

# Physics 173, Physics of Sustainable Energy

## Quiz 1, 1pm Thurs Sept 5, 2024

Each question has one correct answer.

1. Brenda throws a package from the front porch of her house up through the second floor window where it is caught by her brother. Which of the following energy transformations have occurred in this process?  
(A) thermal energy of the package to gravitational potential energy of Brenda's body  
(B) kinetic energy of the package to gravitational potential energy of the package  
(C) gravitational potential energy of the package to chemical energy of the package  
(D) electrical energy in the wiring of the house to chemical energy in Brenda's body
2. The main reason why gasoline is so widely used is  
(A) it explodes when shaken sufficiently strongly  
(B) it does not need oxygen in order to burn  
(C) there is a lot of energy per gram in gasoline  
(D) it is safe to handle and ingest
3. When we say sugar "contains" about 4 Cal per gram, we mean  
(A) it takes that much energy to vaporize a gram of sugar  
(B) that is the thermal energy of sugar molecules at room temperature  
(C) that is the amount of useful work a human body can do using the energy from a gram of sugar  
(D) that is the energy released when sugar is burned to  $\text{CO}_2$  and  $\text{H}_2\text{O}$
4. An iPad battery can store about 40 Watt-hours (Wh) of energy. When you plug it in to a wall socket to charge, it takes electricity which costs about 10¢ per kiloWatt-hour. What is the cost of the electricity needed to take the battery from empty to fully charged?  
(A) 0.4¢      (B) \$2.50      (C) 4¢      (D) 0.25¢

# Physics 173, Physics of Sustainable Energy

## Quiz 2, 1pm Sept 19, 2024

Each question has one correct answer.

1. If you switch from using a gasoline powered car to a hydrogen powered car, will this help to reduce net carbon emissions?
  - (A) yes, because the hydrogen car only emits water vapor when it runs
  - (B) no, because the hydrogen car emits carbon dioxide when it runs
  - (C) it depends what energy source is used to make the hydrogen
  - (D) only if you typically make long journeys
2. The marginal cost of 1 kWh of solar energy
  - (A) is about the same as for nuclear power
  - (B) includes the cost of manufacturing the solar panels but not the cost of disposing of them
  - (C) includes the cost of manufacturing the solar panels and the cost of disposing of them
  - (D) is zero
3. Which form of energy supplies more than 10% of the U.S.'s total power needs?
  - (A) solar
  - (B) wind
  - (C) petroleum
  - (D) hydroelectric
4. Suppose a 1kW electric toaster oven is on for 15 minutes. Roughly how much energy is used by the oven?
  - (A) 30 kWh
  - (B) 1 MJ
  - (C) 2 million Joules
  - (D) 50 Wh

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## Quiz 3, 1pm Thurs Sept 26, 2024

Each question has one correct answer.

1. Maria cycles uphill at 5 mi/hr and then cruises downhill at 20 mi/hr.
  - (A) when going downhill, she has 4 times as much kinetic energy as when going uphill
  - (B) when going downhill, she has 16 times as much kinetic energy as when going uphill
  - (C) her kinetic energy is the same whether going downhill or uphill
  - (D) when going downhill, she has twice as much kinetic energy as when going uphill
2. The power needed to keep a car traveling at 30mph is
  - (A) about the same as when the car is idling
  - (B) about the same as at 70mph
  - (C) less than at 70mph because the kinetic energy is less
  - (D) less than at 70mph because there is less air resistance
3. The atomic mass of naturally-occurring nitrogen is 14.01. From this you can deduce that
  - (A) some nitrogen atoms have more than 7 protons
  - (B) some nitrogen atoms have more than 7 neutrons
  - (C) naturally-occurring nitrogen contains impurities of other elements
  - (D) a small fraction of nitrogen atoms clump together to form molecules
4. In one gram of Iron, roughly how many atoms are there?
  - (A)  $10^{22}$
  - (B)  $10^{25}$
  - (C)  $10^{28}$
  - (D)  $10^{31}$

# Physics 173, Physics of Sustainable Energy

## Quiz 4, 1pm Thurs Oct 3, 2024

1. A lump of stone is at the same temperature as the air around it. This means that the molecules in the stone and in the air have the same
  - (A) atomic mass
  - (B) average kinetic energy
  - (C) average mass
  - (D) average velocity-squared.
2. In order for a heat pump to have a high coefficient of performance,
  - (A) it should be positioned as far from the hot region as possible
  - (B) the temperature difference between hot and cold regions should be small
  - (C) the cold region should be as cold as possible
  - (D) the cold region should be well insulated
3. A gasoline engine burns fuel at a temperature of 500 C, and the exhaust gases are at a temperature of 100 C. What is the maximum possible efficiency of the engine?
  - (A) 35%
  - (B) 20%
  - (C) 67%
  - (D) 50%
4. If a heat pump has a coefficient of performance equal to 3, then
  - (A) for every 1 J of work going in, 3 J of heat come out
  - (B) for every 3 J of work going in, 1 J of heat comes out
  - (C) for every 1 J of work going in, it removes 3 J of heat from the cold region
  - (D) for every 3 J of work going in, it removes 1 J of heat from the cold region