

PHY101

AN INTRODUCTION TO PHYSICS

Important mcqs

Lec 1 - Introduction to physics and this course

What is physics?

- a) The study of the natural world
- b) The study of the human body
- c) The study of psychology
- d) The study of economics

Answer: a) The study of the natural world

Which of the following is an area of physics?

- a) Anatomy
- b) Sociology
- c) Mechanics
- d) Geography

Answer: c) Mechanics

Why is studying physics important?

- a) It provides a foundation for many other sciences
- b) It is required for all students
- c) It is an easy subject to learn
- d) It is not important

Answer: a) It provides a foundation for many other sciences

What is the difference between mechanics and thermodynamics?

- a) Mechanics deals with the motion of objects, while thermodynamics is concerned with the interactions between electrically charged particles and magnetic fields.
- b) Mechanics is concerned with the behavior of heat and temperature in systems, while thermodynamics deals with the behavior of subatomic particles.
- c) Mechanics deals with the motion of objects, while thermodynamics is concerned with the behavior of heat and temperature in systems.
- d) Mechanics is concerned with the interactions between electrically charged particles and magnetic fields, while thermodynamics deals with the motion of objects.

Answer: c) Mechanics deals with the motion of objects, while thermodynamics is concerned with the behavior of heat and temperature in systems.

What is thermodynamics?

- a) The study of the behavior of heat and temperature in systems
- b) The study of subatomic particles
- c) The study of the human body
- d) The study of psychology

Answer: a) The study of the behavior of heat and temperature in systems

What is quantum mechanics?

- a) The study of the behavior of subatomic particles and the principles of uncertainty and probability
- b) The study of motion and forces
- c) The study of heat and temperature in systems
- d) The study of the interactions between electrically charged particles and magnetic fields

Answer: a) The study of the behavior of subatomic particles and the principles of uncertainty and probability

What is relativity?

- a) The study of the behavior of heat and temperature in systems
- b) The study of the interactions between electrically charged particles and magnetic fields
- c) The study of objects moving at high speeds or in strong gravitational fields
- d) The study of the behavior of subatomic particles and the principles of uncertainty and probability

Answer: c) The study of objects moving at high speeds or in strong gravitational fields

What is typically covered in an introductory physics course?

- a) Advanced quantum mechanics
- b) Relativity
- c) The laws of motion, energy, and thermodynamics
- d) Electromagnetism

Answer: c) The laws of motion, energy, and thermodynamics

What is a laboratory experiment in a physics course?

- a) A lecture on physics principles
- b) A hands-on experience with physics concepts
- c) A discussion of current research in physics
- d) A problem set on physics concepts

Answer: b) A hands-on experience with physics concepts

What are some resources available to students who are interested in studying physics?

- a) Textbooks, online resources, and academic journals
- b) Fiction novels and movies
- c) Business magazines and newspapers
- d) Art museums and galleries

Answer: a) Textbooks, online resources, and academic journals

Lec 2 - Kinematics – I

Which of the following is a vector quantity?

- A) Distance
- B) Time
- C) Displacement
- D) Speed

Answer: C) Displacement

What is the SI unit of velocity?

- A) Meter per second
- B) Second per meter
- C) Meter
- D) Meter squared

Answer: A) Meter per second

What is the formula for displacement?

- A) $s = vt$
- B) $s = \frac{1}{2} at^2$
- C) $s = v + at$
- D) $s = v_f - v_i$

Answer: D) $s = v_f - v_i$

What is the difference between distance and displacement?

- A) Distance is a vector quantity while displacement is a scalar quantity.
- B) Distance is the change in position of an object while displacement is the total distance covered by the object.
- C) Distance is the total distance covered by an object while displacement is the change in position of the object.
- D) There is no difference between distance and displacement.

Answer: C) Distance is the total distance covered by an object while displacement is the change in position of the object.

Which of the following is true for uniform acceleration?

- A) The velocity of the object changes at a constant rate.
- B) The acceleration of the object changes at a constant rate.
- C) The displacement of the object changes at a constant rate.
- D) The speed of the object changes at a constant rate.

Answer: D) The speed of the object changes at a constant rate.

What is the equation for average velocity?

- A) $v = \Delta t / \Delta s$
- B) $v = \Delta s / \Delta t$
- C) $v = at$
- D) $v = a / t$

Answer: B) $v = \Delta s / \Delta t$

What is the acceleration due to gravity near the surface of the Earth?

- A) 9.8 m/s
- B) 9.8 m/s²
- C) 9.8 m/s³
- D) 9.8 m/s⁻¹

Answer: B) 9.8 m/s²

Which of the following is not a type of motion?

- A) Uniform motion
- B) Circular motion
- C) Oscillatory motion
- D) Static motion

Answer: D) Static motion

What is the equation for average acceleration?

A) $a = \Delta v / \Delta t$

B) $a = \Delta t / \Delta v$

C) $a = v / t$

D) $a = t / v$

Answer: A) $a = \Delta v / \Delta t$

Which of the following is true for an object in free fall?

A) Its acceleration is zero.

B) Its velocity is constant.

C) Its acceleration is due to air resistance.

D) Its acceleration is due to gravity.

Answer: D) Its acceleration is due to gravity.

Lec 3 - Kinematics – II

A car moves in a circular path of radius 100 meters with a constant speed of 10 m/s. What is the magnitude of the centripetal acceleration of the car?

- A. 1 m/s²
- B. 10 m/s²
- C. 100 m/s²
- D. 1000 m/s²

Answer: B. 10 m/s²

A ball is thrown horizontally from the top of a cliff with a speed of 20 m/s. If the cliff is 50 meters high, how far from the base of the cliff will the ball hit the ground?

- A. 100 m
- B. 150 m
- C. 200 m
- D. 250 m

Answer: C. 200 m

A person is standing at the edge of a cliff and throws a ball with a velocity of 30 m/s at an angle of 60 degrees with the horizontal. What is the horizontal component of the velocity of the ball?

- A. 15 m/s
- B. 25 m/s
- C. 30 m/s
- D. 35 m/s

Answer: A. 15 m/s

A car is traveling at a speed of 20 m/s and comes to a complete stop in 5 seconds. What is the magnitude of its acceleration?

- A. 4 m/s²
- B. 5 m/s²
- C. 10 m/s²

D. 20 m/s^2

Answer: C. 10 m/s^2

A ball is thrown vertically upwards with a speed of 20 m/s . What is the maximum height reached by the ball?

A. 20 m

B. 40 m

C. 80 m

D. 160 m

Answer: B. 40 m

A train is moving with a velocity of 40 m/s . If the train accelerates uniformly at 4 m/s^2 for 10 seconds, what is the final velocity of the train?

A. 80 m/s

B. 60 m/s

C. 50 m/s

D. 44 m/s

Answer: B. 60 m/s

A car starts from rest and accelerates uniformly at 5 m/s^2 for 10 seconds. What is the distance traveled by car?

A. 125 m

B. 250 m

C. 500 m

D. 1000 m

Answer: C. 500 m

A stone is thrown from the top of a building with an initial velocity of 20 m/s at an angle of 30 degrees with the horizontal. What is the range of the stone?

A. 20 m

B. 40 m

C. 60 m

D. 80 m

Answer: C. 60 m

A rocket is launched vertically upwards with an initial velocity of 100 m/s. What is the maximum height reached by rocket?

A. 5000 m

B. 10000 m

C. 15000 m

D. 20000 m

Answer: D. 20000 m

A ball is thrown horizontally from the top of a building with a velocity of 10 m/s. If the building is 100 meters high, how far from the base of the building will the ball hit the ground?

A. 10 m

B. 20 m

C. 50 m

D. 100 m

Answer: C. 50 m

Lec 4 - Force and Newton's Laws

Which of the following is Newton's first law of motion?

- a. $F = ma$
- b. Every action has an equal and opposite reaction
- c. An object at rest will remain at rest unless acted upon by an external force
- d. The force of gravity is proportional to the mass of the objects involved.

Answer: c. An object at rest will remain at rest unless acted upon by an external force.

What is the SI unit of force?

- a. Meter (m)
- b. Second (s)
- c. Newton (N)
- d. Kilogram (kg)

Answer: c. Newton (N)

What is the relationship between force and acceleration?

- a. Directly proportional
- b. Inversely proportional
- c. No relationship
- d. Exponential relationship

Answer: a. Directly proportional

What is Newton's second law of motion?

- a. An object at rest will remain at rest unless acted upon by an external force.
- b. For every action, there is an equal and opposite reaction.
- c. The acceleration of an object is directly proportional to the net force acting on the object and inversely proportional to its mass.
- d. The force of gravity is proportional to the mass of the objects involved.

Answer: c. The acceleration of an object is directly proportional to the net force acting on the object and inversely proportional to its mass.

Which of the following is an example of Newton's third law of motion?

- a. A rocket launches into space.
- b. A book resting on a table.
- c. A person walking on the ground.
- d. A ball rolling down a hill.

Answer: c. A person walking on the ground.

What is the difference between weight and mass?

- a. Weight is a measure of the amount of matter in an object, while mass is the force exerted on an object due to gravity.
- b. Weight is a measure of the force exerted on an object due to gravity, while mass is a measure of the amount of matter in an object.
- c. Weight and mass are the same thing.
- d. Weight is a measure of the volume of an object, while mass is a measure of the force exerted on an object.

Answer: b. Weight is a measure of the force exerted on an object due to gravity, while mass is a measure of the amount of matter in an object.

What is the force required to accelerate a 5 kg object at a rate of 10 m/s²?

- a. 0.5 N
- b. 5 N
- c. 10 N
- d. 50 N

Answer: d. 50 N (using the formula $F = ma$, where F is the force, m is the mass, and a is the acceleration)

What is the force of gravity acting on a 50 kg object on Earth?

- a. 9.8 N
- b. 98 N
- c. 500 N

d. 980 N

Answer: d. 980 N (using the formula $F = mg$, where F is the force, m is the mass, and g is the acceleration due to gravity, which is approximately 9.8 m/s^2)

What is the weight of a 100 kg object on the Moon, where the acceleration due to gravity is approximately 1.6 m/s^2 ?

a. 100 N

b. 160 N

c. 1000 N

d. 1600 N

Answer: b. 160 N (using the formula $F = mg$, where F is the weight, m is the mass, and g is the acceleration due to gravity on the Moon)

Lec 5 - Applications of Newton's Laws – I

What external force is used to counteract the motion caused by wind and earthquakes in skyscrapers?

- A) Gravity
- B) Friction
- C) Dampers and braces
- D) Electric fields

Answer: C) Dampers and braces

Which law of motion is relevant in the sport of baseball?

- A) Newton's first law
- B) Newton's second law
- C) Newton's third law
- D) None of the above

Answer: B) Newton's second law

What principle is behind rocket propulsion?

- A) Newton's first law
- B) Newton's second law
- C) Newton's third law
- D) None of the above

Answer: C) Newton's third law

How do jet engines operate based on Newton's third law of motion?

- A) By expelling exhaust gases at low speed in one direction
- B) By expelling exhaust gases at high speed in one direction
- C) By attracting particles towards the engine
- D) By rotating rapidly in the opposite direction

Answer: B) By expelling exhaust gases at high speed in one direction

What is the significance of Newton's laws of motion in daily life?

- A) They have no significance in daily life
- B) They are only relevant for scientists and engineers
- C) They have a wide range of applications in daily life
- D) They are only relevant in outer space

Answer: C) They have a wide range of applications in daily life

What is the law of inertia?

- A) Newton's first law of motion
- B) Newton's second law of motion
- C) Newton's third law of motion
- D) None of the above

Answer: A) Newton's first law of motion

What is the force acting on an object equal to, according to Newton's second law of motion?

- A) Mass divided by acceleration
- B) Acceleration divided by mass
- C) Mass multiplied by acceleration
- D) Velocity multiplied by time

Answer: C) Mass multiplied by acceleration

What external force acts on passengers in a car during a sudden stop?

- A) Friction
- B) Gravity
- C) Seat belts
- D) None of the above

Answer: C) Seat belts

How is Newton's third law relevant in the launch of spacecraft?

- A) The force of gravity propels the spacecraft
- B) The force of the exhaust gases propels the spacecraft
- C) The force of electric fields propels the spacecraft
- D) None of the above

Answer: B) The force of the exhaust gases propels the spacecraft

How do engineers ensure the stability of skyscrapers?

- A) By applying external forces to the building
- B) By increasing the mass of the building
- C) By reducing the height of the building
- D) By making the building wider at the base

Answer: A) By applying external forces to the building

Lec 6 - Applications of Newton's Laws – II

A 10 kg object is placed on a surface with a coefficient of static friction of 0.4. What is the maximum force that can be applied to the object before it begins to move?

- A. 4 N
- B. 40 N
- C. 100 N
- D. 400 N

Answer: B. 40 N

A 2 kg object is accelerating at a rate of 5 m/s^2 . What is the net force acting on the object?

- A. 0.4 N
- B. 2.5 N
- C. 5 N
- D. 10 N

Answer: D. 10 N

A 1000 kg car is traveling at a speed of 20 m/s. If the brakes are applied and the car comes to a stop in 5 seconds, what is the average force exerted on the car by the brakes?

- A. 4000 N
- B. 8000 N
- C. 10000 N
- D. 20000 N

Answer: C. 10000 N

An object with a mass of 5 kg is suspended from the ceiling by a rope. What is the tension in the rope?

- A. 5 N
- B. 9.8 N
- C. 49 N
- D. 50 N

Answer: B. 9.8 N

A 20 kg object is sliding down a frictionless incline with an acceleration of 2 m/s^2 . What is the angle of the incline?

- A. 11.3 degrees
- B. 22.6 degrees
- C. 30 degrees
- D. 45 degrees

Answer: B. 22.6 degrees

A 5 N force is applied to an object with a mass of 2 kg. What is the acceleration of the object?

- A. 0.4 m/s^2
- B. 2.5 m/s^2
- C. 5 m/s^2
- D. 10 m/s^2

Answer: D. 10 m/s^2

An object with a mass of 10 kg is on a surface with a coefficient of kinetic friction of 0.3. If a force of 50 N is applied to the object, what is its acceleration?

- A. 1 m/s^2
- B. 2 m/s^2
- C. 3 m/s^2
- D. 5 m/s^2

Answer: A. 1 m/s^2

A 1 kg object is traveling at a speed of 10 m/s. What force is required to bring the object to a stop in 5 seconds?

- A. 2 N
- B. 10 N
- C. 20 N

D. 50 N

Answer: C. 20 N

An object with a mass of 2 kg is pushed with a force of 10 N. What is the acceleration of the object?

A. 2.5 m/s^2

B. 5 m/s^2

C. 10 m/s^2

D. 20 m/s^2

Answer: B. 5 m/s^2

An object with a mass of 10 kg is traveling at a speed of 5 m/s. What force is required to double the object's speed in 5 seconds?

A. 5 N

B. 10 N

C. 25 N

D. 50 N

Answer: D. 50 N

Lec 7 - Work and Energy

Which of the following is a unit of work?

- A) Joule
- B) Watt
- C) Newton
- D) Kilogram

Answer: A) Joule

Which type of energy is possessed by an object at rest?

- A) Kinetic energy
- B) Potential energy
- C) Thermal energy
- D) Electrical energy

Answer: B) Potential energy

What is the work done on an object when a force is applied to it but it does not move?

- A) Positive work
- B) Negative work
- C) Zero work
- D) Cannot be determined

Answer: C) Zero work

A force of 10 N is applied to an object and it moves a distance of 5 m in the direction of the force. What is the work done on the object?

- A) 5 J
- B) 10 J
- C) 20 J
- D) 50 J

Answer: C) 20 J

Which of the following is a non-conservative force?

- A) Gravitational force
- B) Spring force
- C) Frictional force
- D) Electrostatic force

Answer: C) Frictional force

What is the difference between kinetic energy and potential energy?

- A) Kinetic energy depends on the position of the object, while potential energy depends on its motion.
- B) Kinetic energy is the energy possessed by an object due to its motion, while potential energy is the energy possessed by an object due to its position.
- C) Kinetic energy is a conservative force, while potential energy is a non-conservative force.
- D) Kinetic energy and potential energy are the same thing.

Answer: B) Kinetic energy is the energy possessed by an object due to its motion, while potential energy is the energy possessed by an object due to its position.

What is the unit of power?

- A) Joule
- B) Watt
- C) Newton
- D) Kilogram

Answer: B) Watt

What is the law of conservation of energy?

- A) Energy can be created but not destroyed.
- B) Energy can be destroyed but not created.
- C) Energy can neither be created nor destroyed, only transformed from one form to another.
- D) Energy is only conserved in closed systems.

Answer: C) Energy can neither be created nor destroyed, only transformed from one form to another.

A body of mass 2 kg is moving with a velocity of 5 m/s. What is its kinetic energy?

A) 12.5 J

B) 25 J

C) 50 J

D) 125 J

Answer: B) 25 J

A force of 20 N is applied to an object which moves a distance of 2 m against a frictional force of 5 N. What is the net work done on the object?

A) 10 J

B) 30 J

C) 40 J

D) 60 J

Answer: B) 30 J

Lec 8 - Momentum

Which of the following is the correct formula for momentum?

- A) $P = mv$
- B) $P = ma$
- C) $P = F_{net}$
- D) $P = KE$

Answer: A

A 5 kg object is moving with a velocity of 10 m/s. What is its momentum?

- A) 10 kg m/s
- B) 20 kg m/s
- C) 50 kg m/s
- D) 100 kg m/s

Answer: B

What is the unit of momentum?

- A) kg
- B) m/s
- C) N
- D) kg m/s

Answer: D

Which of the following is an example of an inelastic collision?

- A) Two pool balls colliding and bouncing off each other
- B) A ball being dropped from a height and bouncing back up
- C) A car colliding with a wall and coming to a stop
- D) A rocket accelerating in space

Answer: C

If the net force acting on an object is zero, what happens to its momentum?

- A) It increases
- B) It decreases
- C) It remains constant
- D) It becomes negative

Answer: C

According to the law of conservation of momentum, in a closed system, what happens to the total momentum before and after a collision?

- A) It decreases
- B) It increases
- C) It remains constant
- D) It becomes negative

Answer: C

Which of the following is an example of an isolated system?

- A) A moving car
- B) A tennis ball being hit by a racquet
- C) A rocket launching into space
- D) A stationary block on a table

Answer: D

What is the relationship between impulse and momentum?

- A) Impulse is equal to the change in momentum
- B) Impulse is equal to the initial momentum
- C) Impulse is equal to the final momentum
- D) Impulse is not related to momentum

Answer: A

What is the difference between elastic and inelastic collisions?

- A) Elastic collisions conserve kinetic energy, while inelastic collisions do not
- B) Elastic collisions result in objects sticking together, while inelastic collisions result in objects bouncing off each other
- C) Elastic collisions result in a change in momentum, while inelastic collisions do not
- D) Elastic collisions are only possible in space, while inelastic collisions occur on Earth

Answer: A

Two objects with masses of 2 kg and 4 kg, respectively, are moving towards each other with velocities of 3 m/s and -2 m/s. What is the total momentum of the system?

- A) 2 kg m/s
- B) -2 kg m/s
- C) 6 kg m/s
- D) -6 kg m/s

Answer: B

Lec 9 - Collisions

Which of the following is a type of collision?

- a) Elastic collision
- b) Inelastic collision
- c) Both A and B
- d) None of the above

Answer: c) Both A and B

In an elastic collision, which of the following is conserved?

- a) Momentum
- b) Kinetic energy
- c) Both A and B
- d) None of the above

Answer: c) Both A and B

In an inelastic collision, which of the following is conserved?

- a) Momentum
- b) Kinetic energy
- c) Both A and B
- d) None of the above

Answer: a) Momentum

Which of the following statements is true regarding an elastic collision?

- a) The objects stick together after the collision.
- b) The kinetic energy is conserved.
- c) The momentum is conserved.
- d) None of the above

Answer: c) The momentum is conserved.

Which of the following statements is true regarding an inelastic collision?

- a) The objects stick together after the collision.
- b) The kinetic energy is conserved.
- c) The momentum is conserved.
- d) None of the above

Answer: a) The objects stick together after the collision.

Which of the following is an example of an inelastic collision?

- a) A ball bouncing off a wall
- b) A car hitting a wall and crumpling
- c) A satellite orbiting the Earth
- d) None of the above

Answer: b) A car hitting a wall and crumpling

Which of the following is an example of an elastic collision?

- a) A ball bouncing off a wall
- b) A car hitting a wall and crumpling
- c) A satellite orbiting the Earth
- d) None of the above

Answer: a) A ball bouncing off a wall

Which of the following is an example of a completely inelastic collision?

- a) A ball bouncing off a wall
- b) A car hitting a wall and crumpling
- c) A satellite orbiting the Earth
- d) None of the above

Answer: b) A car hitting a wall and crumpling

Which of the following is an example of a perfectly elastic collision?

- a) A ball bouncing off a wall
- b) A car hitting a wall and crumpling
- c) A satellite orbiting the Earth
- d) None of the above

Answer: a) A ball bouncing off a wall

Which of the following statements is true regarding the conservation of momentum in a collision?

- a) The total momentum of the system is always conserved.
- b) The momentum of each object in the system is conserved.
- c) Both A and B
- d) None of the above

Answer: a) The total momentum of the system is always conserved.

Lec 10 - Rotational Kinematics

A disk of radius 0.5 m is rotating with a constant angular velocity of 10 rad/s. What is the linear speed of a point on the circumference of the disk?

- A) 5 m/s
- B) 10 m/s
- C) 15 m/s
- D) 20 m/s

Answer: C) 15 m/s

A solid sphere is rolling down an incline without slipping. What is the ratio of the translational kinetic energy to the rotational kinetic energy?

- A) 1:1
- B) 3:2
- C) 2:3
- D) 5:7

Answer: C) 2:3

A 1 kg mass is attached to a rod of length 0.5 m and is rotated in a horizontal plane about one end of the rod. If the angular velocity of the mass is 4 rad/s, what is the centripetal force acting on the mass?

- A) 4 N
- B) 8 N
- C) 12 N
- D) 16 N

Answer: B) 8 N

A point on the rim of a wheel of radius 0.4 m moves through an angle of 60 degrees. What is the distance travelled by the point?

- A) 0.14 m
- B) 0.24 m
- C) 0.40 m

D) 0.80 m

Answer: B) 0.24 m

A solid cylinder of mass 2 kg and radius 0.5 m is rolling without slipping with a linear velocity of 10 m/s. What is the angular velocity of the cylinder?

A) 4 rad/s

B) 8 rad/s

C) 10 rad/s

D) 20 rad/s

Answer: A) 4 rad/s

A torque of 10 Nm is applied to a wheel of moment of inertia 4 kg m^2 . What is the angular acceleration of the wheel?

A) 2.5 rad/s^2

B) 4 rad/s^2

C) 6 rad/s^2

D) 8 rad/s^2

Answer: B) 4 rad/s^2

A uniform rod of length 2 m and mass 1 kg is pivoted at one end and allowed to fall under gravity. What is the angular acceleration of the rod when it makes an angle of 45 degrees with the vertical?

A) 1.5 rad/s^2

B) 2.5 rad/s^2

C) 3.5 rad/s^2

D) 4.5 rad/s^2

Answer: B) 2.5 rad/s^2

A solid sphere of radius 0.3 m and mass 5 kg is rotating about its diameter with an angular velocity of 6 rad/s. What is the kinetic energy of the sphere?

A) 54 J

B) 108 J

C) 162 J

D) 216 J

Answer: B) 108 J

A thin hoop of mass 2 kg and radius 0.5 m is rolling down an incline without slipping. What is the velocity of the hoop when it reaches the bottom of the incline?

A) 3.3 m/s

B) 6.6 m/s

C) 9.9 m/s

D) 13.2 m/s

Answer: A) 3.3 m/s

A flywheel of moment of inertia 5 kg m^2 is rotating about its axis with an angular velocity of 10 rad

Lec 11 - Conservation of Energy

What is the law of conservation of energy?

Answer: The law of conservation of energy states that energy cannot be created or destroyed, only transferred or transformed from one form to another.

Explain the difference between kinetic and potential energy.

Answer: Kinetic energy is the energy possessed by a moving object while potential energy is the energy possessed by an object due to its position or configuration.

Can energy be completely conserved in a real-world situation?

Answer: Energy cannot be completely conserved in a real-world situation due to the presence of various energy losses such as friction, air resistance, and heat.

What is the principle of work-energy theorem?

Answer: The principle of the work-energy theorem states that the net work done on an object is equal to the change in its kinetic energy.

What is elastic potential energy?

Answer: Elastic potential energy is the potential energy stored in an elastic material when it is stretched or compressed.

Give an example of a non-conservative force.

Answer: Friction is an example of a non-conservative force as it dissipates energy in the form of heat and sound.

Why is mechanical energy conserved in an isolated system?

Answer: Mechanical energy is conserved in an isolated system because no external work is done on the system, and there are no energy losses due to non-conservative forces.

What is the relationship between potential energy and conservative forces?

Answer: Potential energy is associated with conservative forces as they depend on the position or configuration of an object in a force field.

Can the total energy of a system be negative?

Answer: No, the total energy of a system cannot be negative as energy is always a positive quantity.

How can the conservation of energy be applied to solve real-world problems?

Answer: Conservation of energy can be used to analyze and solve real-world problems involving energy transfer and transformation. By applying the principle of conservation of energy, one can determine the initial and final energies of a system and calculate the work done or energy transferred in a given process.

Lec 12 - Physics of Many Particles

Which of the following is an example of a system of many particles?

- a) A single atom
- b) A bowling ball
- c) A gas in a container
- d) A photon

Answer: c) A gas in a container

What is the name for the force that acts between particles that have an electric charge?

- a) Gravitational force
- b) Electromagnetic force
- c) Strong nuclear force
- d) Weak nuclear force

Answer: b) Electromagnetic force

What is the name for the property of a material that describes how easy it is to bend or deform?

- a) Density
- b) Elasticity
- c) Hardness
- d) Brittleness

Answer: b) Elasticity

Which of the following is an example of a non-conservative force?

- a) Gravity
- b) Elastic force
- c) Friction
- d) Electrostatic force

Answer: c) Friction

What is the name for the quantity that describes how much matter is in a given space?

- a) Volume
- b) Density
- c) Mass
- d) Weight

Answer: b) Density

What is the name for the force that acts between particles that have mass?

- a) Gravitational force
- b) Electromagnetic force
- c) Strong nuclear force
- d) Weak nuclear force

Answer: a) Gravitational force

What is the name for the property of a material that describes how much it can be compressed or squeezed?

- a) Density
- b) Elasticity
- c) Hardness
- d) Compressibility

Answer: d) Compressibility

Which of the following is an example of a conservative force?

- a) Gravity
- b) Elastic force
- c) Friction
- d) Electrostatic force

Answer: a) Gravity

What is the name for the property of a material that describes how much it resists being pulled apart?

- a) Density
- b) Elasticity
- c) Hardness
- d) Tensile strength

Answer: d) Tensile strength

What is the name for the quantity that describes the amount of matter in an object?

- a) Volume
- b) Density
- c) Mass
- d) Weight

Answer: c) Mass

Lec 13 - Angular Momentum

Which of the following statements is true about angular momentum?

- A. It is a scalar quantity.
- B. It is a vector quantity.
- C. It is a measure of an object's rotational inertia.
- D. It is the product of an object's mass and velocity.

Answer: B. It is a vector quantity.

Which of the following is an example of conservation of angular momentum?

- A. A spinning top eventually comes to a stop.
- B. A figure skater spins faster when she pulls her arms in.
- C. A car's wheels stop rotating when the brakes are applied.
- D. A basketball player's shot is affected by the spin he puts on the ball.

Answer: B. A figure skater spins faster when she pulls her arms in.

Which of the following statements is true about the direction of angular momentum?

- A. It is always perpendicular to the plane of rotation.
- B. It is always in the same direction as the angular velocity.
- C. It can be in any direction relative to the plane of rotation.
- D. It depends on the direction of the applied torque.

Answer: C. It can be in any direction relative to the plane of rotation.

Which of the following is a unit of angular momentum?

- A. meters per second
- B. newtons
- C. joules
- D. kilograms meters squared per second

Answer: D. kilograms meters squared per second

Which of the following is an example of a system with no net angular momentum?

- A. A spinning top
- B. The Earth revolving around the Sun
- C. A bicycle wheel in motion
- D. A figure skater spinning on one leg

Answer: B. The Earth revolves around the Sun

Which of the following is an example of an object with zero angular momentum?

- A. A planet orbiting the Sun
- B. A ball rolling down a hill
- C. A spinning top
- D. A car driving on a straight road

Answer: D. A car driving on a straight road

Which of the following statements is true about the conservation of angular momentum?

- A. It is only conserved in isolated systems.
- B. It is always conserved in any system.
- C. It is only conserved in systems with no external torques.
- D. It is not a conserved quantity.

Answer: B. It is always conserved in any system.

Which of the following is an example of a system with changing angular momentum?

- A. A satellite in circular orbit around the Earth
- B. A pendulum swinging back and forth
- C. A ball bouncing off a wall
- D. A figure skater spinning at a constant rate

Answer: C. A ball bouncing off a wall

Which of the following statements is true about the moment of inertia?

- A. It is a measure of an object's mass.
- B. It is a measure of an object's resistance to rotational motion.
- C. It is the same for all objects.
- D. It is always equal to the object's radius.

Answer: B. It is a measure of an object's resistance to rotational motion.

Which of the following is an example of an object with high moment of inertia?

- A. A thin hoop
- B. A thin rod
- C. A solid sphere
- D. A hollow sphere

Answer: D. A hollow sphere

Lec 14 - Equilibrium of Rigid Bodies

Which of the following is not a condition for a rigid body to be in equilibrium?

- A) The net force acting on the body is zero
- B) The net torque acting on the body is zero
- C) The center of mass of the body is at rest
- D) The body is not rotating

Answer: D) The body is not rotating

A uniform rod of length 2 meters is balanced horizontally at its midpoint. What is the net torque acting on the rod?

- A) Zero
- B) mg
- C) $2mg$
- D) $4mg$

Answer: A) Zero

A ladder is leaning against a wall. Which of the following forces contribute to the torque acting on the ladder?

- A) The force of gravity on the ladder
- B) The force of the wall pushing back on the ladder
- C) The normal force acting on the ladder
- D) Both A and B

Answer: D) Both A and B

Two forces of equal magnitude and opposite direction act on a rigid body. What is the net torque acting on the body?

- A) Zero

- B) Equal to the magnitude of the forces
- C) Double the magnitude of the forces
- D) Cannot be determined without knowing the distance between the forces

Answer: A) Zero

What is the relationship between torque and moment arm?

- A) Torque is proportional to moment arm
- B) Torque is inversely proportional to moment arm
- C) Torque is equal to moment arm squared
- D) Torque is equal to moment arm cubed

Answer: A) Torque is proportional to the moment arm

A force of 10 N is applied to a wrench with a moment arm of 0.1 meters. What is the torque produced by the force?

- A) 0.1 Nm
- B) 1 Nm
- C) 10 Nm
- D) 100 Nm

Answer: B) 1 Nm

An object is in rotational equilibrium if:

- A) The net force acting on it is zero
- B) The net torque acting on it is zero
- C) The object is at rest
- D) The object is not rotating

Answer: B) The net torque acting on it is zero

An object is in translational equilibrium if:

- A) The net force acting on it is zero
- B) The net torque acting on it is zero
- C) The object is at rest
- D) The object is not rotating

Answer: A) The net force acting on it is zero

A person is holding a weight in one hand. Which of the following forces is producing torque?

- A) The force of gravity on the weight
- B) The force of the person's hand on the weight
- C) The normal force acting on the weight
- D) Both A and B

Answer: B) The force of the person's hand on the weight

Which of the following is a condition for rotational equilibrium?

- A) The net force acting on the object is zero
- B) The object is at rest
- C) The net torque acting on the object is zero
- D) The object is not rotating

Answer: C) The net torque acting on the object is zero

Lec 15 - Oscillations – I

Which of the following is a necessary condition for simple harmonic motion?

- A) Force is directly proportional to velocity
- B) Acceleration is directly proportional to position
- C) Velocity is directly proportional to position
- D) Acceleration is directly proportional to velocity

Answer: B) Acceleration is directly proportional to the position

Which of the following is true for the displacement of a simple harmonic oscillator?

- A) It is directly proportional to the velocity of the oscillator.
- B) It is directly proportional to the acceleration of the oscillator.
- C) It is proportional to the square of the velocity of the oscillator.
- D) It is proportional to the square of the acceleration of the oscillator.

Answer: B) It is directly proportional to the acceleration of the oscillator.

A simple pendulum oscillates with a period T . If the length of the pendulum is doubled, what is the new period of oscillation?

- A) $T/2$
- B) T
- C) $2T$
- D) $4T$

Answer: C) $2T$

The restoring force in a simple harmonic oscillator is given by $F = -kx$, where x is the displacement from equilibrium and k is the spring constant. What is the period of oscillation?

- A) $T = 2\pi/k$
- B) $T = \pi/k$
- C) $T = 2\pi\sqrt{m/k}$
- D) $T = \pi\sqrt{m/k}$

Answer: D) $T = \sqrt{m/k}$

Which of the following quantities remains constant in simple harmonic motion?

- A) Amplitude
- B) Frequency
- C) Phase
- D) Energy

Answer: D) Energy

A mass attached to a spring oscillates with a period of 2 seconds. What is the frequency of oscillation?

- A) 1 Hz
- B) 0.5 Hz
- C) 2 Hz
- D) 4 Hz

Answer: A) 1 Hz

The amplitude of a simple harmonic oscillator is 0.2 m and its period is 5 seconds. What is the maximum velocity of the oscillator?

- A) 0.04 m/s
- B) 0.2 m/s
- C) 0.4 m/s
- D) 1 m/s

Answer: C) 0.4 m/s

The motion of a particle is described by the equation $x = 3\cos(2\pi t)$ where x is the displacement from equilibrium and t is time. What is the frequency of oscillation?

- A) 1 Hz
- B) 2 Hz
- C) 3 Hz
- D) 4 Hz

Answer: B) 2 Hz

The kinetic energy of a simple harmonic oscillator is maximum when the displacement is:

- A) At the equilibrium position
- B) At the maximum displacement from the equilibrium
- C) At the minimum displacement from equilibrium
- D) The kinetic energy is the same at all points

Answer: A) At the equilibrium position

The period of a simple pendulum of length L and mass m is given by $T = 2\pi\sqrt{L/g}$, where g is the acceleration due to gravity. If the length of the pendulum is doubled, what is the new period of oscillation?

- A) T
- B) $2T$
- C) $T/2$
- D) $4T$

Answer: B) $2T$

Lec 16 - Oscillations – II

What happens to the amplitude of damped oscillations over time?

- a) It increases
- b) It remains constant
- c) It decreases
- d) It oscillates

Answer: c) It decreases

What is resonance in forced oscillations?

- a) The amplitude of oscillation decreases
- b) The frequency of the external force is lower than the natural frequency of the oscillator
- c) The frequency of the external force is equal to the natural frequency of the oscillator
- d) The frequency of the external force is higher than the natural frequency of the oscillator

Answer: c) The frequency of the external force is equal to the natural frequency of the oscillator

What is the equation that describes damped oscillations?

- a) The harmonic oscillator equation
- b) The damped harmonic oscillator equation
- c) The forced harmonic oscillator equation
- d) The coupled harmonic oscillator equation

Answer: b) The damped harmonic oscillator equation

What are forced oscillations?

- a) Oscillations that occur naturally in a system
- b) Oscillations that are affected by external forces
- c) Oscillations that are damped over time
- d) Oscillations that are coupled to other oscillators

Answer: b) Oscillations that are affected by external forces

What is the equation that describes coupled oscillations?

- a) The harmonic oscillator equation
- b) The damped harmonic oscillator equation
- c) The forced harmonic oscillator equation
- d) The coupled harmonic oscillator equation

Answer: d) The coupled harmonic oscillator equation

What is synchronized behavior in coupled oscillations?

- a) The oscillators all oscillate with the same frequency and phase
- b) The oscillators oscillate with different frequencies and phases
- c) The oscillators all come to rest
- d) The oscillators oscillate with increasing amplitudes over time

Answer: a) The oscillators all oscillate with the same frequency and phase

What happens to the period of a damped oscillator over time?

- a) It increases
- b) It remains constant
- c) It decreases
- d) It oscillates

Answer: a) It increases

What is beating in coupled oscillations?

- a) The amplitude of oscillation decreases
- b) The amplitude of oscillation increases
- c) The frequency of the oscillation decreases
- d) The amplitude of oscillation varies periodically

Answer: d) The amplitude of oscillation varies periodically

What causes damping in oscillations?

- a) An external periodic force
- b) Friction or air resistance
- c) Resonance
- d) Coupling to other oscillators

Answer: b) Friction or air resistance

What is the behavior of a forced oscillator when the frequency of the external force is much higher than the natural frequency of the oscillator?

- a) The amplitude of the oscillation is very large
- b) The amplitude of the oscillation is very small
- c) The oscillator does not oscillate
- d) The behavior of the oscillator depends on the amplitude of the external force

Answer: b) The amplitude of the oscillation is very small

Lec 17 - Physics of Materials

Which of the following materials has the highest thermal conductivity?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: c) Metals

Which of the following materials is most commonly used in electronic devices?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: c) Metals

What is the key property of ceramics that makes them useful for high-temperature applications?

- a) High electrical conductivity
- b) High thermal conductivity
- c) High melting point
- d) High ductility

Answer: c) High melting point

Which of the following materials is known for its flexibility and good insulating properties?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: a) Polymers

What is X-ray diffraction used for in materials science?

- a) Studying the mechanical properties of materials
- b) Studying the thermal properties of materials
- c) Studying the atomic and molecular structure of materials
- d) None of the above

Answer: c) Studying the atomic and molecular structure of materials

Which of the following is not a key mechanical property of materials?

- a) Tensile strength
- b) Thermal conductivity
- c) Hardness
- d) Elastic modulus

Answer: b) Thermal conductivity

Which of the following materials is used in the aerospace industry due to its high strength and light weight?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: c) Metals

Which of the following materials has the highest dielectric constant?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: b) Ceramics

What is the role of specific heat in materials science?

- a) It determines how easily a material can be melted.
- b) It determines how easily a material can conduct electricity.
- c) It determines how easily a material can be heated or cooled.
- d) None of the above

Answer: c) It determines how easily a material can be heated or cooled.

Which of the following materials is known for its hardness and resistance to wear?

- a) Polymers
- b) Ceramics
- c) Metals
- d) None of the above

Answer: b) Ceramics

Lec 18 - Physics of Fluids

What is the relationship between pressure and velocity in a fluid, according to Bernoulli's principle?

- A. Pressure and velocity are directly proportional
- B. Pressure and velocity are inversely proportional
- C. Pressure and velocity are not related
- D. None of the above

Answer: B. Pressure and velocity are inversely proportional

What is the unit of viscosity?

- A. kg/m^3
- B. m/s^2
- C. $\text{Pa}\cdot\text{s}$
- D. J/kg

Answer: C. $\text{Pa}\cdot\text{s}$

What is the term for the force per unit area acting on a surface in contact with a fluid?

- A. Buoyancy
- B. Pressure
- C. Surface tension
- D. Viscosity

Answer: B. Pressure

Which type of fluid flow occurs when the fluid moves in a straight line at a constant velocity?

- A. Laminar flow
- B. Turbulent flow
- C. Transitional flow
- D. Viscous flow

Answer: A. Laminar flow

What is the term for the ratio of a fluid's density to its viscosity?

- A. Mach number
- B. Reynolds number
- C. Weber number
- D. Froude number

Answer: B. Reynolds number

What is the term for the point in a fluid flow where the velocity is at its maximum and the pressure is at its minimum?

- A. Stagnation point
- B. Separation point
- C. Vortex point
- D. Turbulent point

Answer: A. Stagnation point

Which principle states that the total pressure in a fluid flow system is constant?

- A. Pascal's principle
- B. Archimedes' principle
- C. Bernoulli's principle
- D. Hooke's principle

Answer: C. Bernoulli's principle

What is the term for the upward force on an object submerged in a fluid?

- A. Pressure
- B. Buoyancy
- C. Drag
- D. Lift

Answer: B. Buoyancy

What is the term for the resistance of a fluid to flow?

- A. Viscosity
- B. Surface tension
- C. Compressibility
- D. Reynolds number

Answer: A. Viscosity

Which type of fluid flow occurs when the fluid moves in a chaotic and unpredictable manner?

- A. Laminar flow
- B. Turbulent flow
- C. Transitional flow
- D. Viscous flow

Answer: B. Turbulent flow

Lec 20 - Physics of Sound

What type of waves are sound waves?

- A) Transverse waves
- B) Electromagnetic waves
- C) Longitudinal waves
- D) None of the above

Answer: C) Longitudinal waves

Which of the following is not a characteristic of a wave?

- A) Wavelength
- B) Amplitude
- C) Mass
- D) Frequency

Answer: C) Mass

Which of the following waves requires a medium to travel through?

- A) Transverse waves
- B) Electromagnetic waves
- C) Longitudinal waves
- D) All of the above

Answer: C) Longitudinal waves

What is the relationship between frequency and wavelength?

- A) They are inversely proportional
- B) They are directly proportional

- C) There is no relationship between them
- D) It depends on the type of wave

Answer: A) They are inversely proportional

What is the speed of light in a vacuum?

- A) 3×10^8 m/s
- B) 3×10^6 m/s
- C) 3×10^{10} m/s
- D) 3×10^2 m/s

Answer: A) 3×10^8 m/s

Which of the following waves has the highest frequency?

- A) Radio waves
- B) Microwaves
- C) X-rays
- D) Gamma rays

Answer: D) Gamma rays

What is the amplitude of a wave?

- A) The distance between two consecutive crests or troughs
- B) The distance between the highest and lowest points of a wave
- C) The number of waves that pass a point in one second
- D) The time it takes for one wave to pass a point

Answer: B) The distance between the highest and lowest points of a wave

Which of the following is an example of a mechanical wave?

- A) Radio wave
- B) Light wave
- C) Sound wave
- D) X-ray

Answer: C) Sound wave

What is the phenomenon of interference in waves?

- A) When two waves combine to form a larger wave
- B) When a wave bounces off a surface
- C) When a wave changes direction as it passes through a medium
- D) None of the above

Answer: A) When two waves combine to form a larger wave

What is the difference between a standing wave and a traveling wave?

A) A standing

Lec 21 - Wave Motion

What type of waves are sound waves?

- A) Transverse waves
- B) Electromagnetic waves
- C) Longitudinal waves
- D) None of the above

Answer: C) Longitudinal waves

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- B) Amplitude
- C) Mass
- D) Frequency

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- A) When two waves combine to form a larger wave
- B) When a wave bounces off a surface
- C) When a wave changes direction as it passes through a medium
- D) None of the above

Answer: A) When two waves combine to form a larger wave

What is the difference between a standing wave and a traveling wave?

A) A standing

Lec 22 - Gravitation

What is the acceleration due to gravity on the surface of the Earth?

- A) 9.8 m/s^2
- B) 1.6 m/s^2
- C) 6.0 m/s^2
- D) 5.5 m/s^2

Answer: A) 9.8 m/s^2

What is the formula for calculating the gravitational force between two objects?

- A) $F = ma$
- B) $F = G(m_1 + m_2)$
- C) $F = Gm_1m_2/r^2$
- D) $F = mgh$

Answer: C) $F = Gm_1m_2/r^2$

Who discovered the law of gravitation?

- A) Albert Einstein
- B) Galileo Galilei
- C) Isaac Newton
- D) Johannes Kepler

Answer: C) Isaac Newton

What is escape velocity?

- A) The velocity at which an object falls to Earth
- B) The velocity at which an object escapes the gravitational pull of a planet or star
- C) The velocity at which an object reaches terminal velocity
- D) The velocity at which an object moves in a circular orbit

Answer: B) The velocity at which an object escapes the gravitational pull of a planet or star

What is the Schwarzschild radius?

- A) The radius of the Earth's orbit around the sun
- B) The radius of a black hole's event horizon
- C) The radius of a planet's atmosphere
- D) The radius of a star's core

Answer: B) The radius of a black hole's event horizon

Which of the following is not a fundamental force of nature?

- A) Gravitational force
- B) Electromagnetic force
- C) Strong nuclear force
- D) Weak nuclear force

Answer: E) None of the above

Which planet in our solar system has the strongest gravitational pull?

- A) Jupiter
- B) Saturn
- C) Earth
- D) Mars

Answer: A) Jupiter

How does the mass of an object affect its gravitational force?

- A) The greater the mass, the greater the gravitational force
- B) The smaller the mass, the greater the gravitational force
- C) Mass has no effect on gravitational force
- D) The effect of mass on gravitational force depends on the distance between objects

Answer: A) The greater the mass, the greater the gravitational force

What is the difference between weight and mass?

- A) Weight is a measure of an object's mass, while mass is a measure of the force of gravity on an object
- B) Weight is a measure of the force of gravity on an object, while mass is a measure of the amount of matter in an object
- C) Weight and mass are two different ways of measuring the same thing
- D) Weight and mass are not related to each other

Answer: B) Weight is a measure of the force of gravity on an object, while mass is a measure of the amount of matter in an object

What is the role of dark matter in the study of gravitation?

- A) Dark matter has no effect on gravitation
- B) Dark matter is responsible for the gravitational pull of galaxies
- C) Dark matter is a force that opposes gravity
- D) Dark matter is a theoretical construct that has no relation to gravitation

Answer: B) Dark matter is responsible for the gravitational pull of galaxies

