

Jerusalem Science Contest 5783
Environmental Sustainability and Energy
Test 3
Form – A
Answer Key

1) When a glass of water is cooled from 22°C to 4°C, the water (and the glass), lose heat energy. What becomes of that lost heat energy?

a) It goes into the surroundings

b) It goes into the universe

c) It just disappears

d) It is replaced by potential energy

2) Based on our discussion / lecture, which of the following is NOT true about heat.

a) Heat is one form of potential energy

b) Heat may be transferred from one object to another

c) A chemical reaction that releases heat is said to be exothermic

d) Chemical energy may be converted into heat.

3) When natural gas from a Bunsen Burner is ignited to produce a flame which we use in the laboratory as a source of heat, the process that produces heat may be described as which of the following?

a) A chemical reaction

b) An oxidation / reduction reaction

c) A combustion reaction

d) All of the above

4) What is the change in heat, q , for a 2.10 L sample of water if it is cooled from 22.0 °C to 1.0 °C? The specific heat capacity, C , of water is 4.18 J/g °C. The density of water is 1.00 g/mL.

a) $-1.84 \times 10^5 \text{ J}$

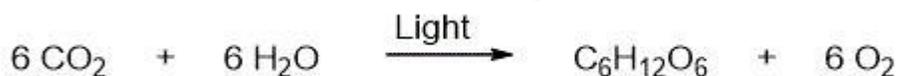
b) $-1.84 \times 10^2 \text{ J}$

c) $1.84 \times 10^5 \text{ J}$

d) 184 J

- 5) A hydrocarbon is defined as a chemical compound that contains only water and carbon.
- a) True
 - b) False**
- 6) To raise the temperature of a sample of ethanol from 22.0 °C to its normal boiling point of 78.0 °C, the sample must absorb 81.6 kJ of heat. If the specific heat capacity of ethanol is 2.46 J/g °C, then what is the mass of the sample?
- a) 592g**
 - b) $3.58 \times 10^3\text{g}$
 - c) $1.85 \times 10^6\text{g}$
 - d) 3.58g
- 7) Which of the following is not considered a fossil fuel?
- a) Natural Gas
 - b) Propane
 - c) Gasoline
 - d) Solar Power**
- 8) The total internal energy of a system is equal to the sum of heat and work of that system. Mathematically, this can be written as $E = q + w$. If the burning of the fuel in a potato cannon performs 855 J of work on the potato and releases 1.42 kJ of heat, what is ΔE for the fuel that is burned?
- a) $-2.28 \times 10^3\text{J}$**
 - b) $2.28 \times 10^3\text{J}$
 - c) 565 J
 - d) -565 J
- 9) If a balloon is inflated from 0.100 L to 1.85 L against an external pressure of 1.00 atm, how much work, in Joules (J), is done by the gas that inflates the balloon? $1 \text{ L}\cdot\text{atm} = 101.3 \text{ J}$
- a) -177 J**
 - b) 177 J
 - c) 1.75 J
 - d) -1.75 J

- 10) Photosynthesis is the process by which green plants convert carbon dioxide into the sugar, glucose, by a reaction with water in the presence of light. The enthalpy of reaction, $\Delta H_{\text{reaction}}$, is 2.80×10^3 kJ per mole of glucose. This reaction may be best described as which of the following?



- a) **Endothermic**
b) Exothermic
c) Combustion
d) a hypothesis
- 11) Which one of the following reflects the Law of Conservation of Energy?
a) **Energy cannot be created or destroyed**
b) The total amount of energy in the universe is always changing
- 12) A certain process results in a gas system releasing 68.3 kJ of energy. During the process, 15.8 kcal of heat is released by the system. If the external pressure is kept constant at 1.00 atm and the initial volume of the gas is 10.0 L, what is the final volume of the gas? (1 kcal = 1000 cal, 1 cal = 4.18 J, 1.00 atm•L = 101.3 J).
a) 23 L
b) **33 L**
c) 13 L
d) 5.0 L
- 13) A block of metal weighing 350.0 g at a temperature of 100.0 °C is immersed in an insulated cup containing 160.0 g of water at 22.4 °C. The water warms and the copper cools until the final temperature of both is 35.2 °C. Calculate the specific heat capacity, C , of the metal.
a) **0.378 J/g°C**
b) 861 J/g°C
c) 1585 J/g°C
d) 0.695 J/g°C
- 14) During a chemical reaction, the reactants absorb more heat to break the initial bonds than the heat released when the new product bonds are formed. This reaction may be classified as
a) **Endothermic**
b) Exothermic
c) Isothermic
d) Combustion

- 15) The combustion reaction of natural gas (methane) has an enthalpy of reaction of -812 kJ/mol . How many moles of natural gas would need to be burned to raise the temperature of $2.00 \times 10^3 \text{ g}$ water from $22.0 \text{ }^\circ\text{C}$ to its normal boiling point of $100.0 \text{ }^\circ\text{C}$?
- a) **0.813 mol**
 - b) 813 mol
 - c) 1.04 mol
 - d) 104 mol
- 16) What statement about the Mitzvah of Shemitah is not correct?
- a) It applies nowadays.
 - b) It applies only in the land of Israel.
 - c) **It has no relevance to you unless you are a farmer.**
 - d) Any produce that grows during Shemitah have a degree of sanctity and must be treated with special care.
- 17) The Mitzvos of the Torah are not only to regulate and obligate, but also to educate. What does this mean?
- a) The Mitzvos teach us what to do and how to do it.
 - b) The Mitzvos are not mere actions devoid of meaning, but each Mitzvah has a lot of meaning and significance.
 - c) **The Mitzvos teach us important lessons about the world and about our lives, and not only what we should do.**
 - d) If we would perform all of the Mitzvos, then we would be filled with a spirit of wisdom.
- 18) What is a reason given for the Mitzvah of Shemitah?
- a) God wants us to let the land lie fallow once every seven years so that its strength will be replenished.
 - b) Leaving the land to lie fallow every seventh year reminds us that the world has a Creator, just as resting every seventh day does.
 - c) Leaving the land to lie fallow every seventh year engenders in us a sense of faith and trust in God.
 - d) **All of the above**
- 19) According to the Rambam's understanding of the reason for Shemitah, the Mitzvah of Shemitah may be a possible source for the value of sustainability. What is an argument against that?
- a) The Rambam's reasoning is sound and conclusive. There is no argument against it.
 - b) **Why then does the Mitzvah of Shemitah apply only in the Land of Israel and not outside?**
 - c) When the Torah was given, there was so much land available that it is not logical that the Torah would have been concerned with land losing its ability to produce.
 - d) Why then are there not other Mitzvos concerned with sustainability?

20) Which of the following classic works gives a summary of the “who, what, when, where, and why” of each Mitzvah in the Torah?

a) The Rambam’s Mishneh Torah

b) *The Sefer ha’Chinuch*

c) The Ramban on the Chumash

d) The Chizkuni