

# **Answers To Uw Physics 121 Tutorial Homework**

Answers To Uw Physics 121 Tutorial Homework Answers to UW Physics 121 Tutorial Homework A Comprehensive Guide to Mastering Mechanics This comprehensive guide provides detailed solutions to the tutorial homework problems assigned in UW Physics 121 covering a wide range of mechanics concepts Each solution is presented stepbystep emphasizing clear explanations and logical reasoning making it easy for students to understand and apply the concepts to other problems UW Physics 121 Mechanics Tutorial Homework Solutions Kinematics Dynamics Energy Momentum Work Power This document is a valuable resource for students enrolled in UW Physics 121 offering them a clear understanding of the course material and enabling them to confidently tackle their tutorial homework assignments It covers a diverse range of problems encompassing topics like kinematics dynamics work energy and momentum Each solution is meticulously crafted to provide not only the answer but also a thorough explanation highlighting key concepts and problemsolving strategies The goal is to not only provide the correct answer but also to foster a deeper understanding of the underlying physics principles Conclusion The pursuit of knowledge is an ongoing journey and Physics 121 marks an exciting step in your exploration of the physical world While the solutions provided here offer guidance and support remember that true understanding stems from active engagement with the material Dont be afraid to question explore and challenge yourself beyond the textbook The wonders of physics await those who are curious enough to unravel its secrets FAQs 1 Are these solutions guaranteed to be correct While every effort has been made to ensure accuracy errors can

still occur It is always recommended to crosscheck the solutions with your professor or teaching assistants The aim is to provide a comprehensive framework for understanding the concepts not a guaranteed set of answers 2 2 Can I use these solutions to simply copy answers The goal of this guide is not to provide a shortcut to completing homework but to provide a tool for understanding and learning Copying answers without understanding the underlying principles will not aid in your longterm learning Instead use these solutions to actively work through the problems and grasp the concepts 3 What if Im struggling with a concept not covered in the solutions The solutions provided here cover a wide range of topics but may not address every possible question It is highly recommended to attend office hours seek help from your teaching assistants or utilize online resources to further explore the concepts you find challenging 4 Will this guide help me with exams While understanding the concepts covered in the tutorial problems is essential for exam preparation it is not a guarantee of success Exams often include different types of questions that require a deeper understanding of the material Remember to review your class notes practice past exams and actively participate in class discussions to maximize your exam preparation 5 How can I ensure that I truly understand the material beyond just completing the homework The key to understanding physics lies in active engagement Go beyond just solving problems Try to explain the concepts in your own words relate them to realworld examples and consider different scenarios and applications The more you interact with the material the deeper your understanding will become Solutions Problem 1 A car accelerates from rest to a speed of 30 ms in 10 seconds What is the cars acceleration Solution We can use the equation  $a = \frac{v - u}{t}$  Where  $a$  acceleration  $v$  final velocity 30 ms  $u$  initial velocity 0 ms  $t$  time 10 s 3 Substituting these values  $a = \frac{30 - 0}{10} = 3$  ms Therefore the cars acceleration is 3 ms Problem 2 A ball is thrown vertically upward with an initial velocity of 20 ms How high does the ball go Solution At the highest point the balls final velocity will be 0 ms We can use the

equation  $v^2 = u^2 + 2as$  Where  $v$  final velocity  $0 \text{ ms}^{-1}$   $u$  initial velocity  $20 \text{ ms}^{-1}$   $a$  acceleration due to gravity  $98 \text{ ms}^{-2}$   $s$  displacement height Substituting the values  $0 = 20^2 + 2(98)s$  Solving for  $s$  we get  $s = 2.04 \text{ m}$  Therefore the ball goes approximately 2.04 meters high Problem 3 A 10 kg box is pushed across a horizontal surface with a force of 50 N The coefficient of kinetic friction between the box and the surface is 0.2 What is the acceleration of the box Solution First we need to calculate the force of friction  $F_{\text{friction}} = \mu F_{\text{normal}}$  Where  $\mu$  coefficient of kinetic friction 0.2  $F_{\text{normal}}$  normal force equal to the weight of the box  $10 \text{ kg} \times 98 \text{ ms}^{-2} = 980 \text{ N}$  Therefore  $F_{\text{friction}} = 0.2 \times 980 \text{ N} = 196 \text{ N}$  Now we can find the net force acting on the box  $F_{\text{net}} = F_{\text{applied}} - F_{\text{friction}} = 500 \text{ N} - 196 \text{ N} = 304 \text{ N}$  Finally we can use Newton's second law to find the acceleration  $a = F_{\text{net}} / m = 304 \text{ N} / 10 \text{ kg} = 30.4 \text{ ms}^{-2}$  Therefore the acceleration of the box is  $30.4 \text{ ms}^{-2}$  Problem 4 A 2 kg object is moving with a velocity of  $4 \text{ ms}^{-1}$  A constant force of 10 N is applied to the object for 3 seconds What is the final velocity of the object Solution We can use the equation  $v = u + at$  Where  $v$  final velocity  $u$  initial velocity  $4 \text{ ms}^{-1}$   $a$  acceleration  $F/m = 10 \text{ N} / 2 \text{ kg} = 5 \text{ ms}^{-2}$   $t$  time 3 s Substituting the values  $v = 4 + 5(3) = 19 \text{ ms}^{-1}$  Therefore the final velocity of the object is  $19 \text{ ms}^{-1}$  Problem 5 A 5 kg block is released from rest at the top of a frictionless incline that is 10 meters long and makes an angle of 30 degrees with the horizontal What is the speed of the block at the bottom of the incline Solution We can use the conservation of energy principle At the top of the incline the block has potential energy and no kinetic energy At the bottom the potential energy is converted to kinetic energy Potential energy at the top  $PE_{\text{top}} = mgh$  Kinetic energy at the bottom  $KE_{\text{bottom}} = \frac{1}{2}mv^2$  Where  $m$  mass of the block 5 kg  $g$  acceleration due to gravity  $98 \text{ ms}^{-2}$   $h$  height of the incline  $10 \text{ m} \sin 30^\circ = 5 \text{ m}$   $v$  velocity at the bottom Setting  $PE_{\text{top}}$  equal to  $KE_{\text{bottom}}$   $5 mgh = \frac{1}{2}mv^2$  Solving for  $v$   $v = \sqrt{2gh} = \sqrt{2 \times 98 \times 5} = 99 \text{ ms}^{-1}$  Therefore the speed of the block at the bottom of the incline is approximately  $99 \text{ ms}^{-1}$  Problem 6 A 2 kg object is moving with a velocity of  $5 \text{ ms}^{-1}$  A 3 kg object is moving with a velocity of  $2 \text{ ms}^{-1}$  What is the velocity of the center of mass of the system Solution The velocity of the center of mass  $V_{\text{cm}}$  is

given by  $V_{cm} = \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2}$  Where  $m_1$  mass of the first object 2 kg  $v_1$  velocity of the first object 5 ms  $m_2$  mass of the second object 3 kg  $v_2$  velocity of the second object 2 ms Substituting the values  $V_{cm} = \frac{2 \cdot 5 + 3 \cdot 2}{2 + 3} = \frac{10 + 6}{5} = \frac{16}{5} = 3.2$  ms Therefore the velocity of the center of mass of the system is 3.2 ms

Problem 7 A 10 kg object is moving with a constant velocity of 4 ms What is the net force acting on the object Solution Newtons first law states that an object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force Since the object is moving with constant velocity it means there is no net force acting on it Therefore the net force acting on the object is 0 N

Problem 8 A 5 kg object is suspended from a vertical spring The spring stretches 10 cm when the object is attached What is the spring constant of the spring Solution We can use Hookes Law  $F = kx$  6 Where  $F$  force exerted by the spring  $k$  spring constant  $x$  displacement from equilibrium 10 cm 0.1 m The force exerted by the spring is equal to the weight of the object  $F = mg = 5 \text{ kg} \cdot 9.8 \text{ ms}^{-2} = 49 \text{ N}$  Substituting the values in Hookes Law  $49 \text{ N} = k \cdot 0.1 \text{ m}$  Solving for  $k$   $k = \frac{49 \text{ N}}{0.1 \text{ m}} = 490 \text{ Nm}$  Therefore the spring constant of the spring is 490 Nm

Problem 9 A 2 kg object is dropped from a height of 10 meters What is the speed of the object just before it hits the ground Solution We can use the equation  $v^2 = u^2 + 2as$  Where  $v$  final velocity what we want to find  $u$  initial velocity 0 ms  $a$  acceleration due to gravity 9.8 ms  $s$  displacement 10 m Substituting the values  $v^2 = 0^2 + 2 \cdot 9.8 \cdot 10$   $v^2 = 196$   $v = \sqrt{196} = 14$  ms Therefore the speed of the object just before it hits the ground is approximately 14 ms

Problem 10 A 10 kg object is placed on a frictionless surface A constant force of 20 N is applied to the object What is the work done by the force over a distance of 5 meters Solution The work done by a force is given by  $W = Fd \cos \theta$  7 Where  $W$  work done  $F$  force 20 N  $d$  displacement 5 m angle between the force and displacement 0 since the force is applied in the direction of motion Substituting the values  $W = 20 \text{ N} \cdot 5 \text{ m} \cdot \cos 0 = 100 \text{ J}$  Therefore the work done by the force over a distance of 5 meters is 100 Joules

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