Physics 173, Physics of Sustainable Energy Homework 3 Due: 1pm Tues Sept 17, 2024

Please upload your answers at the Canvas website as a PDF file. You can easily convert JPEG photos to PDF using online tools. When doing so, please ensure that in the PDF your photos are in the proper orientation.

Short report

Write a short critical summary (about 300 words) of a recent published article which is related to the topics covered so far the course, namely energy storage, different types of car, fuels, etc. You can choose the article but first read the instructions for writing the report which are on the course web page in the "Materials" tab.

Using AI tools such as ChatGPT: You are allowed to use an AI tool to help you with your short report; if you do that, please provide additional information as described in the instructions.

Piazza: If you are unsure about your choice of article or use of AI tools or have other questions, you can post on the Piazza page,

https://piazza.com/class/lvy8oqrzxjr1ln

Multiple choice questions

$\{2 \text{ points each}\}\$

Each question has one correct answer, unless the question specifies otherwise. You do not have to show your working, but it may help the grader. You may look up online any quantities that are needed but not supplied in the question or in lecture materials. If you hand-write your answers please use capital letters.

- 1. A Tesla electric car has a battery that holds 80 kWh of energy, whereas the gas tank of a conventional car holds about 500 kWh of energy. If the conventional car has a range of 300 miles on one full tank, what do you expect is the range of the Tesla car on a full charge?
 - (A) 50 mi (B) 100 mi (C) 200 mi (D) 400 mi
- 2. In regenerative breaking,
 - (A) gravitational potential energy \rightarrow kinetic energy
 - (B) kinetic energy \rightarrow gravitational potential energy
 - (C) kinetic energy \rightarrow chemical energy
 - (D) chemical energy \rightarrow kinetic energy
- 3. Roughly what volume of liquid hydrogen stores the same amount of energy as a liter of gasoline?
 - (A) 4 gallons (B) 4 liters (C) 1/3 gallon (D) 1/3 liter
- 4. Which of the following is a significant advantage of hydrogen-powered vehicles over gasoline-powered vehicles?
 - (A) hydrogen is not explosive when mixed with air
 - (B) we can mine naturally-available liquid hydrogen
 - (C) hydrogen fuel tanks will be smaller than gasoline tanks
 - (D) one can use a variety of energy sources to create the hydrogen

$\{20 \text{ points}\}$

- 5. Blue hydrogen is
 - (A) made from natural gas, releasing CO_2 in to the atmosphere
 - (B) made from natural gas, producing CO_2 which is stored underground
 - (C) extracted from natural underground deposits of hydrogen gas
 - (D) made from water using energy from low-carbon sources
- 6. The energy density of methanol is about half that of gasoline. Using your knowledge of the efficiency of fuel cells versus gasoline engines, how many miles would you expect a methanol-powered car could travel on a gallon of methanol? (The density of methanol is similar to gasoline)
 - (A) 50 miles (B) 20 miles (C) 5 miles (D) 1 mile
- 7. A methanol powered car produces CO_2 when it runs. Does that mean it is contributing to global warming?
 - (A) No, if the methanol was produced from recently living biomass
 - (B) Yes, if the methanol was produced from recently living biomass
 - (C) Yes, if the methanol was produced from solar power
 - (D) No, if the methanol was produced from natural gas.
- 8. Which of the following is included in the marginal cost of making 1 kWh of electrical energy from coal?
 - (A) Just the cost of the coal burned
 - (B) The cost of the coal burned and the wages of the plant workers
 - (C) The cost of building the plant and the cost of the coal burned
 - (D) The cost of building the plant and decomissioning it when it shuts down.
- 9. Based on the numbers given in the "Marginal cost of energy" lecture slide, how much coal does it take to generate 1 kWh of electricity?
 (A) 100 lb
 (B) 5 kg
 (C) 1 lb
 (D) 50 g
- 10. Suppose your electric bill for a whole year is \$1200. Assuming your electricity comes from burning coal, how much coal was burned to supply you with electricity for a year?
 - (A) 600 kg (B) 1.5 tons (C) 5 tons (D) 16 tons