ACT Science Homework
Science 1, Set 2

20 Minutes — 24 Questions

DIRECTIONS: There are five passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Passage I

Scientist 1

What happened to the dinosaurs? There are several theories. One has to do with an asteroid strike. Iridium is an element found only very rarely in the earth's crust. It has been found in large quantities in volcanoes and in meteorites and asteroids. Near fossils of dinosaurs there are typically large amounts of iridium, much more than would typically be found in the earth's crust normally. It has been calculated that an asteroid approximately 10km in diameter would contain enough iridium to account for the iridium spike contained in the clay layer.

Since the original discovery of the iridium spike, other evidence has come to light to support the asteroid theory. Analysis of the clay layer has revealed the presence of soot within the layer. It is thought that the presence of the soot comes from the very large global fires that would have been the result of the large temperatures caused by an impact. Something else that was found within the clay was quartz crystals that had been physically altered. This alteration only occurs under conditions of extreme temperature and pressure, and quartz of this type is known as shocked quartz. Evidence has been found of what could have been an impact site, a ring structure 180km in diameter called Chicxulub. The crater has been dated as being 65 million years old, from approximately the same time the dinosaurs mysteriously died out. The blast of a large asteroid impact would have destroyed everything within a radius of between 400 and 500km, including the object. At the same time, large fires would have been started by the intense shock wave, which would have traveled long distances. Trillions of tons of debris (dust, gases, and water vapour) would have been thrown into the atmosphere when the object vaporized. In the days and weeks following the impact, the cloud of debris would have been carried over large distances by the post blast high winds. This will have caused months of darkness and a decrease in global temperatures. After this there would have been an increase in temperatures caused by the large amounts of CO_2 released by what would have been global fires. Eventually this would cause chemical reactions that would result in the formation of acid rains.

On the land the effects of the impact on the flora and fauna would have been devastating, especially for the large animals that would need large food supplies and for the dinosaurs that would need sun light to keep warm. The global fires would have destroyed considerable amounts of vegetation (by the analysis of the soot in the boundary between the end of dinosaurs and the beginning of the new era, it is estimated that 25% of the vegetation cover was destroyed); the immediate effect of this would have resulted in the death of the large herbivores. Analysis of the boundary fossils shows that there was a short-term takeover of the land by the hardy ferns, which moved into the areas were there had been fires.

Scientist 2

What happened to the dinosaurs and their contemporaries? The extinction of the dinosaurs – thought to be caused by an asteroid impact some 65 million years ago – was more likely to have been caused by a 'mantle plume' – a huge volcanic eruption from deep within the earth's mantle, the region between the crust and the core of the earth.

This theory, already supported by a significant body of geologists and paleontologists, is strengthened by new evidence to be presented at an international conference. Research by an American earth scientist suggests that a similar eruption under the Indian Ocean several million years before the extinction of the dinosaurs had a similarly devastating impact on the environment. However, at this earlier time there is no evidence of any asteroid impact. Her findings are based on analysis of microfossil assemblages, which were found inside cores that had been drilled deep into sediments on the ocean floor.

The eruptions that were responsible for these two extinction events were a result of mantle plumes – a phenomenon caused by rising hot mantle from deep within the earth. Likened to the actions of a lava lamp, the mantle's heat causes it to rise and mushroom out; it then flattens causing the mantle to melt and erupt magma over the earth's surface and across an area of some 1,000 kilometers diameter. These eruptions last between one and two million years, and more than one million cubic kilometers of lava can be erupted in that time. Today, it is possible to witness seven huge remnants of such mantle plume activity. These are also known as 'hotspots' and are responsible for the volcanic activity on Iceland, the islands of Hawaii, Easter, Reunion, Tristan, and Louisville as well as volcanism in the Afar region of Ethopia. These eruptions not only destroy many kilometers of land, but they also throw fine particulate or ash high into the air. This particulate acts as a sun block, cooling the entire globe down while altering weather patterns and climates for many years. Also, magma and lava are the only terrestrial or earth bound source of major iridium.

"Mantle plumes are literally a hot topic for debate," said Dr. Andrew Kerr of Cardiff University's School of Earth, Ocean, and Planetary Sciences. "They are a catalyst for the formation of ocean basins and fundamentally reshaping the earth's surfaces. The massive outpouring of lava, ashes, and gas can have significant effects on climate, which destabilizes the environment and has the potential to dictate the course of evolution. It is likely that were it not for mantle plumes, mammals would not have become predominant, and humankind would not be here today.

http://web.ukonline.co.uk/a.buckley/dino.htm source material
http://www.bbc.co.uk/beasts/whatkilled/theories/volcanoes1.shtml source material

1. Scientist 1 and Scientist 2 would agree on which of the following statements?
   A. The presence of iridium near fossils confirms the asteroid theory.
   B. Dinosaurs were killed when an enormous asteroid hit the surface of the planet.
   C. Dinosaurs were killed when a very large volcano exploded and caused widespread damage.
   D. Dinosaurs were killed by something that blocked out the sun, causing climate change and habitat destruction.

2. Scientist 1 would argue that
   F. The size of the crater suggests it could have caused the downfall of the dinosaurs.
   G. The large presence of dust would indicate an asteroid.
   H. Mantle plumes are so gigantic that they would pack as much power as the asteroid hit.
   J. Mantle plumes are continuing to rise to the surface, threatening another mass extinction.

3. Scientist 2 would argue that
   A. The theory of a 'mantle' plume is a stronger argument for the extinction of the dinosaurs than the asteroid theory.
   B. The presence of iridium confirms the asteroid theory.
   C. The evidence of soot confirms the asteroid theory.
   D. The volcano was not all over the globe and therefore could not have done as much damage.

4. Scientist 1's theory is refuted by
   F. Evidence of a large asteroid crater.
   G. Large amounts of asteroid material around the fossilized bodies of the dinosaurs.
   H. Large amounts of volcanic ash around the fossilized bodies of the dinosaurs.
   J. Evidence of a small amount of volcanic action.

5. An extension of Scientist 2's theory would be
   A. The inability to find large mantle plumes anywhere in the crust and mantle.
   B. Mantle plumes that produced more land.
   C. Eruption of another super volcano.
   D. Huge asteroid fragments in many places throughout the dinosaur fossil beds.

6. Scientist 1's theory is confirmed by
   F. Large amounts of volcanic ash around the fossilized bodies of the dinosaurs.
   G. Large amounts of asteroid material around the fossilized bodies of the dinosaurs.
   H. Evidence of a small amount of volcanic action.
   J. Evidence of a large asteroid crater.

7. To prove the theory of Scientist 2, a study would have to show
   A. The existence of mantle plumes capable of producing large quantities of land.
   B. The existence of mantle plumes capable of producing large quantities of ash and heat.
   C. The existence of asteroids that are 10-20 km in diameter.
   D. The existence of new mantle plumes.

Passage II

Scientist 1

PVC or polyvinyl chloride is a plastic that is used for a myriad of things. Flooring and windows are made from PVC as are water bottles, water pipes, and plastic wrap. It is found in hundreds of products that most people use on a daily basis. It is an inexpensive plastic to manufacture and can be recycled. When in its early days, there were some wasteful processes; as technology improves so does the ability to make and recycle PVC with less and less energy.

PVC is used extensively in children's toys, particularly those that young children put in their mouths. Some discussion has taken place about the safety of PVC in toys that are mouthed. PVC can degrade into a chemical called a phthalate that can be dangerous. However, research has concluded that for a child to have any risk the child would have to have the toy in his or her mouth for 75 minutes a day or more. The average daily mouthing time (the amount of time the toy is in the mouth) of soft plastic toys for young children was 1.9 minutes a day, far below the level at which there may be a risk. Even the children with the highest amount of mouthing time were far below the 75 minutes a day mark.

Though PVC can degrade, releasing phthalates, it is also possible to reuse and recycle them. Taking this step would prevent them from being incinerated, when phthalates can be released, or left in a landfill, where phthalates can leak into groundwater. It is possible to build a "closed loop" system that recycles all PVC instead of reducing it to landfill. This would also reduce the amount of energy needed to create it, helping the environment. PVC is a welcome product that can help people in thousands of ways, if the public treats it correctly.

Scientist 2

Exposure to PVC in its many uses has been shown to be associated with many health problems. There is research that links PVC in flooring to an increase in respiratory problems. Also there are many studies that link the exposure of phthalates to many different types of disorders, including reproductive, endocrine, and nervous systems. This exposure also seems to affect children more than adults. The amount of PVC in children's toys is very disconcerting.

As PVC gets made, many phthalates are released into the air. Even after the true manufacturing is done, there is still phthalate residue on the plastic, which escapes into the environment. Along with phthalates, chlorine gas and chloride residue have been found around manufacturing facilities. This residue seeps into the ground water and makes it not potable.

The recycling of PVC is another problem. It can only be recycled with like materials, meaning that PVC can only be recycled with other PVC. One bottle made of plastic containing PVC would contaminate up to 10000 already recycled bottles. The vinyl chloride containing plastic will need to be sorted separately from all of the other plastic—sorted only by its small label of a three in a tiny triangle on the bottom of the packaging.

PVC is found in hundreds of things used on a daily basis by most Americas. Once it is used and thrown away, it generally goes into a landfill, unable to be broken down. The sorting facilities do not exist for it to be properly recycled. Between the manufacture of PVC, the phthalates exuded in its use, and the inability to find a new life for it, it is hard to believe the manufacture of PVC is still highly encouraged today.

http://www.naturalstep.org.uk/2020_top.html source material
http://www.toy-tia.org/Content/NavigationMenu/Press_Room/Industry_Statements/DINP/CPSC_Staff_Report_September_2002/CPSCStaffReportSep2002.pdf source material

8. Both scientists would agree that
   F. Plastics have many important uses.
   G. PVC is a plastic that has outlived its usefulness.
   H. PVC can protect lives.
   J. PVC should continue to be manufactured prolifically.

9. Scientist A probably works for
   A. Someone who is advocating for the plastic industry.
   B. Someone who is interested in using science to find the true answer.
   C. Someone who is advocating for children's health.
   D. Someone who is advocating for the environment.

10. One advantage of having PVC is
    F. The amount of phthalates that are in the environment.
    G. The amount of chloride that is in the environment.
    H. The amount of things that can be made cheaply.
    J. The amount of recycling that can be done easily.

11. According to Scientist 2, people who are exposed to PVC
    A. Will be grateful for the amount of things it can be used to do.
    B. Will recycle all of their PVC separately from other plastics.
    C. May develop heart conditions.
    D. May develop reproductive cancers.

12. Assuming the research Scientist 1 did is correct, how would supporters of Scientist 2 explain the large number of children that have been exposed to PVC and phthalates and have not developed any disorders at all?
    F. Scientist 1 did not take into account all of the things that have PVC.
    G. The amount of PVC and phthalates that are considered dangerous was incorrect.
    H. The link between these disorders and PVC and phthalates is tenuous.
    J. The disorders are apparent only after years of exposure, which was not tested in the research.

Passage III

Scientist A

Genetically modified foods haven't been proven safe for all people to eat. Since there isn't a strict testing or labeling law, many people have already eaten genetically modified foods with disastrous results. Genes are inserted from one species to another; scientists have no way of telling which aspects of the secondary species are going to show up. Many allergens have been introduced this way: people eat a food they are typically not allergic to and have a reaction. Their immune systems are reacting to the gene that had been spliced into the first species. These genes are very unpredictable. When they are placed in plants that are grown in an open field, many times the pollen travels and unknowingly affects plants that were grown to be non-genetically modified. Also, genes have been inserted into animals that have escaped into the wild, infecting indigenous and endangered species. Before we irrevocably change our environment, the long-term effects of cross species genetic engineering should be intensely studied. While scientists agree that there are advances that can help increase crop production, nothing should be released into the wild until all of its effects can be studied. Only then can scientists determine the true safety of genetically modified food.

Scientist B

Is it dangerous for us to eat foods made from soybean or corn varieties that are genetically modified? Definitely not. The soybean and corn varieties differ from their conventional parent in two ways: each has an extra gene and each makes a protein that otherwise would not be made. Consuming the DNA is not a hazard. We do that all the time. It is the sequence of four chemicals in DNA that provides the blueprint for making proteins, and during digestion the sequence is destroyed so the blueprint is destroyed. The protein made by the corn that is toxic to the European corn borer is not toxic to people. In fact, we digest it like we would any other protein. The same is true of the extra protein made by the herbicide-resistant soybeans.

Critics of genetically modified foods have expressed concern that these types of hybrids could cause allergic reactions. However, more than 90 percent of food allergies are known to occur in response to specific proteins in eight foods: peanuts, tree nuts, milk, eggs, soybeans, shell fish, fish, and wheat. The FDA is well aware of the problem that could occur if allergenic proteins were transferred to other foods without consumer knowledge and has taken steps to prevent that.

Even if genetically modified crops are safe, is there any compelling reason to switch to them? Some farmers think so. It is estimated that about 40 percent of soybeans and 30 percent of corn grown in the United States this past year were genetically modified. In the case of these crops, there are economic as well as envi-

ronmental incentives to use the modified varieties. In addition to somewhat increased yields, lesser quantities of herbicides and pesticides are needed. That lowers production costs and decreases the addition of chemicals to the environment.

Still, these are only two of the first-generation crops that have been produced by biotechnology. It is fortunate that advances can be expected to have an even greater impact on productivity because the world's population continues to increase with no increase in land to grow food. It is estimated that the world's population will hit 9 billion within 50 years. Advances in biotechnology provide the best hope that enough food can be produced to feed an ever-expanding population. If the use of molecular biology is done with as much care as it has been up until now, our food supply should remain abundant and safe long into the future.

13. Scientist A and B would agree that
    A. Genetically modified foods are safe to eat.
    B. Genetically modified foods should be studied more thoroughly before beginning widespread planting.
    C. Genetically modified plants can pollinate other indigenous plants and cause harm.
    D. Genetically modified planting should be done with extreme care.

14. Scientist A would probably also agree that
    F. The people who are depending on genetically modified organisms should be allowed to use them.
    G. Genetically modified organisms will help the world's ecosystems remain diverse.
    H. Planting of genetically modified organisms should be allowed after they have been tested.
    J. If genetically modified organisms are allowed to reproduce and enter the food chain, they should be labeled.

15. Scientist B's position is
    A. Genetically modified foods are good for the people who eat them and fine for the environment.
    B. Genetically modified foods are bad for the environment.
    C. Genetically modified plants differ from the original species by more than just DNA.
    D. Genetically modified plants that are used in foods should be labeled as such.

16. Scientist B would argue that Scientist A
    F. Is putting the needs of the people of the earth before the health of the earth.
    G. Is not considering the research that has already been done.
    H. Sees genetically modified food objects as the same as non-modified objects.
    J. Has reason before passion.

17. A point of contention between Scientist A and Scientist B is
    A. Genetically modified organisms are the next step in plant science.
    B. Genetically modified organisms are not different from the original and their planting should be allowed.
    C. Genetically modified organisms are virtually the same as the original and need not be labeled any differently in foods.
    D. Genetically modified organisms are different from the original and their planting should not be allowed.

18. Scientist B thinks
    F. Genetically modified foods will not help the world.
    G. Genetically modified foods will help save animals from extinction.
    H. Genetically modified foods are the answer to world hunger.
    J. Genetically modified foods will endanger animals and plants wherever they are planted.

19. Scientist B would also agree that
    A. Genetically modified organisms should continue to be as strictly tested as they have already been.
    B. Genetically modified organisms should be tested in a long-term study to see their effects.
    C. Genetically modified organisms will harm indigenous salmon population.
    D. Without genetically modified organisms, the population of the earth will still have enough to eat.

Passage IV

Scientist A

Many car companies are considering using hydrogen as an automotive fuel. While it only has a range of approximately 200 miles, the research and development that is being done is very positive. Hydrogen engines work differently than standard gas-powered engines and do not produce carbon monoxide, like gasoline-powered cars. When hydrogen is burned, it turns into water and is released harmlessly into the air. The source of power is significantly cleaner than the combustion that occurs in gasoline powered engines today. 90 percent of all carbon monoxide pollutants come from automobiles. This carbon monoxide is the major greenhouse gas that is causing the purported global warming. A hydrogen-burning car, on the other hand, only produces water as its by-product. In addition, the demand for oil is increasing exponentially causing major spikes in prices. A major source of hydrogen is actually from coal, another fossil fuel. When coal is burned to make electricity, it produces hydrogen as a by-product. Right now, this is being released into the air. Since it is already being produced, it would only have to be harvested and stored before it could be used. Hydrogen can be stored in various ways, even though it will take much more hydrogen to fuel cars than it does gasoline. Hydrogen can be stored in its room temperature gaseous form or in a smaller, liquid form, though much colder. This cold, liquid hydrogen can then be pumped into cars and used. Filling stations are being set up all across the country in order to respond to the growing demand for alternative energy cars.

Scientist B

Scientists, though encouraged by the possible reduction in carbon monoxide emissions, are fearful of other emissions from hydrogen-powered cars. Studies are showing that the leaked hydrogen could increase the concentration of greenhouse gases in the atmosphere. The problem is destruction of OH radicals, but this time in the troposphere. OH is an environmental scrubber, reacting with and removing all manner of pollutants, including the potent greenhouse gas methane. Lower levels of OH would allow methane to stick around in the atmosphere longer, allowing the greenhouse influence to rise. No one is really sure just how much hydrogen will escape into the atmosphere, but since it needs to be stored under temperatures much cooler than average room temperature, the chances are high that at least some will. However, any increase in hydrogen, under the current research, has the potential to increase rates of methane and the average global temperature. While creating the hydrogen from the coal will create more carbon monoxide as the coal is being gasified, it will allow the carbon monoxide to be created in one location, with the possibility of collecting and recycling instead of millions of cars spewing it into the atmosphere. Another possible problem is the excess hydrogen in the atmosphere. Right now, microbes in the soil utilize hydrogen, taking it from the atmosphere. If there is an increase in atmospheric

hydrogen, there are no models for the amount of hydrogen these microbes will absorb. Are we just trading one set of problems for another? Before we commit large amounts of resources, scientists should be sure all of these variables are controlled.

http://web1.infotrac.galegroup.com.ezproxy.downersgrovelibrary.org/itw/infomark/23/630/63516402w1/purl=rc1_GRGM_0_A110400404&dyn=7!xrn_15_0_A110400404?sw_aep=down78413 source material
http://www.efoa.org/fr/mtbe_air_quality/auto_pollution.htm source material
New Scientist, Nov 15, 2003 v180 i2421 p6(2) –source material

20. An extension of Scientist B's argument is
    F. Research should determine how much hydrogen would leak before hydrogen-powered cars are put into production.
    G. Using hydrogen as fuel for cars is not going to help the problems of global warming.
    H. The amount of oil being used for gasoline will increase in the future.
    J. The amount of carbon monoxide created will pollute the atmosphere as much as the exhaust from cars.

21. One thing Scientist A and B will agree on is
    A. The need for new technology isn't that pressing.
    B. Hydrogen-fueled cars will help decrease our use of oil.
    C. Hydrogen-fueled cars will solve all our energy problems.
    D. New forms of fuel will create more problems than they solve.

22. Scientist A would agree
    F. Hydrogen-fueled cars will also increase global warming, albeit not as quickly.
    G. Though there are some design flaws that still need to be addressed, hydrogen-fueled cars are not going to decrease the amount of global warming.
    H. With the increase in demand of oil, making hydrogen cars will not alleviate the cost of new technology.
    J. Though the range for hydrogen-fueled cars is somewhat limited today, their ability to move vehicles cheaply and cleanly is something to be admired.

23. A weakness of Scientist B's argument is
    A. Using hydrogen as fuel may decrease the amount of methane in the air, increasing the risk of global warming.
    B. Using hydrogen as fuel may increase the amount of carbon monoxide in the air, increasing the risk of global warming.
    C. Using hydrogen as fuel may increase the amount of hydrogen in the air, with unknown results.
    D. Using hydrogen as fuel may increase the amount of OH in the air, helping reduce the amount of methane.

24. A strength of Scientist A's argument is
    F. Hydrogen will only emit water.
    G. Gasoline is easier to store.
    H. Gas powered cars have further range.
    J. Hydrogen production will keep all carbon monoxide out of the air.