

Solutions Manual

The Spacetime Frontier
Science and Society in the 21st Century

by

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Master Planned Review



True or False

1. F Don't make assumptions!
2. F No one escaped the gun battle.
3. T
4. T
5. F Real plants give off oxygen, which is good for humans.

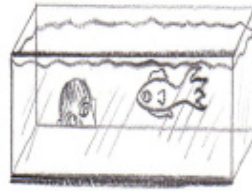
Multiple Choice

1. C Based on the information given, this is the best answer.
2. D
3. D
4. C Nylon is a thermoplastic polymer.
5. C The whole idea that strangers were present made the situation remarkable.

Short Answer

1. In a parallel hybrid, batteries power the electric motor. In a series hybrid, the gas engine powers the electric motor.
2. People tend to feel safe in numbers. Therefore, safety would be the greatest benefit.
3. Sound travels in Earth's atmosphere at 1200 feet per second, regardless of how loud the sound is.
4. Entropy means disorder. The 2nd Law of Thermodynamics says entropy increases spontaneously. The Master Planned neighbors were resisting the 2nd Law.
5. Constant exposure to a stimulus causes numbness. If our society can decrease exposure to violent acts, we might not be so desensitized. Turn off the TV!

PC Me Review



True or False

1. F They bought Martin a stable career.
2. T
3. T
4. T
5. T It's called cognitive engineering.

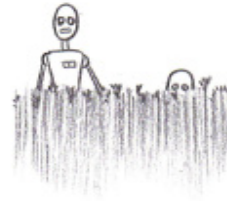
Multiple Choice

1. D
2. D The human body runs on chemical electrical energy.
3. A Also known as Teflon.
4. D
5. B

Short Answer

1. There are more similarities than differences. Both approaches attempt to create superior organisms.
2. Your personality is influenced by your genetics and your environment.
3. I would get an acoustic guitar implant.
4. The rich would get richer, and the poor would get poorer.
5. Martin is a good case study because his father already has an implant. The BioBrain Corporation could examine whether or not implants, contaminated or not, are affected by genetics.

Short Circuit Review



True or False

1. F Alpha suffered temporary sensory overload.
2. T
3. T
4. F Beta was impressed. Alpha was in pieces.
5. F The lieutenant didn't like robots, period!

Multiple Choice

1. B
2. A As of 2009, it is in Russia.
3. A
4. C This is energy that can be converted to other forms of energy.
5. C A robot with an old CPU would be comparable to a human having lesser intelligence.

Short Answer

1. Robots could save human lives. Reliance on too many robots could result in an unexpected and catastrophic full-system failure.
2. Speed = distance / time *or* $d = st$ so 1200 feet per second x 3 seconds = 3600 feet.
3. Free-thinking artificial intelligence = trouble.
4. Sending robots into space is easier than sending humans because robots don't require food, water, and artificial life-support equipment. A rocket filled with robots weighs less and is much smaller.
5. Oxygen and a fuel. Cells use glucose as the fuel.

New World Man Review



True or False

1. F He worked as a rocket pilot.
2. F Bottle rockets use a burning wick, so it depends on the type of fuel in the rocket.
3. F He was disgruntled, not insane.
4. T
5. T

Multiple Choice

1. D
2. D
3. C
4. C
5. C Using a telescope, the human eye will always travel farther than a rocket.

Short Answer

1. I would rent it, and fly to our moon.
2. His intuition told him that the moratorium was wrong.
3. It's not currently possible because modern solar power doesn't create enough energy to propel a rocket through our atmosphere.
4. By definition, Rudy was a follower of scientific law. The astronaut was a pioneer of scientific hypothesis and theory.
5. The 1st Law of Thermodynamics says the energy of the universe is constant. To isolate a sample means to disrupt the entire system. The astronaut believed halting space exploration was a crime against the advancement of the human race.

Love at 1st Byte Review



True or False

1. F This information wasn't provided in the story.
2. F Ellis had no human friends.
3. F She smelled like latex.
4. T
5. T

Multiple Choice

1. B Find a common denominator.
2. C
3. B This is the smallest number.
4. D Synergy means $1 + 1 = 3$
5. B All else aside, Gem worked for Ellis.

Short Answer

1. The nuclear-powered engine, if shot down, would become a dirty bomb.
2. When an atom is split, free energy is released.
3. I would try to find out who the designer was, so I could order more friends.
4. Cell phones, computers, televisions, and cars.
5. $T = d / s$ so $2500 \text{ miles} / 1250 \text{ miles per hour} = 2 \text{ hours of flight time}$. The drone's maximum strike radius would be one hour flight distance from the launch site, giving it one hour to fly home.

The Price of Power Review



True or False

1. T
2. T
3. F There is no apparent connection between the two events.
4. T Gas travels from a high to a low concentration or pressure.
5. F Modern smog contains large particles. Metabolic smog has microscopic particles and climbs high into the atmosphere.

Multiple Choice

1. D
2. D
3. C This answer is the most correct.
4. D
5. B Lithium is an Alkaline Metal.

Short Answer

1. Solar cells collect the sun's radiation - the greenhouse effect. Increased concentrations of radiation in a polluted atmosphere accelerated the growth of the existing microorganisms.
2. I would pay the bill myself.
3. The filter would have to trap the bacteria and kill it, too. Electrocutation, used with bug zappers, would work just fine.
4. When I was growing up, nothing was fat free. Now everything is fat free. So, fat was good, then it was bad. Now, certain types of fat, like HDLs and unsaturated are good again.
5. Greenhouse gases trap the sun's radiation in our atmosphere because they are big, and they collect together to form a big bad blanket. We need to reduce these types of pollutants.

Pay the Premium Review



True or False

1. F He had lots of money.
2. T
3. F It was a fancy ultimate edition.
4. F Everything was fire proof. Nothing was flammable.
5. F A trapped, high pressure system elevates a hovercraft.

Multiple Choice

1. B They wanted to leave all the televisions and computers behind.
2. B Doug's hovercraft was designed for Earth gravity - 9.8 m/s^2
3. D The colonists couldn't decide how to punish the crime.
4. B It was small and really hot!
5. A Getting sick wasn't illegal, just frowned upon.

Short Answer

1. A hovercraft balances between an artificial pocket of pressurized air pushing up and the downward pull of gravity. Open space has no surface for creating a pressurized gas pocket.
2. Make them donate the hovercraft to the museum, and send them back to Earth on the first rocket available.
3. $F = m \times a$, so decreasing mass, (improving the aerodynamics), or decreasing acceleration, or both, would have resulted in less force, which might have prevented the accident.
4. Doug was angry because he lost all control, and no one would help him. Setting the hovercraft and himself on fire, was the ultimate act of self-control.
5. A horse.

Until Death Do Us Part Review



True or False

1. T She had Italian blood that ran thick.
2. T It was electric blue.
3. T
4. T This is a normal gestation period for a human.
5. F Insulin is a hormone, not a drug, but too much can cause low blood sugar, which can lead to brain death, and ultimately cardiac arrest.

Multiple Choice

1. C
2. A
3. C Fifteen million dollars a year.
4. B Cars get hot inside due to the same process.
5. C This is why cold fronts are often windy and sometimes violent.

Short Answer

1. I would want a faster brain with a bigger memory and more creative juice.
2. Grow a clone, remove your bad organs, and replace them with fresh cloned organs. But don't kill the clone!
3. A clone could attend meetings for you. Your friends might learn to like your clone more than you.
4. Abandoned clones would overrun homeless shelters.
5. Janet would be found guilty of murder, and Kevin would be guilty of tampering with the evidence. Jason was guilty of having delusions of grandeur - he was arrogant, which isn't a punishable crime.

The Violation Review



True or False

1. F The forecast was only off by 50 degrees. That's not much for outer space.
2. F This information was not provided.
3. T The pupil dilates in the dark to activate the rods in the eye, which are for black and white vision. The pupil constricts in the light to activate the cones in the eye, which are for color vision.
4. F Theoretically, the gravity is very strong.
5. T

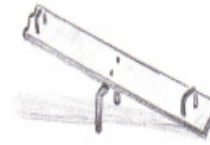
Multiple Choice

1. C
2. A This is why we have high and low pressure systems dominating the weather.
3. D
4. D According to Colonel Richards, telescopes could have done the job.
5. A According to Colonel Richards, chances were good he might survive.

Short Answer

1. The event horizon was moving at a speed sufficient to create friction between atoms, causing red, visible electromagnetic radiation to be released.
2. Putting words together eventually creates books.
3. When stars of a certain mass die, they implode due to sudden and extreme gravitational forces. The very fabric of space and time warps violently, and a black hole is born.
4. Allie agreed with his philosophy about the future and his theory about a stable core. Allie, too, was hungry for further discovery. However, she was an accomplice to the crime.
5. The 1st Law of Thermodynamics says the energy of the universe is constant. The complete elimination of just one human might be enough to imbalance the entire human species.

October Rocket Review



True or False

1. F Fourteen months.
2. F A rocket pilot.
3. T The likelihood of the rocket working properly was slim. It might have even blown up.
4. T A sonic boom requires an atmosphere for sound conduction.
5. F The oxygen is stored in tanks.

Multiple Choice

1. A
2. A
3. A H_2O is the exhaust. Some cars run on the same fuel source.
4. D Morgan's daydreaming was severe. He appeared to be mentally ill.
5. C A runaway chemical reaction, as with a leak in a fuel tank, could cause a fatal explosion.

Short Answer

1. Beef jerky, vitamins, and water.
2. The milk glass was always empty, Eli had a habit of disappearing, and the front door was falling off its hinges.
3. Hydrogen and oxygen. Steam is H_2O .
4. I would try to fix the playground rocket, too.
5. Some math problems can be solved with logic. Your rocket has a speed that is half the speed of light, which would double the time it takes to go one light-year. Doubling 4.3 light-years gives you 8.6 years of travel time.

Sunset Boulevard Review



True or False

1. T
2. T Density and temperature differences contribute to typical smog production.
3. T It takes about 30 days for the sun to turn one rotation.
4. F $V = IR$. Voltage = current x resistance. This is called Ohm's Law.
5. T Magnetic forces create rotational motion, causing small axles to turn.

Multiple Choice

1. D
2. A Bacteria can live on nonliving substances and surfaces.
3. A The visible layer, the corona, isn't the hottest layer.
4. D
5. A White light is violet, blue, green, yellow, orange, and red combined.

Short Answer

1. They would surely see humans as inferior and try to enslave or eliminate us.
2. I would make it run all my errands and do all my shopping.
3. $V = IR$ so $2.0 \text{ amps} \times 2.0 \text{ Ohms} = 4 \text{ volts}$
4. Nuclear, solar, chemical, electrical, fossil fuel, and old-fashioned wind-up springs.
5. My robot would learn to type my books.

Space Ark Noah Review



True or False

1. F Leslie was programmed to run the greenhouse.
2. F The evidence is circumstantial.
3. T Introverts often have great powers of analysis and concentration.
4. T
5. T Biomes form because certain plant species share common needs.

Multiple Choice

1. D
2. D Forests are being replaced by profitable crops like feed corn and soy beans.
3. D
4. A You could easily run out of food in a biodome.
5. A If all visible light is absorbed, then the resulting color is black.

Short Answer

1. One way to silently suspend a camera would be through the use of concentrated magnetic fields radiating from the camera itself, or just use wires.
2. The practice of storing seeds preserves the species, but seeds don't take part in photosynthesis, which produces oxygen.
3. One massive volcano would do it. The atmosphere would turn very cold very fast.
4. Photosynthesis requires plants. Having plants on Earth are the only way to maintain our 21% oxygen levels.
5. Dr. Shaver electrocuted himself. If he had waited a few more minutes, the rain would have stopped. There is no evidence to prove Leslie was trying to kill him.

The Edge of Understanding Review



True or False

1. F Fogle was a student.
2. T The evidence indicates the admiral has a serious problem.
3. F Fogle was fearful because the admiral was psychotic, and his actions were completely unpredictable.
4. T Diffusion means moving from a high concentration to a low concentration.
5. T It takes sunlight about 5 hours to reach Pluto.

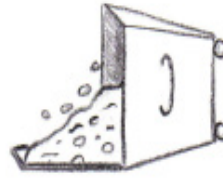
Multiple Choice

1. D Called Olbers' Paradox, there is no explanation why the night sky is dark.
2. B Delusions and hallucinations are apparent side effects to light-speed sickness.
3. C
4. D
5. A

Short Answer

1. As you move through space, time will be conserved. The faster and farther you travel, the more time you will save. Space and time are the same entity.
2. My understanding of astrophysics is modest, but greatly enjoyed, just the same.
3. If you are travelling in a rocket for ten years at light-speed, and your wife is waiting for you on Earth, when you return, she will be ten years older, and you will only be a few days older.
4. Respect the chain of command. Fogle should go to his commanding officer, and no higher, unless his superior fails to respond.
5. We need to stick with telescopes until time travel is invented. Light-speed exploration is just too slow to be much benefit in such a big universe.

It's Not Your Fault Review



True or False

1. F Rio de Janeiro is a city on the coast of Brazil.
2. F It doesn't get cold in Rio because it's located on a coastline, and near the equator.
3. T
4. T Earthquake epicenters can be located this way.
5. F This is a common myth.

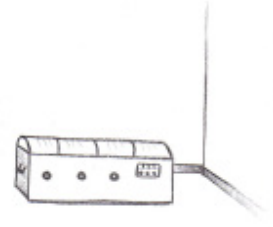
Multiple Choice

1. A This is why sunsets are often red - the other visible colors have short wavelengths and can't make it through our thick atmosphere.
2. D
3. B
4. C The clone betrayed Major Biddle.
5. C

Short Answer

1. Complete power disruption. Cars would stop, appliances would stop, water would stop flowing, and all communication would be disrupted for weeks. It would be a highly effective weapon.
2. Anything rocket-propelled relies on a chemical reaction, or the result of gases expanding in a reaction chamber. A paintball gun is propelled by expanding carbon dioxide alone, not a chemical reaction with another substance.
3. $S = d / t$ so $50 \text{ meters} / 5 \text{ seconds} = 10 \text{ meters per second}$ - a very fast shark!
4. A polymer is a very long chain of carbon atoms surrounded by hydrogen atoms. It's flexible because of its long shape.
5. She was cold and clammy, pale, skinny, and rather unemotional.

The 100-Year Lease Review



True or False

1. F He was dreaming about love and acceptance.
2. F The thug wanted to use the chamber to preserve his own skin.
3. T Everyone has to face reality eventually.
4. F Venus is closer to the sun, but its atmosphere is too thick for efficient solar power.
5. F We are carbon-based and have a limited life-span.

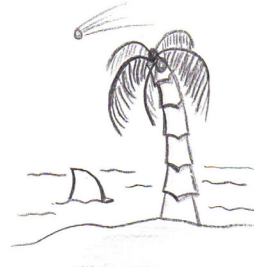
Multiple Choice

1. A Archeologists say Neandertals were small humanoids living alongside existing humans.
2. A
3. C Increasing pressure will decrease temperature, all else remaining constant. Charles's Law says $V_1/T_1 = V_2/T_2$. Since the gas molecules can't move as much, the temperature decreases.
4. B This is twice our atmospheric level. The other measures indicate normal levels.
5. D No matter what technology you employ, humans only live for an average of 70 years.

Short Answer

1. The thug had immediate rightful claim to the chamber simply because he was armed and dangerous.
2. Society as we know it would dissolve. People from all times past would constantly be dropping in on the present. Government would be impossible.
3. I would have to be sponsored to suspend my life for 10 years. Who's going to pay the bills?
4. If you had an incurable disease, you could be suspended until the cure was found.
5. I would use it 3x per week for 24 hours, adding 30 usable years to my life.

Satellite Time Review



True or False

1. T Wow!
2. T
3. T
4. F Susan was fairly content living in a penthouse in Miami.
5. T An inflated balloon would contract if it went to the bottom of a pool.

Multiple Choice

1. D
2. C Deadly chemicals can enter the body through the eyes, nose, mouth, and skin.
3. A
4. A The pupils dilate, allowing more light to come in.
5. B Speed = distance / time, so 25,000 miles divided by 24 hours equals 1042 mph.

Short Answer

1. Self Contained Underwater Breathing Apparatus - the high pressure air in the tank naturally flows to the low pressure air in the regulator and lungs. The regulator keeps it from happening all at once.
2. Much of the infrastructure on our planet already runs automatically. Humans are only needed to fix breakdowns and monitor the artificial intelligence.
3. Newton's 1st Law of Motion says an object in motion will remain in motion unless acted on by an external force. The satellite will continue in its orbit, fire or no fire.
4. Our atmosphere is dense and dynamic, so a pollutant can readily diffuse and spread planet-wide in a short time.
5. We can start by eliminating weapons of mass destruction.

A Celebration Worlds Apart Review



True or False

1. F He was out for a casual walk.
2. T
3. F The problem was - they didn't share a common reality.
4. T
5. T If you look at the world with one eye closed, you can still perceive distance, but your accuracy decreases significantly, and you will have to rely on visual cues to measure distance.

Multiple Choice

1. D Combining both realities.
2. B Localized heating and convection currents are a good recipe.
3. D Earth has seasons because it tilts 23.5 degrees from perpendicular.
4. A Refraction is similar to bending.
5. B

Short Answer

1. According to the theory of relativity, it would depend on Pluto's linear speed. The faster it is moving, the less you would age in Earth years. As it turns out, Pluto's average orbital speed is 10,400 mph, which is much slower than Earth's speed of about 70,000 mph. In short, you would age faster if you lived on Pluto.
2. Crime is punishable, and all men have the right to life, liberty, and the pursuit of happiness.
3. A physical abnormality in the spacetime fabric would have to be present, like a warp or overlap, the result of extreme astrophysical forces. Chances are, it would be a dangerous place to be standing or picking flowers. The Bermuda Triangle is known for the same.
4. Hunger, war, disease, pollution, and capitalism. There's money to be made on Mars!
5. D₂O boils at 215 degrees Fahrenheit. H₂O boils at 212 degrees Fahrenheit.

Shallow Grave Review



True or False

1. T Planets and ore deposits.
2. F Richard was a robot. Apparently his legs weren't finished.
3. F He was just another robot.
4. T
5. T Walking is an incredible act of balance, granted to only a few species.

Multiple Choice

1. A
2. C Hydrogen + hydrogen = helium.
3. D No part of our galaxy is truly devoid of matter, although the density of open space is extremely low. Space averages 10^6 atoms per cubic meter, or just one atom per cubic centimeter.
4. A This assumes Mercury Six had a tilted axis. No tilt means no variation in the sun's radiation throughout the year. If Earth had a slower revolution, our seasons would be longer, too.
5. B The formula for gravity involves mass divided by distance.

Short Answer

1. A red giant is an old star, with low mass, and low gravity, running out of fuel quickly.
2. Government is supported by many emotional decisions. A robot without emotion would make dramatic changes.
3. I would want a robot with a personality like Charlie Allnut.
4. Don't discard spent fuel cells. Don't leave tools floating in space. No speeding close to planets. If your rocket breaks down, park it out of the way.
5. Both theories help to explain gravity.