

Reading Questions from September 2006 Scientific American
on website, pages 46-114.

The following questions serve as a reading and study guide for exam 3. Answers do not need to be turned in, however, if you write out answers for each question, you are more likely to remember them when you take the exam. At least 25% of exam 3 points will come from the reading questions that follow. ~~Questions that are struck through, such as this sentence, do not need to be answered.~~

1. The author states that the debate on global warming is over. What specifically is said about present carbon dioxide levels, compared with the past?
 2. Fill in the blanks, from page 47: "The U.S. holds less than ___ percent of the world's population but produces nearly ___ percent of carbon emissions and has played the role of _____ by failing to _____ the Kyoto Protocol..."
 3. From the diagram on page 48, explain exactly how greenhouse gasses warm the lower atmosphere.
 4. What is potentially dangerous about advocating a single technology as a solution for clean energy?
 - ~~5. What is the definition of carbon intensity? What has its rate of decline been over the last 30 years? For global emissions to be the same in 2056 as today, the carbon intensity will need to fall at what rate from now on?~~
 6. Describe and briefly explain the two long-term trends that will help control carbon intensity (p. 52).
 7. Using coal to make synthetic fuels would result in what change in emissions per mile of driving? What effect could this have on global carbon intensity?
 - ~~8. Tony Blair of Britain has advocated an emissions goal for the UK and the world. If this goal were applied to the US (p. 57), what are the three basic strategies that would enable it to be accomplished (see caption under graph)?~~
 9. Transportation accounts for approximately ___ % of worldwide greenhouse emissions.
 10. What are the four options explored for reducing greenhouse gas emissions from motor vehicles? (pp. 60-63)
 11. On page 63, the authors state that market forces alone are unlikely to curb our ever growing appetite for petroleum. Summarize the meaning of each part of the coordinated package of fiscal and regulatory policies that they suggest will need to come into play
 - feebates
 - stricter CAFE standards
 - fuel taxes (you need not summarize the meaning of this!)
 - tax incentives
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1. Beginning of page 64, the authors identify what the quickest, least expensive way to stem carbon emissions is. Summarize, and then describe what was learned in 4000 buildings in Europe.
 2. The authors of this article have in mind in the final paragraph a meaning of energy efficiency. Summarize. Does this necessarily entail reduced comfort?
 3. Discuss two primary reasons why coal presents such a dilemma (article beginning on page 68).
 4. What is the solution to the coal emissions issue that is proposed in this article? What keeps this potential solution from being an actual solution? (Write an essay length response, and be sure to read rest of article for full answer)
 5. Regarding the previous question, why do the authors believe that delaying carbon capture and storage at coal power plants is shortsighted?
 6. In the context of the theme of this edition of the Scientific American, why is the chapter on nuclear energy included?

7. Describe and explain the three things that the authors argue are necessary for their scenario of more nuclear power to be implemented.
 8. ~~What did the MIT study estimate as the likely cost, in cents per kilowatt-hour, of:~~
 - ~~a) nuclear power:~~
 - ~~b) natural gas, with no carbon tax:~~
 - ~~c) coal, with no carbon tax:~~
 - ~~d) coal, with a tax of \$50 per ton of carbon emitted:~~
 - ~~e) solar photovoltaic (p. 86):~~
 - ~~f) solar thermal (p. 89, both now and ultimately):~~
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RENEWABLE ENERGY (p. 84)

1. What are advantages of renewable energy that are cited by the author? (also include list on page 92, last paragraph).
 2. Sunlight could supply _____ times as much energy as the world currently consumes.
 3. What are current cost trends of solar power in cents per kilowatt-hour? (up or down)
Students: note that since this article came out, the trend has been even stronger.
 4. Which country is the world leader in the number of solar power systems installed per capita, and what is a reason for this, as inferred by the author?
 5. Compare growth in wind power with that of solar power.
 6. In the US, what share of current total electricity consumption could wind provide? (p.89)
(note: also to be discussed and explained in class)
 7. What is one societal barrier to the placement of some wind installations?
 8. The authors suggest that in the case of the US, corn-based ethanol's impact on greenhouse gas emissions is troublesome. Summarize. Why then, is corn-based ethanol being trumpeted as a cornerstone of US energy policy? (also to be discussed in lectures)
 9. ~~Read the section on page 38 on biodiesel. On what criteria is biodiesel better than corn-based ethanol?~~
 10. What is cellulosic ethanol? Why is utilizing it likely to be more greenhouse gas favorable?
 11. Between 1980 and 2005, the fraction of all US R&D spending devoted to energy declined from ____% to ____2%. Total private spending on energy R&D in 2005 dropped to just ____% of its 1980 levels.
 12. Summarize the market based schemes put forward by the author to creating a sustainable energy economy. How does he believe this approach would give energy companies enormous financial benefits (p. 93)?
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13. The author of the chapter on hydrogen (p. 94) states that in the near term, _____ is the best way to slow the rise in oil use. However, why does she believe that even if this happens, oil consumption and carbon emissions are likely to rise?
 14. What are the emission products that come from the tailpipe of a hydrogen-powered fuel cell car?

15. What are the renewable ways that hydrogen can be made, and non-renewable ways that hydrogen can be made, according to the article?
16. In a paragraph, summarize each of the reasons why the author believes that a transition to hydrogen, if it occurs, will be a marathon, not a sprint?
17. ~~Assuming a cost of production of \$8 per kilo of hydrogen (utilizing electrolysis or biomass gasification), and that a fuel cell will propel an auto some three times as far per energy use equivalent as a standard internal combustion engine, compare the cost of auto travel with gasoline at \$2.67 per gallon. Which is cheaper, assuming someday that either type of technology in an auto costs the same?~~
18. In the article on Plan B that begins on page 102, nuclear fusion is discussed. It is technologically possible given today's level of technology, but it is still a long ways off. Why? (a one word answer will suffice)?
19. What does high altitude wind offer that is superior to wind energy generation that is near the surface?
20. What two characteristics does space-based solar have that terrestrial-based solar energy collection does not? What are the challenges facing the collection of solar energy from space, besides cost?
21. What is meant by the term "nanotech" solar cells, and what do they offer over the conventional PV cells that are currently in use?
22. Is the potential of wave energy sufficient to generate a significant amount of the electricity needed in the US? Explain with the sentence addressing this in the reading.
23. Which of the Plan B technologies discussed is/are ready for market?
24. ~~If you were a specialist in national and global energy policy and you had influence over how national and international energy research will allocate its monies, summarize a wise approach.~~
25. ~~Now, turn back to the editorial on page 8. The editors of Scientific American state that the U.S. leadership void impairs progress on climate change. Read the entire page. In the paragraph that begins with: "Regaining a modicum of credibility", what do the editors believe the president and Congress should do?~~