INSTRUCTIONS FOR USE

The Reading Quizzes in this file can be used:

- as handouts on which the students check the correct answers.
- as overhead transparencies.
- as a source of material that can be modified to suit your own needs.

To locate and print a specific Reading Quiz:

- Use the bookmarks at left
- Click the triangle in front of desired subject to reveal all quizzes for that subject.
- Click on the name of the desired Reading Quiz.
- Use “Print” from the “File” menu to make a printout of the quiz.

To search for a specific word or phrase within this file:

- Use “Find” from the “Tools” menu .

To re-organize or modify the text in this file:

- Use “Select Text” from the “Tools” menu to copy the text you want to edit.
- Paste the copied text into your word processor or other application.

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KINEMATICS

1. The slope of the curve in the position vs. time graph for a particle's motion gives

___ 1. the particle's speed.
___ 2. the particle's acceleration.
___ 3. the particle's average velocity.
___ 4. the particle's instantaneous velocity.
___ 5. not covered in the reading assignment

2. Is it possible for an object's instantaneous velocity and instantaneous acceleration to be of opposite sign at some instant of time?

___ 1. yes
___ 2. no
___ 3. need more information

3. Without air resistance, an object dropped from a plane flying at constant speed in a straight line will

___ 1. quickly lag behind the plane.
___ 2. remain vertically under the plane.
___ 3. move ahead of the plane.
___ 4. not covered in the reading assignment

4. A ball is thrown downward (not dropped) from the top of a tower. After being released, its downward acceleration will be

___ 1. greater than *g*.
___ 2. exactly *g*.
___ 3. smaller than *g*.
___ 4. not covered in the reading assignment

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NEWTON'S LAWS

1. Which of these laws is not one of Newton's laws?

___ 1. Action is reaction.
___ 2. $F = ma$.
___ 3. All objects fall with equal acceleration.
___ 4. Objects at rest stay at rest, etc.

2. The law of inertia

___ 1. is not covered in the reading assignment.
___ 2. expresses the tendency of bodies to maintain their state of motion.
___ 3. is Newton's 3rd law.

3. "Impulse" is

___ 1. not covered in the reading assignment.
___ 2. another name for force.
___ 3. another name for acceleration.

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FORCES

1. Viscous friction is

___ 1. larger than kinetic friction.
___ 2. equal to kinetic friction.
___ 3. smaller than kinetic friction.
___ 4. not covered in the reading assignment.

2. Astronauts on the Moon can jump so high because

___ 1. they weigh less there than they do on Earth.
___ 2. their mass is less there than it is on Earth.
___ 3. there is no atmosphere on the Moon.

3. Is the normal force on a body always equal to its weight?

___ 1. yes
___ 2. no
___ 3. not covered in the reading assignment

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WORK

1. A woman holds a bowling ball in a fixed position. The work she does on the ball

___ 1. depends on the weight of the ball.

___ 2. cannot be calculated without more information.

___ 3. is equal to zero.

2. A man pushes a very heavy load across a horizontal floor. The work done by gravity on the load

___ 1. depends on the weight of the load.

___ 2. cannot be calculated without more information.

___ 3. is equal to zero.

3. When you do positive work on a particle, its kinetic energy

___ 1. increases.

___ 2. decreases.

___ 3. remains the same.

___ 4. need more information about the way the work was done

4. In a collision between two billiard balls,

___ 1. energy is not conserved if the collision is perfectly elastic.

___ 2. momentum is not conserved if the collision is inelastic.

___ 3. not covered in the reading assignment

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CONSERVATIVE FORCES

1. The gravitational potential energy of a particle at a height z above Earth's surface

___ 1. depends on the height z.
___ 2. depends on the path taken to bring the particle to z.
___ 3. both 1 and 2.
___ 4. is not covered in the reading assignment.

2. Which of the following is not a conservative force?

___ 1. the force exerted by a spring on a particle in one dimension
___ 2. the force of friction
___ 3. the force of gravity
___ 4. not covered in the reading assignment

3. Which of the following was not discussed in the reading assignment?

___ 1. conservation of mechanical energy
___ 2. block and tackle
___ 3. power
___ 4. none of the above

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POTENTIAL ENERGY

1. Suppose you know the potential energy function corresponding to a force. Is it always possible to calculate the force?

___ 1. yes
___ 2. only if the force is nonconservative
___ 3. not covered in the reading assignment

2. The potential energy of a spring is

___ 1. proportional to the amount the spring is stretched.
___ 2. proportional to the square of the amount the spring is stretched.
___ 3. not covered in the reading assignment.

3. A car slows down as a result of air friction. Which is true?

___ 1. The car's kinetic energy decreases.
___ 2. Heat is generated.
___ 3. The energy of the car/road/air system is constant.
___ 4. all of the above
___ 5. none of the above

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GRAVITATION

1. Which is true? The gravitational force between two particles

___ 1. can be shielded by the presence of an intervening mass.

___ 2. is inversely proportional to the distance between the particles.

___ 3. obeys the law of superposition.

___ 4. is independent of the distance between the particles.

2. The gravitational constant G is

___ 1. equal to g at the surface of Earth.

___ 2. different on the Moon than on Earth.

___ 3. obtained by measuring the speed of falling objects having different masses.

___ 4. none of the above

3. Which is one of Kepler's laws?

___ 1. The gravitational attraction of Earth and the Sun provides a centripetal acceleration explaining Earth's orbit.

___ 2. The gravitational and inertial masses of an object are equivalent.

___ 3. The radial line segment from the Sun to a planet sweeps out equal areas in equal time intervals.

4. Which term was not introduced in today's reading assignment?

___ 1. escape velocity

___ 2. perihelion

___ 3. gravitational mass

___ 4. Hubble's constant

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MOMENTUM

1. Which is true? Conservation of the total momentum of a system

___ 1. holds only when mechanical energy is conserved.

___ 2. holds for any system.

___ 3. follows from Newton's second law.

___ 4. is equivalent to Newton's third law.

2. The center of mass of a rigid object of arbitrary shape

___ 1. is always inside the object.

___ 2. can lie outside the object.

___ 3. depends on the motion of the object.

___ 4. depends on the frame of reference of the object.

3. Compared with the kinetic energy of its center of mass (CM), the total kinetic energy of a system is

___ 1. always less than the kinetic energy of the CM.

___ 2. always equal to the kinetic energy of the CM.

___ 3. greater than or equal to the kinetic energy of the CM.

___ 4. depends on the particular system

4. A rocket is propelled forward by ejecting gas at high speed. The forward motion is a consequence of

___ 1. conservation of energy.

___ 2. conservation of momentum.

___ 3. both of the above.

___ 4. neither of the above.

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COLLISIONS

1. The impulse delivered to a body by a force is
___ 1. defined only for interactions of short duration.
___ 2. equal to the change in momentum of the body.
___ 3. equal to the area under an F vs. x graph.
___ 4. defined only for elastic collisions.

2. In an elastic collision
___ 1. energy is conserved.
___ 2. momentum is conserved.
___ 3. the magnitude of the relative velocity is conserved.
___ 4. all of the above

3. In an inelastic collision
___ 1. both energy and momentum are conserved.
___ 2. energy is conserved.
___ 3. momentum is conserved.
___ 4. neither is conserved.

4. In two-dimensional elastic collisions, the conservation laws
___ 1. allow us to determine the final motion.
___ 2. place restrictions on possible final motions.
___ 3. do not allow us to say anything about the final motion.
___ 4. are not covered in the reading assignment.

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ROTATIONAL KINEMATICS I

1. An object is rotated about a vertical axis by 90° and then about a horizontal axis by 180°. If we start over and perform the rotations in the reverse order, the orientation of the object

___ 1. will be the same as before.

___ 2. will be different than before.

___ 3. depends on the shape of the object.

___ 4. is not covered in the reading assignment.

2. A disk is rotating at a constant rate about a vertical axis through its center. Point *Q* is twice as far from the center of the disk as point *P* is. The angular velocity of *Q* at a given time is

___ 1. twice as big as *P*'s.

___ 2. the same as *P*'s.

___ 3. half as big as *P*'s.

___ 4. none of the above.

3. When a disk rotates counterclockwise at a constant rate about a vertical axis through its center, the tangential acceleration of a point on the rim is

___ 1. positive.

___ 2. zero.

___ 3. negative.

___ 4. impossible to determine without more information.

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ROTATIONAL KINEMATICS II

1. The rotational inertia of a rigid body

___ 1. is a measure of its resistance to changes in rotational motion.
___ 2. depends on the location of the axis of rotation.
___ 3. is large if most of the body's mass is far from the axis of rotation.
___ 4. is all of the above.
___ 5. is none of the above.

2. The angular momentum of a particle

___ 1. is independent of the specific origin of coordinates.
___ 2. is zero when its position and momentum vectors are parallel.
___ 3. is zero when its position and momentum vectors are perpendicular.
___ 4. is not covered in the reading assignment.

3. Which term was not introduced in today's reading assignment?

___ 1. axis of rotation
___ 2. rotational kinetic energy
___ 3. gyroscopes
___ 4. moment of inertia

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ROTATIONAL DYNAMICS I

1. When a force F acts on a body, the perpendicular distance between the line of action of F and the origin of coordinates is called the

___ 1. torque.
___ 2. moment arm.
___ 3. angular momentum.

2. The equation of motion for a rotating body, $\tau = dL/dt$,

___ 1. is a new law of physics.
___ 2. can be derived from Newton's laws.
___ 3. can be derived, but depends on laws other than Newton's.

3. A wheel rolls without slipping along a horizontal surface. The center of the wheel has a translational speed v. The lowermost point on the wheel has a net forward velocity

___ 1. $2v$.
___ 2. v.
___ 3. zero.
___ 4. need more information

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ROTATIONAL DYNAMICS II

1. The moment of inertia of a rigid body about a fixed axis through its center of mass is I. The moment of inertia of this same body about a parallel axis through some other point is always

___ 1. smaller than I.

___ 2. the same as I.

___ 3. larger than I.

___ 4. whether it's larger or smaller depends on the choice of axis

2. A disk rolls without slipping along a horizontal surface. The center of the disk has a translational speed v. The uppermost point on the disk has a translational speed

___ 1. 0.

___ 2. v.

___ 3. $2v$.

___ 4. need more information

3. An ice-skater spins about a vertical axis through her body with her arms held out. As she draws her arms in, her angular velocity

___ 1. increases.

___ 2. decreases.

___ 3. remains the same.

___ 4. need more information

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OSCILLATIONS

1. The time interval for one repetition of the cycle in simple harmonic motion is called the

___ 1. frequency.
___ 2. period.
___ 3. amplitude.
___ 4. phase.

2. The frequency of a coupled mass-spring oscillator depends on

___ 1. the value of the spring constant alone.
___ 2. the value of the mass alone.
___ 3. both of the above
___ 4. neither of the above

3. The total energy of a frictionless mass-spring oscillator

___ 1. is constant.
___ 2. depends on the amplitude of the oscillations.
___ 3. both of the above
___ 4. is not covered in the reading assignment.

4. Which term is not associated with forced oscillations?

___ 1. sympathetic oscillation
___ 2. driving force
___ 3. Doppler shift
___ 4. resonance

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WAVES

1. A transverse wave propagates along a string. The particles in the string move
___ 1. perpendicular to the direction of propagation.
___ 2. parallel to the direction of propagation.
___ 3. depends on the initial disturbance
___ 4. not covered in the reading assignment

2. The speed of a wave on a string depends on
___ 1. the amplitude of the wave.
___ 2. the material properties of the string.
___ 3. both of the above.
___ 4. neither of the above.

3. Beats occur when two superimposed waves are of
___ 1. slightly different amplitudes and the same frequency.
___ 2. slightly different frequencies.
___ 3. the opposite amplitude and identical frequency.
___ 4. the same amplitude and frequency, but different phase.

4. Antinodes and nodes occur
___ 1. during beats.
___ 2. in standing waves.
___ 3. in traveling waves.
___ 4. in longitudinal waves.
___ 5. in more than just one of the above.
___ 6. in none of the above.

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SOUND

1. Which of the following characterize(s) sound waves in air?

___ 1. They are longitudinal.
___ 2. The restoring force is supplied by air pressure.
___ 3. The density of the air molecules oscillates in space.
___ 4. 1 and 2
___ 5. 1 and 3
___ 6. 1, 2, and 3

2. A standing sound wave in a tube having one open end has a displacement

___ 1. antinode at the closed end and node at the open end.
___ 2. antinode at the closed end and at the open end.
___ 3. node at the closed end and antinode at the open end.
___ 4. node at the closed end and at the open end.

3. You are at rest on a platform at a railroad station. A train approaches the platform blowing its whistle. As the train passes you, the pitch of the whistle

___ 1. increases.
___ 2. decreases.
___ 3. stays the same.
___ 4. depends on the amplitude of the sound.

4. Seismic waves differ from sound waves in that seismic waves

___ 1. have a restoring force provided by the elasticity of Earth.
___ 2. may propagate transversely.
___ 3. both of the above
___ 4. neither of the above

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FLUID STATICS

1. Which statement does not apply? In the steady flow of an incompressible fluid,

___ 1. the flow velocity at a point is tangent to the streamline through that point.
___ 2. the density of the fluid is proportional to the density of streamlines.
___ 3. streamlines cannot cross each other.
___ 4. the wider the streamline spacing, the lower the velocity of the flow.

2. A fluid is

___ 1. a liquid.
___ 2. a gas.
___ 3. anything that flows.
___ 4. anything that can be made to change shape.

3. A static fluid in a container is subject to both atmospheric pressure at its surface and Earth's gravitation. The pressure at the bottom of the container

___ 1. depends on the height of the fluid column.
___ 2. depends on the shape of the container.
___ 3. is equal to the atmospheric pressure.

4. The buoyant force on an immersed body has the same magnitude as

___ 1. the weight of the body.
___ 2. the weight of the fluid displaced by the body.
___ 3. the difference between the weights of the body and the displaced fluid.
___ 4. the average pressure of the fluid times the surface area of the body.

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FLUID DYNAMICS

1. The equation of continuity says that the velocity of fluid flow in a pipe is inversely proportional to the cross-sectional area

___ 1. only for an incompressible fluid.
___ 2. only for a horizontal pipe.
___ 3. both of the above
___ 4. always

2. Bernoulli's equation is a conservation law for

___ 1. momentum.
___ 2. energy.
___ 3. mass.
___ 4. streamlines.

3. Which situation cannot be described with Bernoulli's equation?

___ 1. the flow of water out of a tank having a small hole near its bottom
___ 2. the steady flow of water in a fire hose
___ 3. the static pressure distribution due to the air velocities near (but not at) airfoil surfaces.
___ 4. fluid flow through a pump equipped with a piston

4. When the velocity of a fluid flow increases, pressure decreases. This relationship is expressed by

___ 1. Pascal's principle.
___ 2. the equation of continuity.
___ 3. Bernoulli's equation.
___ 4. none of the above.

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ELECTROSTATICS I

1. Which of the following is not true? The electric force

___ 1. decreases with the inverse of the square of the distance between two charged particles.

___ 2. between an electron and a proton is much stronger than the gravitational force between them.

___ 3. between two protons separated by a distance *d* is larger than that between two electrons separated by the same distance *d*.

___ 4. may be either attractive or repulsive.

2. A material that permits electric charge to move through it is called a(n)

___ 1. insulator.

___ 2. conductor.

___ 3. capacitor.

___ 4. inductor.

3. When the electric charge on each of two charged particles is doubled, the electric force between them is

___ 1. doubled.

___ 2. quadrupled.

___ 3. the same.

___ 4. none of the above

4. In any reaction involving charged particles, the total charge before and after the reaction is always the same. This relationship is known as

___ 1. quantization of charge.

___ 2. conservation of charge.

___ 3. the law of induction.

___ 4. not covered in the reading assignment

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ELECTROSTATICS II

1. Which statement is not true?

___ 1. The electric field obeys the principle of superposition.

___ 2. The tangent to an electric field line at a point gives the direction of the field at that point.

___ 3. The density of electric field lines is directly proportional to the strength of the field.

___ 4. Negative charges are sources of electric field lines and positive charge sinks.

2. An electric dipole in a uniform electric field experiences

___ 1. only a net external force.

___ 2. only a torque.

___ 3. both a net external force and a torque.

___ 4. neither a net external force nor a torque.

___ 5. answer depends on the strength of the field

3. Which is (are) true?

___ 1. The electric flux through a closed surface whose volume holds a net charge Q depends on both Q and the surface area.

___ 2. For charges at rest, Coulomb's law and Gauss' law are equivalent.

___ 3. both 1 and 2

___ 4. neither 1 nor 2

4. Which is (are) true? When the charge distribution on a conductor reaches equilibrium,

___ 1. the electric field within the conductor is zero.

___ 2. any electric charge deposited on the conductor resides on the surface.

___ 3. the electric field at the surface is perpendicular to the surface.

___ 4. all of the above

___ 5. two of the above

___ 6. none of the above

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ELECTRIC POTENTIAL I

1. A charge q is placed a distance r from the origin, and a charge $2q$ is placed a distance $2r$. There is a charge Q at the origin. If all charges are positive, which charge is at the higher potential?

___ 1. q

___ 2. $2q$

___ 3. The two charges have the same potential.

2. Which charge in question 1 has the higher electrostatic potential energy?

___ 1. q

___ 2. $2q$

___ 3. The two charges have the same potential energy.

3. A spherical metal shell carries a uniform positive surface charge. The potential is the same over the surface of the shell. Which statement is correct?

___ 1. The potential is highest at the geometrical center of the shell volume.

___ 2. The potential is lowest at the geometrical center of the shell volume.

___ 3. The potential at the center of the shell volume is the same as on the shell surface.

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ELECTRIC POTENTIAL II

1. Which statement(s) is(are) true? The electric potential energy of a charge distribution is

___ 1. equal to the amount of work required to bring the charges to their final configuration if they are initially separated by large distances.

___ 2. proportional to the square of the electric field generated by the charges.

___ 3. both of the above

___ 4. neither of the above

2. The amount of energy required to assemble a point charge is called the charge's

___ 1. capacitance.

___ 2. self-energy.

___ 3. field strength.

___ 4. not covered in the reading assignment.

3. Two isolated metallic spheres each have a net charge Q uniformly distributed over their surfaces. One sphere has a radius r and the other has a radius R, where $R > r$. Which charge distribution stores more electric energy?

___ 1. the sphere of radius r.

___ 2. the sphere of radius R.

___ 3. need more information.

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CAPACITANCE

1. Two identical capacitors are connected first in parallel and then in series. Which combination has the greater capacitance?

___ 1. the pair in parallel

___ 2. the pair in series

___ 3. the two combinations have the same capacitance

2. Which statement(s) is(are) true? A dipole moment is created in a dielectric placed in an electric field when

___ 1. molecules or atoms of the dielectric material become polarized.

___ 2. randomly oriented permanent dipoles in the material realign themselves.

___ 3. both 1 and 2, with the particular mechanism depending on the material

___ 4. none of the above.

3. Compared with the applied electric field, the electric field within a linear dielectric is

___ 1. smaller.

___ 2. larger.

___ 3. depends on the dielectric

4. In order to increase the energy stored in a parallel-plate capacitor when an electric potential is applied, we should

___ 1. increase the area of the plates.

___ 2. increase the separation between the plates.

___ 3. insert a dielectric between the plates.

___ 4. all of the above

___ 5. two of the above

___ 5. none of the above

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OHM'S LAW

1. Which statement(s) is(are) true? When a long straight conducting wire of constant cross-section is connected to the terminals of a battery, the electric field

___ 1. lines are uniformly distributed over the cross-sectional area of the conductor.

___ 2. inside the wire is of constant magnitude and its direction is parallel to the wire.

___ 3. both of the above

___ 4. neither of the above

2. Which statement(s) is(are) true? Ohm's law

___ 1. asserts that the current in a conducting wire is proportional to the resistance of the wire.

___ 2. is a general law of nature like Newton's laws and Gauss' law.

___ 3. describes the electrical properties of some conducting materials.

___ 4. all of the above

___ 5. two of the above

3. Which term was not defined in the reading assignment?

___ 1. drift velocity

___ 2. impedance

___ 3. superconductivity

___ 4. resistivity

4. Two identical resistors are connected first in series and then in parallel. Which combination has the larger net resistance?

___ 1. the pair in series

___ 2. the pair in parallel

___ 3. The two combinations have the same resistance.

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DC CIRCUITS

1. Which is(are) true? The emf of a source of electric potential energy is

___ 1. the amount of electric energy delivered by the source per coulomb of positive charge as this charge passes through the source from the low- to the high-potential terminal.

___ 2. equal in magnitude to the potential drop in the external circuit connected between the terminals of the source of emf.

___ 3. both of the above

___ 4. neither of the above

2. Which is(are) true? Kirchhoff's second rule

___ 1. relates the sum of the emfs around a closed loop in a circuit to the potential changes across all resistors and circuit elements.

___ 2. implies conservation of energy in electric circuits.

___ 3. relates the currents entering and leaving any branch point in a circuit.

___ 4. all of the above

___ 5. two of the above

___ 6. none of the above

3. A Wheatstone bridge is a device used to measure

___ 1. current.

___ 2. potential.

___ 3. resistance.

___ 4. joule-heating losses.

4. A resistor and an initially uncharged capacitor arranged in series are charged by a battery, which is connected at $t = 0$. The current in the circuit

___ 1. is constant because the emf supplied by the battery is constant.

___ 2. decreases exponentially in time.

___ 3. increases exponentially in time.

___ 4. There is no current because the electrons cannot flow through the gap in the capacitor.

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MAGNETOSTATICS

1. Two charges q and Q move with nonzero velocities with respect to a fixed reference frame. The magnetic force on q exerted by Q is

___ 1. perpendicular to the velocity of q and depends only on the velocity of Q.
___ 2. perpendicular to the velocity of q and depends on both the velocity of Q and that of q.
___ 3. perpendicular to the velocity of Q and depends only on the velocity of q.
___ 4. perpendicular to the velocity of Q and depends on both the velocity of Q and that of q.

2. Which is(are) true?

___ 1. The magnetic field lines of a moving charge form closed loops.
___ 2. The magnetic field obeys the principle of superposition.
___ 3. The magnetic flux through a closed surface is proportional to the total number of magnetic poles enclosed within the surface.
___ 4. all of the above
___ 5. two of the above
___ 6. none of the above

3. A long straight wire lies along the x-axis and carries a current of electrons that move in the positive x-direction. The magnetic field due to this current, at a point P on the negative y-axis, points in which direction?

___ 1. $+x$
___ 2. $-x$
___ 3. $+y$
___ 4. $-y$
___ 5. $+z$
___ 6. $-z$

4. Which is(are) true? The magnetic dipole moment of a current loop

___ 1. is proportional to the area enclosed by the loop.
___ 2. is proportional to the current in the loop.
___ 3. is well defined only when the observer is far from the loop.
___ 4. all of the above
___ 5. two of the above
___ 6. none of the above

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AMPÈRE'S LAW

1. Ampère's law gives the magnetic field produced by a distribution of currents. Which condition(s) must be satisfied?

___ 1. The distribution of currents must be steady.
___ 2. In order to solve, the distribution must have sufficient symmetry.
___ 3. both of the above
___ 4. neither of the above

2. Which is(are) true? The magnetic field inside a solenoid

___ 1. is parallel to the axis of the solenoid.
___ 2. has circular field lines centered on the axis.
___ 3. has a magnitude that is proportional to the total number of turns.
___ 4. all of the above
___ 5. two of the above

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HALL EFFECT

1. The Hall effect

___ 1. provides empirical evidence that the charge carriers in metals are negative.

___ 2. can be used to determine the density of free electrons in a metal.

___ 3. both of the above

___ 4. neither of the above

2. A small planar current loop is placed in a uniform magnetic field. The magnitude of the torque on the loop is a maximum when

___ 1. the plane of the loop is parallel to the direction of the field.

___ 2. the plane of the loop is perpendicular to the direction of the field.

___ 3. the angle between the plane of the loop and the magnetic field is somewhere between 0 and 90°.

___ 4. the torque is independent of the angle between its plane and the magnetic field

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MAGNETIC INDUCTANCE

1. Which is true?

___ 1. The field lines of an induced electric field form closed loops.
___ 2. The induced electric field is conservative.
___ 3. both of the above
___ 4. neither of the above

2. The magnetic energy stored in an inductor is

___ 1. proportional to the square of the current through the inductor.
___ 2. proportional to the square of the magnetic field of the inductor.
___ 3. both of the above
___ 4. neither of the above

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MUTUAL INDUCTANCE

1. Two current-carrying coils of wire are in close proximity. We can change the mutual inductance of the pair by

___ 1. changing the relative positions of the coils.
___ 2. changing the currents.
___ 3. increasing the number of turns in one of the coils.
___ 4. all of the above.
___ 5. two of the above.

2. A resistor R and an inductor L are connected in series to a battery, which is switched on at $t = 0$. The current in the circuit is time-dependent. If we repeat the experiment with a resistor of resistance $5R$, the time constant

___ 1. decreases by a factor of 5.
___ 2. increases by a factor of 5.
___ 3. does not change.

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AC CIRCUITS I

1. In a circuit consisting of a resistor connected to an oscillating source of emf, the current

___ 1. leads the emf.
___ 2. lags behind the emf.
___ 3. is in phase with the emf.
___ 4. the answer depends on the source of emf

2. A capacitor is connected to an oscillating source of emf. As the frequency of the emf increases, the capacitive reactance

___ 1. increases.
___ 2. decreases.
___ 3. remains the same.
___ 4. depends on the direction of the current.

3. In a dc circuit (which means the frequency of the source of emf is zero), which circuit element presents the greatest "resistance" to charge flow?

___ 1. capacitor
___ 2. inductor
___ 3. resistor
___ 4. Answer depends on the relative values of C, L, and R.

4. The current in an ac circuit is represented by a phasor. The value of the current at some time t is given by

___ 1. the length of the phasor.
___ 2. the value, in radians, of the angle between the phasor and the horizontal axis.
___ 3. the projection of the phasor on the vertical axis.
___ 4. the projection of the phasor on the horizontal axis.

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AC CIRCUITS II

1. A capacitor having an initial charge Q and an inductor are connected in series. The energy in the inductor is a maximum when the charge on the capacitor is

___ 1. Q.
___ 2. $\frac{1}{2}\,Q$.
___ 3. zero.
___ 4. the energy does not depend on the charge

2. A capacitor having an initial charge Q is connected in series with an inductor and a resistor. As a function of time, the charge on the capacitor

___ 1. oscillates sinusoidally.
___ 2. oscillates sinusoidally with exponentially decreasing amplitude.
___ 3. does not vary in time as there is no driving emf.
___ 4. not covered in the reading assignment

3. Which of the following terms were introduced in the reading assignment to describe an RLC circuit having an external emf?

___ 1. resonance
___ 2. impedance
___ 3. bandwidth
___ 4. all of the above

4. In transmitting electricity from a power plant to the consumer, transformers are utilized for which of the following tasks?

___ 1. stepping up the output voltage at the power plant
___ 2. stepping down the voltage just before it reaches the consumer
___ 3. both of the above
___ 4. neither of the above

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MAXWELL'S EQUATIONS

1. A capacitor has been charged to a constant potential V. The displacement current between its plates

___ 1. is equal to the current that was required to charge up the capacitor.

___ 2. depends on the Ampèrian surface chosen.

___ 3. is zero.

___ 4. induces a magnetic field.

2. The Maxwell modification of Ampère's law describing the creation of a magnetic field is the analog of

___ 1. Gauss' law on electric fields and charges.

___ 2. Gauss' law on magnetic fields and poles.

___ 3. the Lorentz equation.

___ 4. Faraday's law.

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ELECTROMAGNETIC WAVES I

1. An electromagnetic wave polarized in the positive y direction propagates in the negative z-direction. What is the direction of the magnetic field?

___ 1. $+x$

___ 2. $-y$

___ 3. $-x$

___ 4. $+z$

2. In a planar harmonic wave, the magnetic field achieves its maximum when the electric field

___ 1. is also at its maximum.

___ 2. is at its minimum.

___ 3. is at some intermediate value.

___ 4. the relationship between electric and magnetic fields depends on the plane wave

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ELECTROMAGNETIC WAVES II

1. Which is(are) true? The energy carried by an electromagnetic wave in a vacuum

___ 1. propagates at the speed of light.

___ 2. consists of equal contributions from the electric and magnetic fields.

___ 3. propagates along the direction of the electric field.

___ 4. all of the above

___ 5. two of the above

2. A grain of interplanetary dust is in the Sun's gravitational field. If we consider the grain to be isolated from all influences except the Sun, is it possible for the grain to move away from the Sun?

___ 1. Yes, if the grain is sufficiently large and is a good absorber of light.

___ 2. Yes, if the grain is sufficiently small and is a good absorber of light.

___ 3. No, the Sun's gravitational field always attracts the grain to the Sun.

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GEOMETRICAL OPTICS I

1. Snell's law describes

___ 1. Huygens' construction.

___ 2. magnification.

___ 3. reflection.

___ 4. refraction.

2. The phenomenon of dispersion occurs when

___ 1. there is total internal reflection.

___ 2. the index of refraction depends on the wavelength.

___ 3. there is a virtual image.

___ 4. the incident beam is completely reflected.

3. For angles of incidence exceeding a certain value, light traveling from a medium of high refractive index to one of lower index is

___ 1. totally reflected.

___ 2. dispersed.

___ 3. totally refracted.

___ 4. completely polarized.

4. Light is incident upon two polarizing filters arranged in tandem. The filters are crossed so that their polarization directions are perpendicular. The transmitted intensity through the second filter

___ 1. is 100%.

___ 2. depends on the frequency of the incident light.

___ 3. depends on the intensity of the incident light.

___ 4. is zero.

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GEOMETRICAL OPTICS II

1. Light from an object is reflected by a mirror in such a way that the rays diverge from and pass through the reflection. This is known as

___ 1. a virtual image.
___ 2. a real image.
___ 3. spherical aberration.
___ 4. a focal point.

2. Which of the following is *not* a principal ray of a spherical mirror?

___ 1. a ray that goes through the center of the sphere
___ 2. a ray that approaches the mirror along a line parallel to the axis
___ 3. a ray that goes through the focal point on the way to the mirror
___ 4. a ray that hits the mirror at the same place that the axis hits

3. For a lens that produces a positive magnification, the image is

___ 1. virtual and upright.
___ 2. virtual and inverted.
___ 3. real and upright.
___ 4. real and inverted.

4. For a thin lens made of two spherical surfaces, the focal length given by the lens-maker's formula depends on

___ 1. the index of refraction of the lens.
___ 2. the radii of the two spherical surfaces.
___ 3. the assumption of incident rays near the axial line.
___ 4. the magnification of the lens.
___ 5. all of the above.
___ 6. 1 and 2.
___ 7. 1, 2, and 3.

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PHYSICAL OPTICS I

1. Interference occurs with
___ 1. light waves.
___ 2. sound waves.
___ 3. water waves.
___ 4. all of the above.
___ 5. none of the above.

2. In order for interference effects to be observable,
___ 1. the wavelength of the light must be comparable to the width of any apertures the light encounters.
___ 2. the intensity of the light must be sufficiently high.
___ 3. the phase relationships between waves is not important.
___ 4. the wavelength of the light must be much smaller than the width of any apertures the light encounters.

3. If the interference pattern produced by two light sources is to remain stationary in space, the sources must have
___ 1. different frequencies and an arbitrary phase difference.
___ 2. the same frequencies and an arbitrary phase difference.
___ 3. different frequencies and a phase difference that is time-independent.
___ 4. the same frequencies and a phase difference that is time-independent.

4. Which term does not arise in the discussion of interference patterns?
___ 1. coherent sources
___ 2. Fraunhofer approximation
___ 3. magnifying power
___ 4. principal maximum

Name: _____ ID:_____
Course: _____ Date:_____

PHYSICAL OPTICS II

1. The bending of light around an obstacle is called
___ 1. interference.
___ 2. resolution.
___ 3. diffraction.
___ 4. coherence.

2. Light impinges on a single slit but suffers no significant diffraction. We conclude that the wavelength of the light is
___ 1. much shorter than the slit width.
___ 2. much longer than the slit width.
___ 3. on the order of the slit width.
___ 4. We cannot say anything about the wavelength.

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DIFFRACTION

1. The diffraction pattern generated by a single slit can be constructed using the

___ 1. Fresnel approximation.
___ 2. Huygens-Fresnel principle.
___ 3. Huygens construction.
___ 4. Rayleigh criterion.

2. Light waves from two point-like sources arrive at the circular aperture of a telescope simultaneously. The telescope will resolve the two sources if which of the following conditions is satisfied?

___ 1. the Fresnel approximation
___ 2. the Fraunhofer approximation
___ 3. the Huygens-Fresnel principle
___ 4. the Rayleigh criterion

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HISTORICAL INTRODUCTION TO MODERN PHYSICS

1. The spectral emittance of a blackbody depends on
___ 1. the material out of which the body is made.
___ 2. the characteristics of the body's surface.
___ 3. the body's temperature.
___ 4. all of the above.

2. Calculated classically, the spectral emittance of a blackbody diverges at short wavelengths. This result is known as
___ 1. the Stefan-Boltzmann law.
___ 2. the ultraviolet catastrophe.
___ 3. the Compton effect.
___ 4. Wien's law.

3. The number of photoelectrons emitted from a metal surface depends on
___ 1. the frequency of the incident light.
___ 2. the workfunction of the metal.
___ 3. both of the above.
___ 4. neither of the above.

4. As the wavelength of the light incident on a metal surface is shortened, the kinetic energy of photoelectrons emitted from the surface
___ 1. increases.
___ 2. decreases.
___ 3. stays the same.
___ 4. need more information

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WAVE-PARTICLE DUALITY/UNCERTAINTY

1. The Compton effect illustrates

___ 1. the wave nature of light.

___ 2. the ejection of an electron from an irradiated metal surface.

___ 3. the particle nature of light.

___ 4. the probabilistic nature of quantum waves.

2. In the Compton experiment, the wavelength of the scattered light is

___ 1. longer than

___ 2. the same as

___ 3. shorter than

___the wavelength of the incident light.

3. The probability of finding a photon of light at a given point

___ 1. increases as the wavelength of the light decreases.

___ 2. is proportional to the intensity of the light.

___ 3. is proportional to the magnitude of the electric field.

___ 4. is independent of the electric field.

4. Suppose the momentum of a photon is determined with complete accuracy (the uncertainty approaches zero). The uncertainty in a simultaneous measurement of the photon's position

___ 1. also approaches zero.

___ 2. approaches infinity.

___ 3. has some intermediate value.

___ 4. cannot be determined.

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SPECTRAL LINES

1. White light passes through sodium vapor and is then analyzed with a prism. The resulting spectrum

___ 1. is continuous.

___ 2. consists of spectral lines.

___ 3. is continuous and contains absorption lines.

___ 4. none of the above

2. The systematic pattern in the spacing of the spectral lines of hydrogen was fit to an empirical formula by

___ 1. Balmer.

___ 2. de Broglie.

___ 3. Bohr.

___ 4. Rutherford.

3. The Rutherford alpha particle/gold foil experiment gave evidence for the

___ 1. existence of matter waves.

___ 2. Rydberg-Ritz combination principle.

___ 3. "plum-pudding" model of the atom.

___ 4. nuclear atom.

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BOHR ATOM

1. Which quantity(ies) is(are) quantized in the Bohr atom?

___ 1. the electron orbit
___ 2. the electron energy
___ 3. the electron angular momentum
___ 4. all of the above
___ 5. two of the above

2. In the Bohr atom, the laws of classical mechanics apply to

___ 1. the orbital motion of the electron in a stationary state.
___ 2. the motion of the electron during transitions between stationary states.
___ 3. both of the above.
___ 4. neither of the above.

3. In the Bohr atom, an electron radiates

___ 1. when accelerating in its orbit around the nucleus.
___ 2. during transitions between orbits.
___ 3. both of the above
___ 4. neither of the above

4. Who postulated the wavelike properties of material particles?

___ 1. Bohr
___ 2. Schrodinger
___ 3. Heisenberg
___ 4. de Broglie