

Black Holes Virtual Lessons: Go to the site below and register
Use your class period as log on: Period 1 (example) and password: marshall
<http://spaceclass.org/default.aspx?ReturnUrl=%2fcontrolpanel.aspx>
Check off the lessons as you complete them

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Gravity Quiz

1. Gravity is a force of nature that

- a. Pulls all objects toward the center of the earth b. Holds the moon in orbit around the earth c. Both a & b

2. Without gravity,

- a. There would be no stars. b. There would be no life. c. Both a and b.

3. Who is most widely known for his experiments and analysis of gravity?

- a. Aristotle b. De Vinci c. Galileo

4. During what space mission did an astronaut confirm that light and heavy objects dropped simultaneously on the moon would hit the surface at the same time?

- a. Mercury 7 b. Apollo 13 c. Apollo 15

Escape Velocity

1. What do falling apples have in common with the moon?

- a. They both are pulled toward the earth. b. They both have worm holes. c. Their weight is the same in space

2. Sir Isaac Newton is best known for his

- a. Botanical work with apple trees. b. Discovery of gravity. c. Law of universal gravitation.

3. _____ is the speed it takes to get out beyond Earth's orbit.

- a. Escape energy. b. Escape velocity. c. Cannonball speed.

4. The escape velocity from Earth is about

- a. 2 miles per second. b. 50 miles per second. c. 7 miles per second.

The Speed of Light Quiz

1. Whose theory of relativity included the speed of light in calculating the relationship between energy and matter?

- a. Sir Isaac Newton b. Leonardo de Vinci c. Albert Einstein.

2. How fast does light travel? a. 186,000 miles/second b. One million miles/second c. 150 miles/second.

3. The closest star to Earth is a. Venus b. Sirius c. Proxima Centauri

4. Since it takes light from Proxima Centauri 4.3 years to reach Earth, astronomers say

- a. It is 4.3 light meters away b. It is 4.3 light years away c. We will be able to travel there, once we got to Mars

Relativity at Higher Speeds Quiz

- 1. Nothing can travel at the speed of light because**
 - a. The danger of obstacles in the way is too great.
 - b. The high speed would cause a vehicle to explode.
 - c. It would take infinite amounts of energy.
- 2. An object moving at a pace near the speed of light is said to be moving at**
 - a. Escape velocity
 - b. Relativistic speeds
 - c. Twin speed
- 3. _____ refers to two people or objects affected when relativistic speeds are applied to one of them.**
 - a. Twin paradox
 - b. Twin complex
 - c. Theory of relativity.
- 4. Light always travels**
 - a. Faster at higher elevations
 - b. At the same speed
 - c. Faster when nothing blocks its path

Space Time

- 1. Who said that if the sun vanished, all planets including Earth, would lose their orbits and move in a straight line?**
 - a. Albert Einstein
 - b. Leonardo de Vinci
 - c. Sir Isaac Newton.
- 2. "What goes up must come down" applies to**
 - a. Earth's gravitational force pulling everything down
 - b. Falling off a bike or spilling a glass of milk
 - c. Both a & b
- 3. Curvature of space-time is**
 - a. Sir Isaac Newton's unseen force of gravity between two objects.
 - b. The method used to move objects in space.
 - c. A "fabric" of length, width, height and time in space, in which heavier objects create gravity wells that lighter objects roll around.
- 4. In Einstein's description of space-time,**
 - a. Because of a gravity well produced by the sun, the warped space around the sun travels outward like ripples on a pond.
 - b. The smaller the mass, the deeper the depression or gravity well.
 - c. Gravity is not caused by the curvature of space-time.

The Formation of Stars

- 1. The most abundant gas in the universe is**
 - a. Hydrogen
 - b. Carbon
 - c. Oxygen
- 2. A star is a hot ball of gas called**
 - a. Plasma
 - b. Telstar
 - c. Radon
- 3. Accretion is the clumping of gas and dust in space, caused by gravity, to form a**
 - a. Brown dwarf
 - b. Star
 - c. Both a & b
- 4. The point at which the temperature of a mass of gas and dust causes its core to melt together and release huge amounts of energy.**
 - a. Equilibrium.
 - b. Nuclear fusion.
 - c. Convection.

The Lives of Stars

- 1. When a star is in a stage of burning its hydrogen, it is called a**
 - a. Red giant
 - b. Main sequence star
 - c. White dwarf.
- 2. When a star has burned up its hydrogen, balloons out and begins to burn its helium core, it is called a**
 - a. Protostar
 - b. Brown dwarf
 - c. Red giant.
- 3. When a star burns out its helium core, it**
 - a. Collapses into a small, dim object called a white dwarf.
 - b. Gathers strength and builds back up again.
 - c. Disappears forever.
- 4. Is our sun a star?**
 - a. Yes
 - b. No
 - c. Maybe.

Supergiants and Explosions in Space

- 1. Giant and supergiant stars that are larger than our sun**
 - a. Burn brighter
 - b. Live only a fraction of the sun's life span
 - c. Both a&b
- 2. All of the heaviest elements on Earth, including the _____ in our bodies, were formed in the hearts of massive stars.**
 - a. Carbon
 - b. Bones
 - c. Blood cells
- 3. How do stars release the heavy elements that one day end up making planets like ours?**
 - a. They disappear.
 - b. They explode into a supernova.
 - c. They move on an eastward path around the universe.
- 4. Neutrinos are**
 - a. Ghostly particles formed when electrons and protons from a star's core are crushed together and ejected into space.
 - b. Massless particles that pass through the earth and our bodies without much happening to them.
 - c. Both a and b.

Radiation

- 1. _____, generated by nuclear explosions, are the most energetic form of light.**
 - a. Beta rays
 - b. Gamma rays
 - c. Sunlight
- 2. Any light with a wavelength classified by the electromagnetic spectrum is a**
 - a. Photon
 - b. Neutron
 - c. X-ray
- 3. All living species are adapted to natural radiation found at the earth's surface, called**
 - a. Cosmic rays
 - b. Gamma rays
 - c. Background radiation
- 4. Pulsars are**
 - a. Rapidly spinning neutron stars emitting radiation in the form of x-rays and gamma rays.
 - b. Stars spinning at such constant frequencies that they can be considered cosmic lighthouses.
 - c. Both a and b.

Formation of Black Holes

- 1. According to Karl Schwarzschild, if a star two or three times the mass of our sun collapses, it becomes very dense and curves space-time into what is called a**
 - a. White dwarf
 - b. Cosmic timekeeper
 - c. Singularity
- 2. The gravitational pull inside the center of a collapsing star is called**
 - a. An event horizon
 - b. A core mass
 - c. A deep core
- 3. _____ coined the term, "Black Hole" when referring to objects with such strong gravity fields that not even light can escape.**
 - a. Karl Schwarzschild
 - b. John Wheeler
 - c. Tom Bolton.
- 4. Stephen Hawking discovered that**
 - a. Under certain conditions, black holes give off radiation that we can see from Earth.
 - b. Matter flowing through a black hole must pass through the event horizon or point of no return, and the matter passing through the black hole gives off radiation in the form of x-rays.
 - c. Both a and b.

Gamma Rays Signal Black Holes

1. Gamma ray detectors have to be _____ in order to detect the wave lengths of gamma rays in space.

- a. At least as far away as Mars
- b. Above the earths atmosphere
- c. Within earths atmosphere.

2. The first gamma ray detector was launched

- a. By the Explorer 11 satellite in 1961.
- b. In the year 1054.
- c. By the Vela satellites when the Department of Defense was looking for bombs.

3. Astronomers say that _____ are the sign of the birth of a black hole.

- a. Steady movements of soft light in space.
- b. Shooting stars.
- c. Short gamma ray bursts.

4. When a black hole is born,

- a. A collapsing star sends gas and dust outward at different speeds.
- b. Layers or shells of matter from a collapsing star crash into each other, releasing intense gamma rays.
- c. Both a and b.

Extra Credit! Complete the 26. Black Hole Hunting Virtual Lab 15 pts

1. Write at least 5 sentences about the procedure you had to do in the lab

2. Write at least 5 sentences about your hypothesis or what you expected

3. Write at least 5 sentences about what you learned
