

Physics JEOPARDY



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To the Teacher

Physics Jeopardy deals with facts and information about the branch of science known as physics. It is designed to be used for several purposes: as a fun and easy way to reinforce what is being studied, as a study guide, and as a review of the unit or a culminating activity. It challenges your students to remember important facts and encourages them to enjoy themselves in the process.

The format of *Physics Jeopardy* is like the popular television quiz show *Jeopardy!* A student is given the answer and is asked to provide the question. The fact given as a question is actually stated (“Another term for stored energy”), not asked. The student response is given as a question (“What is potential energy?”). Many students will be familiar with the format from watching the *Jeopardy!* television show or playing its computer or board-game versions.

The questions are classified according to general topic and further by category. Some game boards include a potpourri category, which can contain questions from all of physics. This format lends itself to use with a variety of attention-keeping games. Some games are suggested here; you and your students may invent others.

A number of questions throughout the book have more than one correct response. Often, an alternate response is written in parentheses, for example, “What is length (or distance)?”

How to Use This Book

Each topic, or game, consists of five general categories. Within each category are five questions, each assigned a point value of 5 through 25 depending on its relative difficulty. At the bottom of each game board, there is a Challenge question that requires calculation. You can use this question as described below, or you may choose to utilize the question in a different way.

These questions in this format may be used to play a variety of games. However, it may prove effective to allow the students an opportunity to find the answers to, or study, the questions first. You may wish to reproduce the questions for a series of assignments, and then use a game as an evaluation, a further review, or a culmination of the unit. You may find that using the

questions without a game is adequate. For these reasons, the answers are presented separately at the back of the book rather than with the questions.

Feel free to modify *Physics Jeopardy*. If you have stressed something in your class that is not included in this game, it is easy to add questions. Your students will quickly learn how to make questions for you in order to extend the game. You can also modify the questions to make them easier or harder to fit the needs of each particular class. Your class can play the same game more than once, which will help them remember material.

The same basic procedure can be used for playing any number of different games. Here are the directions for a typical *Jeopardy!*-style game:

- Write on the board the categories for the game to be played along with point values for each question.
- Divide the class into teams. Play begins when one student asks for a question from a given category with a given point value. For instance, if the topic is Waves and Sound, the student might say, “I want the 10-point question from the ‘Sound Volume’ category.”
- The game leader then reads the 10-point question from the requested category.
- Any student on the team may answer. The first person on the team to raise his or her hand is called on. (It may be the student who asked for the category to begin with.)
- If the answer is correct, record points for the team. The student who answered chooses the category and point value for the next question.
- If the answer is wrong, subtract the point value of the question from the team score. A student from the other team now has the chance to answer the question. Whoever answers the question correctly chooses the category and point value for the next question.
- If no one can answer the question, give the correct answer to the group. The student who last successfully answered a question chooses the next category and point value.

- The Challenge question can be used any time during game play. The game leader should choose a secret spot on the game board that will trigger the Challenge question; when a player chooses that particular category and point value, the Challenge question is given instead of the normal question. The Challenge question can be given to that individual student to solve, or it can be given to all players on both teams.
- The student who receives the Challenge question can choose the number of points the question is worth before the problem is given. Or the game leader may wish to choose the point value beforehand. In either case, if the question is answered correctly, add the points to the team score. If the question is answered incorrectly, subtract the point value from the team score. If the question is given to all students, the points go to the team of the first student who gets the correct answer.
- When all the questions in the category have been used, erase the category from the board. Continue until all the categories are erased and the game is over.

Following are some other variations of the game:

Rounds

The categories and point values are displayed and a scoreboard is drawn on the board to show the teams and what score they receive in each round.

The class is divided into groups, each having an equal number of students if possible. (Up to 25 can play. Extra pupils may serve as scorekeepers, readers, or board keepers.) The players in each group or team sit or stand in a set order—first player, second, etc.

The game begins with Player 1 on Team 1 requesting a question. If the player responds correctly, the earned score is recorded under Team 1/Round 1. If the response is incorrect, the correct answer is read and a score of zero is recorded. In either case, the point value is erased under the respective category. Then Player 1 of Team 2 has a turn to choose a question. After all the first players on each team have played, the play goes to the second players of each team, then the third, and so forth.

The game continues for as many complete rounds as possible. There may be several unused questions. The top-scoring team wins.

Progression

This game is set up like Rounds, preferably in five groups. The first players on each team choose a category

for 5 points, the second players choose a question for 10 points, the third players go for 15, etc. Play continues for as many complete rounds as possible.

Concentration

First, the categories and point values are written on the board. The class is divided into two teams. The first player on one team requests a question. If the player replies correctly, his or her team gets the points, and the point value is erased below the respective category. If the player does not answer correctly, the response is announced to be wrong and nothing is erased from the board. The first person on the opposite team then chooses a question. The play goes from team to team, with each person choosing a question still listed on the board. The advantage goes to the person who knows the answer to a previously asked question and can remember where it is located on the board. Play continues until all questions have been used. The highest-scoring team wins.

Solo

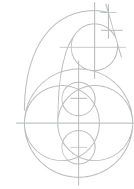
This game is played like Rounds, except that it is played by individual players instead of teams. The play goes from one player to the next in succession until all questions are used. The top scorer wins.

Physics Bee

This game is played like a spelling bee, but no one is eliminated. First the categories and point values are displayed. The class is divided into two teams. The first person on one team asks for a question by stating a category and point value. If the player responds correctly, his or her team receives the points and that point value is erased under that category. The next turn is taken by the first player on the other team, who chooses a question. However, if the first player's response is not correct, the same question is repeated for the first player on the other team. If the player replies correctly, his or her team gets the points, and the play then goes to the second player of the first team. The play continues from one side to the other, with points going to the teams that answer correctly and the respective category points being erased from the board. The game is over when all the questions have been used. The team accumulating the most points wins.

No matter how you use *Physics Jeopardy*, it is an entertaining and stimulating way to review, and it's an excellent change-of-pace activity. You'll find your students eager to play it again and again.

UNIT 6



Modern Physics

6

Modern Physics

Section 18

CROOKES

ATOMS AND
MOLECULES

RADIATION

FALLING APART

ABSORB AND EXPEL

5

The continual random movement of minute particles that are suspended in a liquid

The smallest sample of an element that contains all the properties of that element

The number of protons in the nucleus of an atom

The use of a spectroscope to analyze the spectra of substances

The various layers of energy in an atom where electrons are found

10

The name of the first vacuum tube that generated a stream of electrons

A substance made of two or more atoms chemically combined

Another name for the nuclei of a helium atom

The center of the atom that contains neutrons and protons

The lowest energy level of an electron

15

The charge found on the cathode of a Crookes tube

The total number of protons and neutrons in an atom

Electrons emitted at very high speeds

The amount of time needed for one half of the mass of radioactive material to decay

The series of lines in the spectrum of radiation emitted by excited hydrogen

20

The original name for the stream of electrons found in a Crookes tube

One-twelfth the mass of a carbon-12 atom

A type of radiation, this electromagnetic wave has the ability to penetrate even several centimeters of solid lead.

The measure of the number of radioactive disintegrations per second

An idealized body that absorbs all radiation incident upon it, and is also a perfect emitter

25

The range of the electromagnetic spectrum found directly above ultraviolet light in frequency range

The emission of radiation by the nuclei of atoms

Radiation of great penetrating power that comes to earth from outer space

The SI unit of measure for the number of radioactive disintegrations per second

Astronomers cannot see this material, but theories predict its existence and its gravitational influence has been detected.

**C
H
A
L
L
E
N
G
E**

Problem

Isotopes of the various elements contain varying numbers of neutrons, although all isotopes of an element contain the same number of protons. If an isotope of uranium were to be designated as U-246, then how many neutrons would it have in its nucleus?

Solution

**N
O
T
E
S**

6

Modern Physics

Section 19

STEP IT UP

MAKING PARTICLES

IN THE NUCLEUS

RADIOACTIVE

BOOM!

5

The name for the constant 6.626×10^{-34} J·s

The particle in the nucleus of an atom that has a charge of +1

The particle in the nucleus of an atom that has no charge

A particle that has the same mass as a proton, but has a -1 charge

Nuclear reaction caused by the breakup of a nucleus into multiple nuclei of smaller mass

10

The smallest amount of a quantity that can exist independently, especially a quantity of electromagnetic radiation

Quanta of energy found in light

The name for all the particles found in the nucleus of an atom

An electrically neutral, very weakly interacting particle that has a zero or very small rest energy

A self-sustaining series of nuclear fission in which the release of neutrons from one atom leads to the splitting of others

15

The study of matter that includes wave-particle duality and the tendency of energy to be changed in discrete steps

The quantum number that states the number of energy shells in an atom

Atoms of an element that have the same number of protons but different numbers of neutrons

The energy deposited per unit mass by absorbed radiation, measured in grays

A bomb designed to use nuclear fission in a chain reaction

20

The emission of electrons due to radiation incident on a substance

A tube used for generating streams of electrons, like a television tube

The energy difference between the particles in the nucleus when considered in the nucleus and when considered as separate particles

The measure of dose given to living organisms, multiplied by the quality factor

A radiation effect, where charged particles travel through a medium at a speed greater than that of light in that medium

25

The lowest frequency of incident radiation that will cause the emission of electrons from a substance

The name for any particle in the group proton, neutron, electron, and photon

A particle that has the same mass as an electron, but carries a +1 charge

A unit of 3.7×10^{10} disintegrations per second

A nuclear reaction where nuclei merge to form one nucleus of greater mass

C
H
A
L
L
E
N
G
E

Problem

From the work of Max Planck we are able to calculate the energy of a quantum of radiation. Working backwards from that relationship, calculate the wavelength of a quantum of radiation whose energy is 4.01×10^{-19} .

Solution

N
O
T
E
S

6

Modern Physics

Section 20

LIGHT SHOW

LASER TIME

FUN WITH LIGHT

GET ORGANIZED
INSIDE

CONDUCTIVITY

5

The process by which an atom in an excited state returns to the ground state and randomly emits a photon

A device used to reflect light back and forth to amplify its power

A three-dimensional image produced by interference patterns of lasers

A solid made from repeating crystals

The temperature above which a ferromagnetic becomes paramagnetic or essentially loses its magnetization

10

When incident light of the proper frequency causes the emission of light by excited atoms

When the excited state of a laser medium contains more ions than the ground state

The making and study of holograms

A crystalline solid made from many individual crystalline units called grains

The measure of drift velocity per unit field

15

The acronym for light amplification by stimulated emission of radiation

An interim state in a laser in which a population exists long enough to be used

The number of lines per unit length for an interference pattern

Solids that have only short-ranged periodicity of crystalline structure

A range of energy levels that electrons may have in a solid

20

The name for the medium in a laser capable of being stimulated to emit light

The relationship between the wavelength of a light source and the bandwidth of the light source

The additive primary colors

A liquid that has molecules that lie in a fairly orderly array

A range of energy levels that electrons may not have in a solid

25

The process of exciting the light-emitting medium in a laser

The degree of coherence in light arising from the spatial nature of the light source

The subtractive primary colors

An electronic conductor that conducts electricity with essentially no resistance

A material that may act as either a conductor or an insulator

C
H
A
L
L
E
N
G
E

Problem

If a helium-neon laser is capable of producing a light with a wavelength of 694 nanometers, in a situation where its frequency is 4.32×10^{14} hertz, what is the velocity of the laser light?

Solution

N
O
T
E
S

6

Modern Physics

Section 21

SEMPRECIOUS

WEIRD MATTER

QUARK COUSINS

BIG AND LITTLE

POTPOURRI

5

The name of the voltage generated by the Hall effect

A kind of matter made of antiparticles

Any particle made of two quarks

The distance light can travel in one year

The study of matter and energy, and the interactions between the two

10

A semiconductor in which the concentration of electrons is much higher than the concentration of holes

Another name for the mu-meson

A general name for any particle that experiences the strong nuclear force

Subatomic particles that are the fundamental building blocks of the hadrons

A force used when the work done on an object depends on its initial and final positions

15

A semiconductor in which the concentration of holes is much higher than the concentration of electrons

Another name for the pi-meson

Elementary particles that have no measurable size and are not influenced by the strong nuclear force

In cosmology, the explosion that started the universe

An object that is surrounded by a magnetic field and can attract iron

20

When *n*-type and *p*-type semiconductors are brought into contact to form a potential barrier at their interface

Another name for the *k*-meson

A particle made of three quarks

The charge on a down quark

This light, as from incandescent bulbs, has dissimilar amplitude, direction, and phase.

25

An electric component that allows electricity to flow more freely in one direction than the other

A kind of particle that always includes a proton as one of its decay particles

The charge on an up quark

A theory that describes all four fundamental forces and all of matter in a single framework

The number used to indicate the flow of fluid through a pipe or around a blockage

C
H
A
L
L
E
N
G
E

Problem

In a vacuum, light has a constant velocity. If we wanted to visit a planet that orbits a star in a solar system 4.5 light-years away, and we had a spacecraft capable of traveling at 15,000,000 kilometers per hour, how long would it take us to reach a planet in this other solar system?

Solution

N
O
T
E
S