# Quest Chapter 05

| # | Problem | Hint |
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| 1 | (part 1 of 3)<br>You are driving a car down a straight road at a constant 54 miles per hour.<br>Consider the following forces:<br>I) air drag pushing back on the car;<br>II) gravity pulling down on the car;<br>III) the ground pushing up on the car;<br>IV) friction pushing the wheels (and the car) forward; and<br>V) friction pushing the wheels (and the car) back.<br>Which force(s) act on the car?<br>1. I and II<br>2. I, II and III<br>3. II, III and IV<br>4. I, III and V<br>5. I, II, III and IV | Is the car is in equilibrium?<br><br>Where will the forces act?<br><br>Draw a diagram and label the forces. |
| 2 | (part 2 of 3)<br>Is there a net or unbalanced force acting on the car?<br>1. No; the speed is constant.<br>2. Yes; a net force in the vertical direction.<br>3. Yes; a net force in the horizontal direction.<br>4. Cannot be determined<br>5. No; the velocity is constant. | What are the conditions of car in problem 2?<br><br>Check the definition of net/unbalanced forces. Then choose carefully. |
| 3 | (part 3 of 3)<br>After a while, the car started to go around a long bend, still maintaining its constant speed of 55 miles per hour.<br>Is there a net (unbalanced) force acting on the car?<br>1. No; the velocity of the car does not change.<br>2. Yes; its direction is not the same as the velocity.<br>3. Cannot be determined<br>4. Yes; its direction is the same as the velocity.<br>5. No; the speed of the car does not change. | What happens when the car turns?<br><br>What is changing?<br><br>Is equilibrium maintained? |
| 4 | Two 30 N forces and a 60 N force act on a hanging box as shown.<br>Will the box experience acceleration?<br>1. No; it is balanced.<br>2. Yes; upward.<br>3. Unable to determine without the angle.<br>4. Yes; downward. | Analyze the FBD (free body diagram).<br><br>Will the components of the 30N forces balance the other force? |

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| 5 | An astronaut tosses a rock on the moon. What force(s) act on the the rock during its curved path?<br>1. air push<br>2. All are wrong.<br>3. gravitation force<br>4. air drag<br>5. friction force | Where is the rock being thrown?<br><br>Is there gravity there?<br><br>Draw the FBD and label the forces. |
| 6 | What force pushes up on you when you jump vertically off the ground?<br>1. The ground pushes up on you.<br>2. The force of air drag<br>3. The force of gravitation<br>4. Your feet push up on your body.<br>5. All are wrong. | Draw a FBD for you in this problem.<br><br>Before you jump, are you in equilibrium?<br><br>What direction must a force be applied to you if you jump vertically?<br><br>What must do the pushing? |
| 7 | Consider a girl standing in an elevator that is accelerating upward. The upward normal force N exerted by the elevator on the girl is<br>1. identical to<br>2. larger than<br>3. smaller than the downward weight W of the girl. | Draw the FBD.<br><br>Is she in equilibrium?<br><br>What is the direction of the acceleration?<br><br>Which force vector should be bigger? |
| 8 | Consider a person of weight W standing in an elevator that is accelerating downward. An upward force N is exerted by the elevator floor on the person.<br>The relationship between N and W is<br>1. N < W.<br>2. N > W.<br>3. N = W.<br>4. More information is needed. | Draw the FBD.<br>Is the person in equilibrium?<br><br>What is the direction of the acceleration?<br><br>Which force vector should be bigger? |

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| 9 | Which one of the follow expressions is one of Newton's Law?<br>1. F = ma<br>2. F = mb<br>3. F = my<br>4. F = mz<br>5. F = mc<br>6. F = mx | Did you take notes? |
| 10 | Two identical spring-loaded dart guns are simultaneously fired straight forward. One fires a regular dart; the other a weighted dart. Which dart goes farther?<br>1. The weighted dart.<br>2. The regular dart.<br>3. It's a tie. | Assume the forces on the darts are equal.<br><br>Use the Second Law.<br><br>How will the difference in the masses affect the acceleration of the darts?<br><br>How will that affect the distance? |
| 11 | Five 20 N forces act on a 2 kg object as shown.<br>What is the acceleration of the object? | Look at the FBD in the problem.<br><br>Do any of the forces cancel each other?<br><br>What remains?<br><br>Use the Second Law to determine the acceleration. |
| 12 | What is the acceleration of a 66 kg block of cement when pulled sideways with a net force of 586 N? | Use the Second Law.<br><br>Substitute and solve. |
| 13 | If a mass of 1 kg is accelerated 1 $m/s^2$ by a force of 1 N, what would be the acceleration of a 32 kg mass acted on by a force of 32 N? | Use the Second Law.<br><br>Substitute and solve. |

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| 14 | Before going into orbit, an astronaut has a mass of 55 kg. When in orbit, a measurement determines that a force of 73.7 N causes her to move with an acceleration of 1.1 $m/s^2$. To regain her original weight, should she go on a diet or start eating more candy? To answer this, find her mass in orbit. | Don't be fooled. You may determine whether or not she should lose/gain weight, but you are asked to find her mass in orbit.<br><br>Use the Second Law.<br><br>Substitute and solve. |
| 15 | The net external force on the propeller of a 3.8 kg model airplane is 8.5 N forward. What is the acceleration of the airplane? | Use the Second Law.<br><br>Substitute and solve. |
| 16 | A soccer ball kicked with a force of 12.6 N accelerates at 7.5 $m/s^2$ to the right. What is the mass of the ball? | Use the Second Law.<br><br>Substitute and solve. |
| 17 | What net external force is required to give a 32 kg suitcase an acceleration of 3.8 $m/s^2$ to the right? | Use the Second Law.<br><br>Substitute and solve. |
| 18 | The net external force on a golf cart is 404.5 N north. If the cart has a total mass of 286.9 kg, what is the cart's acceleration? | Use the Second Law.<br><br>Substitute and solve. |
| 19 | What is the greatest acceleration a runner can muster if the friction between her shoes and the pavement is 57% her weight? Assume the acceleration of gravity is 10 $m/s^2$. | Remember: Friction is a function of the normal force between two objects.<br><br>In this case, that would be her weight. |

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| 20 | A bungee jumper feels weightless as she falls toward the Earth.<br>What accounts for her weightless feeling when she fall freely?<br>1. The platform is too high.<br>2. The weightless feeling is because of the lack of a support force that balances gravity.<br>3. The force of gravity disappears when she has jumped off a high platform.<br>4. Her weight becomes less when she has jumped off. | Draw the FBD.<br><br>How does someone "feel" weight?<br><br>Is that represented in the FBD? |
| 21 | The acceleration of gravity is 10 $m/s^2$ .<br>What will be the acceleration of a skydiver when air resistance builds up to 94% of her weight?<br>Assume the acceleration of gravity is 10 $m/s^2$. | What does it mean to say that air resistance builds up to a certain percentage of weight?<br><br>Where would that appear in a FBD?<br><br>If you want to use the Second Law, assume a mass of 1kg. |
| 22 | A box weighing 690 N is pushed along a horizontal floor at constant velocity with a force of 260 N parallel to the floor.<br>What is the coefficient of kinetic friction between the box and the floor? | How does constant velocity affect this problem?<br><br>Draw the FBD.<br><br>What is the equation that defines of the coefficient of kinetic friction?<br><br>Substitute into the equation and solve. |

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| 23 | A crate is pushed horizontally with a force. The acceleration of gravity is 9.8 $m/s^2$. Calculate the acceleration of the crate. Answer in units of $m/s^2$ | Use the definition of the coefficient of kinetic friction to find the friction force that resists motion.<br><br>Find the net force.<br><br>Use the Second Law of Motion to determine the acceleration. |
| 24 | (part 1 of 2)<br>A dock worker loading crates on a ship finds that a 23 kg crate, initially at rest on a horizontal surface, requires a 81 N horizontal force to set it in motion. However, after the crate is in motion, a horizontal force of 58 N is required to keep it moving with a constant speed.<br>The acceleration of gravity is 9.8 $m/s^2$.<br>Find the coefficient of static friction between crate and floor. | Find the weight of the crate.<br><br>What is the equation that defines the coefficient of static friction?<br><br>Substitute and solve. |
| 25 | (part 2 of 2)<br>Find the coefficient of kinetic friction. | Use the definition of coefficient of kinetic friction and repeat. |
| 26 | (part 1 of 2)<br>Hint: Convert centimeters to meters before doing the calculation!<br>A 0.69 kg physics book with dimensions of 32 cm by 17.4 cm is on a table.<br>What force does the book apply to the table? The acceleration of gravity is 9.8 $m/s^2$ .<br>Answer in units of N | What do we call the force the book applies to the table?<br><br>What do you need to calculate that value? |
| 27 | (part 2 of 2)<br>What pressure does the book apply?<br>Answer in units of Pa | What equation defines pressure?<br><br>Substitute and solve. |

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| 28 | Hint: Convert centimeters to meters before doing the calculation!<br>A 25.8 kg woman balances on one heel of a pair of high-heeled shoes.<br>If the heel is circular with radius 0.338 cm, what pressure does she exert on the floor?<br>The acceleration of gravity is 9.8 $m/s^2$.<br>Answer in units of $N/m^2$ | What equation defines pressure?<br><br>What do you need to substitute and solve?<br><br>How do you find the area of the heel? ($A_{circle} = \pi r^2$) |
| 29 | (part 1 of 2)<br>Vector A has x and y components of −20 cm and 3.2 cm, respectively; vector B has x and y components of 2.29 cm and −20 cm, respectively.<br>If A−B +3C = 0, what is the x component of C ?<br>Answer in units of cm | Can you keep your x's and your y's clear? |
| 30 | (part 2 of 2)<br>What is the y component of C ?<br>Answer in units of cm | Can you keep your x's and your y's clear? |
| 31 | Suppose I throw a ball straight up in the air with initial velocity $v_0$.<br>At the ball's highest point, which is true?<br>1. a =/= 0, v = 0<br>2. a =/= 0, v =/= 0<br>3. a = 0, v = 0<br>4. a = 0, v =/= 0 | Note: =/= means "not equal"<br><br>Highest point? Top of curve? Apex? Zenith? |

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| 32 | (part 1 of 2)<br>The speed of an arrow fired from a compound bow is about 15 m/s. An archer sits astride his horse and launches an arrow into the air, elevating the bow at an angle of 51° above the horizontal and 3 m above the ground.<br>The acceleration of gravity is 9.81 $m/s^2$.<br>What is the arrow's range?<br>Assume: The ground is level. Ignore air resistance.<br>Answer in units of m | Projectile Motion? Use Mother and, if needed, Grandmother.<br><br>Remember: $a_g$ should be negative. |
| 33 | (part 2 of 2)<br>What is the height of the projectile?<br>Answer in units of m | Height of the Projectile? (Highest point? Top of curve? Apex? Zenith?)<br><br>At what time is the projectile at his maximum height? Remember, you found total time in part 1.<br><br>Isn't this a hang-time type of problem? Check your notes. |