windshield.

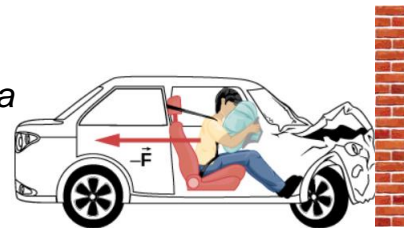


- There really is no such force!
- The real force is the backwards force of the dashboard on you when you hit it.

- Some books (not Etkina) describe the experience in terms of what are called **fictitious forces**.

- These are not real, but they help describe motion *in a noninertial reference frame*.

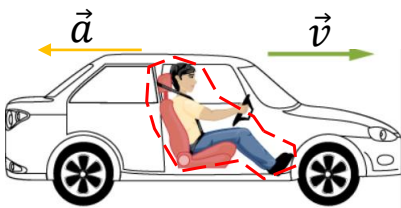
- Etkina avoids fictitious forces by doing all the calculations in inertial frames (better).



- In this case, the forces on the passenger are **backward**.

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- Using the inertial reference frame of the Earth, this is how we draw the force diagram in this course.
- Note there are no forward forces on the passenger.
- The airbag will push backward on the passenger.

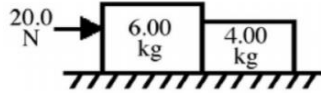


- Define “system” = passenger (also the driver in this case)
- Speed is decreasing
- Acceleration is in opposite direction of velocity.

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A 6.00-kg block is in contact with a 4.00-kg block on a horizontal frictionless surface as shown in the figure. The 6.00-kg block is being pushed by a horizontal 20.0-N force as shown. What is the magnitude of the force that the 4.00-kg block exerts on the 6.00-kg block?

- A. 4.00 N
- B. 6.00 N
- C. 8.00 N
- D. 10.0 N
- E. 20.0 N



REPRESENT MATHEMATICALLY

SKETCH & TRANSLATE.

SOLVE & EVALUATE

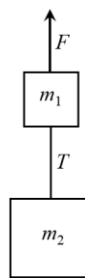
SIMPLIFY & DIAGRAM

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Two masses,  $m_1$  and  $m_2$ , are joined by a string. An upward pulling force of magnitude  $F$  is applied directly to  $m_1$ . As a result, both blocks accelerate upward with acceleration magnitude  $a$ . While accelerating, the tension in the string has a magnitude of  $T$ . If  $F = 36 \text{ N}$ ,  $a = 2.2 \text{ m/s}^2$ , and  $T = 24 \text{ N}$ , what mass of  $m_1$ ?

- A. 1.0 kg
- B. 1.5 kg
- C. 2.0 kg
- D. 2.5 kg
- E. 3.0 kg

SKETCH & TRANSLATE.



REPRESENT MATHEMATICALLY

SIMPLIFY & DIAGRAM

SOLVE & EVALUATE

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## Midterms in Non-Global Pandemic Times

- Midterm Assessments in this course are normally done in person, on paper.
- We book huge rooms in the Exam Centre at 255 McCaul St. It's quiet for 2 hours.
- Calculators and one aid-sheet are allowed.
- Phones and backpacks must be stored at the edges of the room.
- Many invigilators circulate in the room.
- Every student must show photo-ID to an invigilator and sign a signature sheet.



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## Fall 2020 (during COVID-19 pandemic) Midterm Assessment #1

- Each online half-hour assessment is worth between 10 and 12.5% of your mark in this course.
- The lowest of five assessment scores will be dropped.
- The assessment will become available on Quercus to start at 8:10pm tomorrow evening, Toronto time (ie 32 hours from right now)
- If you are registered for the alternate sitting, then you do the whole thing exactly 2 hours later.
- If you miss the assessment, you get a zero.

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Fall 2020 (during COVID-19 pandemic)  
Midterm Assessment #1

- The assessment is "open book"; allowed aids include the course notes, videos, and google-searches for static web-pages.
- You must work on the assessment **individually**.
- No group work or chats with other students are allowed during the assessment.

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Fall 2020 (during COVID-19 pandemic)  
Midterm Assessment #1

- Once you start there will be a 30-minute timer
- The assessment ends when your personal 30-minute timer elapses, or 8:45pm, whichever comes *first*.
- You will see one question at a time, in a random order.
- You must submit each answer by clicking **Next** in order to see the next question; you will **not** have the ability to go back change any answer after it has been submitted.
- After completing all 10 questions you must click **Submit Quiz** before the time has ended.

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## Fall 2020 (during COVID-19 pandemic) Midterm Assessment #1

- There are 3 conceptual questions and 7 numerical questions.
- You **will** need a calculator, or Excel or something to do these. You should have pencil and paper ready for rough work.
- All questions are Multiple Choice, marked automatically.
- The average time per question is 3 minutes, but numerical questions will likely take longer than conceptual, so do not linger long on the conceptual questions.
- Material will cover mostly questions and problems from Chapters 2 and 3 from Etkina. Chapter 1 is also important, but not heavily emphasized in this assessment.

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## Before Class 9 on Wednesday

- On Wednesday we go into: A 2D coordinate system with x and y axes and the text "2D" in the center.
- Please read:
- 4.1 Two-Dimensional Vectors, Force Vector Components
- 4.2 Newton's Second Law in 2D
- Something to think about:
- “If you are driving at a constant speed around a large, circular track, are you accelerating?”

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