

TOSS-UP

1. ENERGY *Multiple Choice* On the octane rating scale, which of the following compounds in gasoline would cause the most engine knocking?

(W) Isooctane
(X) Methanol
(Y) n-Octane
(Z) Hydrogen

ANSWER: Y

TOSS-UP

2. ENERGY *Short Answer* Name all of the following statements that is or are true:

- I. The most common type of octane rating is the research octane rating
- II. The motor octane rating is used for engines under low load, usually under 600 rpm
- III. The anti-knock index is used in the United States, Canada, and Brazil, and is the average of the research octane rating and the motor octane rating

ANSWER: I, III

TOSS-UP

3. ENERGY *Multiple Choice* Which of the following processes is part of the Diesel cycle?

(W) Isobaric compression
(X) Isochoric heating
(Y) Isothermal expansion
(Z) Adiabatic compression

ANSWER: Z

TOSS-UP

4. ENERGY *Short Answer* Which reversible thermodynamic cycle consists of two isothermal processes and two isovolumetric processes, and when plotted on a PV diagram from a real engine, forms an elliptical cycle?

ANSWER: STIRLING CYCLE

TOSS-UP

5. ENERGY *Short Answer* What is the maximum theoretical efficiency of a cycle that operates between a 200 K and a 500 K reservoir?

ANSWER: 60%

TOSS-UP

6. ENERGY *Multiple Choice* Which country has the highest yearly production of bioethanol?

- (W) United States
- (X) Brazil
- (Y) United Kingdom
- (Z) Japan

ANSWER: X

TOSS-UP

7. ENERGY *Short Answer* Which type of fuel is produced by the transesterification of vegetable oils and animal fats?

ANSWER: BIODIESEL

TOSS-UP

8. ENERGY *Multiple Choice* Methods are not yet available but are currently being developed for the production of biofuels from which of the following material?

(W) Lignin in xylem and sclerenchyma
(X) Cellulosistic biomass from most plant walls
(Y) Starch from maize or sugarcane
(Z) Plant and animal triglycerides

ANSWER: W

TOSS-UP

9. ENERGY *Multiple Choice* Which type of renewable diesel uses fractional distillation to process oils from canola, algae, jatropha, salicornia, and tallow, as opposed to biodiesel, which is produced from oils or fats using transesterification and is a liquid similar in composition to fossil diesel?

(W) Green ethanol
(X) Green diesel
(Y) Organic ethanol
(Z) Organic diesel

ANSWER: X

TOSS-UP

10. ENERGY *Multiple Choice* Which of the following is correct regarding biofuels?

(W) The most common design for bioethanol production is synthetic and does not require the use of special enzymes
(X) ABE fermentation is an anaerobic process that was once used to produce acetone, but is now being considered as a method of bioethanol production

(Y) Bioethers are compounds that can be used in place of bioethanol or biodiesel, and increase engine performance, but may increase engine knocking

(Z) Biogas is primarily used as a fuel to decrease greenhouse gas emissions

ANSWER: X

TOSS-UP

11. ENERGY *Short Answer* Which process used in petroleum production is a set of chemical reactions that can convert a mixture of carbon monoxide and hydrogen into liquid hydrocarbons, and is being investigated as a means to produce sulfur-free fuels?

ANSWER: FISCHER-TROPSCH PROCESS

TOSS-UP

12. ENERGY *Multiple Choice* Which of the following is true of second-generation biofuels?

(W) They reduce emissions of greenhouse gasses

(X) Myco-diesel may be used to produce fuels from the fermentation of chitin

(Y) Enzymes for the digestion of cellulose are usually extracted from rhizobacteria

(Z) The government currently subsidizes ethanol production from corn in the United States

ANSWER: W

TOSS-UP

13. ENERGY *Multiple Choice* Which of the following is true of algae fuel?

(W) They can be produced using ocean and waste water

(X) It is one of the most cost-effective forms of green energy

(Y) It requires a large amount of area to operate

(Z) Algae fuels are one of the only non-biodegradeable biofuels

ANSWER: W

TOSS-UP

14. ENERGY *Multiple Choice* The United States Department of Energy estimates that if algae fuel replaced all the petroleum fuel in the United States, to the nearest tenth of a percent, how much of the area on the U.S. map would be required?

(W) 0.1%

(X) 0.4%

(Y) 1.1%

(Z) 2.4%

ANSWER: X

TOSS-UP

15. ENERGY *Short Answer* In addition to bioethanol, which other biofuel can be produced from algae or diatoms, or the green waste left over from the algae oil extraction, and has a 10% lower energy density than gasoline but a higher energy density than both methanol and ethanol?

ANSWER: BIOBUTANOL

TOSS-UP

16. ENERGY *Multiple Choice* Because of rising prices of fossil fuels, which of the following industries in the United States will probably be the first to switch to algal biofuels?

(W) Automobile

(X) Aviation

(Y) Shipping

(Z) Cooking

ANSWER: X

TOSS-UP

17. ENERGY *Short Answer* What is the term for the useful work obtainable from a closed thermodynamic system at a constant temperature and volume?

ANSWER: HEMHOLTZ FREE ENERGY

TOSS-UP

18. ENERGY *Short Answer* Which quantity is equal to the derivative of the enthalpy with respect to temperature at a constant pressure?

ANSWER: (CONSTANT-PRESSURE) HEAT CAPACITY

TOSS-UP

19. ENERGY *Short Answer* In Lagrangian mechanics, which equation can be used to describe the path taken by an object using the Lagrangian, a quantity equal to the potential energy minus the kinetic energy of an object?

ANSWER:

TOSS-UP

20. ENERGY *Short Answer* If the number of microstates in a system is cubed, by how many times does the entropy increase?

ANSWER: 3

TOSS-UP

21. ENERGY *Multiple Choice* Of the following particles, which is the least stable?

(W) Electron

(X) Electron neutrino

(Y) Muon

(Z) Muon-neutrino

ANSWER: Y

TOSS-UP

22. ENERGY *Short Answer* What is the name of the hexagonal patterns that were proposed independently by Gell-Mann and Ne'eman which gave a way to conveniently organize baryons and mesons into octets?

ANSWER: EIGHTFOLD WAY

TOSS-UP

23. ENERGY *Short Answer* What is the name given to a direct current that dissipates the same amount of energy in a resistor that is dissipated by the actual alternating current?

ANSWER: RMS CURRENT

TOSS-UP

24. ENERGY *Multiple Choice* What term is given to the area where turbidity currents deposit their sediments to from deep-sea fans?

- (W) Continental shelf
- (X) Continental rise
- (Y) Continental margin
- (Z) Abyssal plane

ANSWER: X

TOSS-UP

25. ENERGY *Multiple Choice* Which of the following diatomic molecules is paramagnetic?

- (W) Li₂
- (X) B₂
- (Y) C₂
- (Z) F₂

ANSWER: X
