ALBERTA SCIENCE 30 · UNIT D · 25 QUESTIONS

# Energy and the Environment — Practice Test

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**1** **Which of the following energy sources is classified as renewable?**

- A Solar energy
- B Coal
- C Natural gas
- D Uranium-235

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**2** **In a coal-fired generating station, the main sequence of energy conversions that produces electricity is**

- A thermal → chemical → kinetic → electrical
- B chemical → thermal → kinetic → electrical
- C chemical → kinetic → electrical → thermal
- D kinetic → chemical → thermal → electrical

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3 **Nuclear fission is best described as the process in which**

A a heavy nucleus splits into two lighter nuclei, releasing neutrons and energy

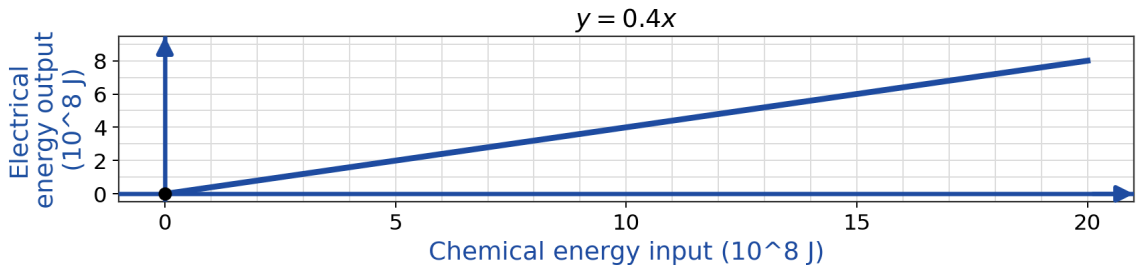
B two light nuclei combine to form one heavier nucleus

C a nucleus spontaneously emits an alpha particle

D an atom absorbs a photon and emits an electron

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**4** **The graph below shows electrical energy output against chemical energy input for a generating station. The efficiency of the station, expressed as a percent, is**




A 25%

B 40%

C 50%

D 80%

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5 **The greenhouse effect that warms the lower atmosphere of the Earth occurs because**

A greenhouse gases block all incoming solar radiation

B the ozone layer converts ultraviolet radiation into thermal energy

C greenhouse gases absorb infrared radiation emitted by the surface of the Earth and reradiate it back down

D greenhouse gases prevent clouds from forming over the oceans

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6 **Energy is released by the Sun mainly because, in its core,**

A gravity compresses helium nuclei into hydrogen nuclei

B hydrogen atoms are burned chemically in oxygen

C uranium nuclei undergo fission reactions

D extremely high temperature and pressure allow hydrogen nuclei to fuse into helium

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7 **The gas produced in the greatest amount when coal is burned, and the gas most responsible for the enhanced greenhouse effect, is**

A sulfur dioxide

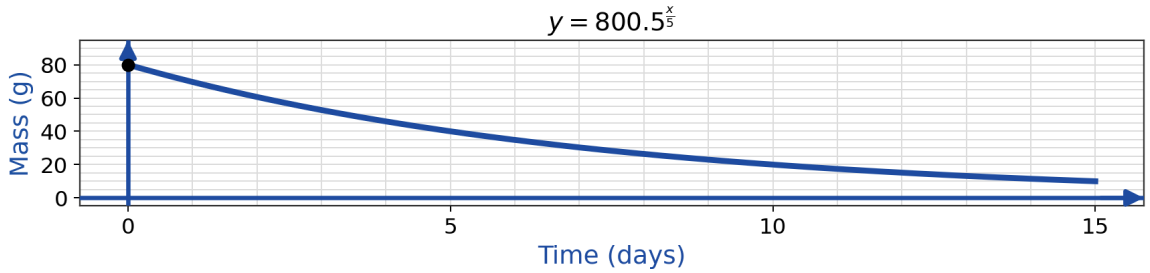
B carbon dioxide

C carbon monoxide

D nitrogen

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**8** **The graph below shows the mass of a radioactive sample against time. The half-life of the sample is**




A 2.5 days

B 5.0 days

C 10 days

D 15 days

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**9** **Which of the following surfaces has the highest albedo, reflecting the greatest fraction of incoming solar radiation?**

- **A** Fresh snow
- **B** Ocean water
- **C** A coniferous forest
- **D** An asphalt parking lot

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**10** $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + x\ {}^{1}_{0}n$

**In the fission reaction above, the value of x is _____**

ANSWER _____

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**11** **In a fission reaction, the total mass of the products is slightly less than the total mass of the reactants. The missing mass**

- **A** is converted entirely into extra neutrons
- **B** is destroyed, which violates the law of conservation of mass
- **C** is converted into energy, as described by $E = mc^2$
- **D** remains stored in the fuel rods as chemical energy

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**12** **In a nuclear reaction, 0.050 kg of mass is converted completely into energy. Using $E = mc^2$ and $c = 3.00 \times 10^8$ m/s, the energy released is $a \times 10^{15}$ J. The value of a is _____**

ANSWER _____

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13 **A cogeneration plant burns fuel to generate electricity and also uses its waste thermal energy to heat nearby buildings. Compared with a conventional generating station, the overall efficiency of the cogeneration plant is higher because**

- A its fuel burns at a much higher temperature
- B energy that would otherwise be lost as waste heat is put to a useful purpose
- C it needs no cooling water to operate
- D its generator produces a higher voltage

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14 **An environmental advantage of hydroelectric generation over coal-fired generation, while the plants are operating, is that hydroelectric generation**

- A has no effect on river ecosystems
- B uses a non-renewable energy source
- C is always cheaper to build
- D does not directly release carbon dioxide while producing electricity

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15 **In a generating station, the boiler converts 90% of the chemical energy in the fuel into thermal energy, and the turbine and generator together convert 40% of that thermal energy into electrical energy. The overall efficiency of the station, expressed as a percent, is _____**

ANSWER _____

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16 **A major limitation of both wind power and solar power is that they**

A are intermittent and depend on local weather and time of day

B produce large amounts of radioactive waste

C emit carbon dioxide while they are operating

D permanently use up the wind and sunlight in an area

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17 **The greatest long-term concern associated with high-level nuclear waste from fission reactors is that the waste**

A is highly flammable and difficult to extinguish

B expands until it breaks its storage containers

C remains dangerously radioactive for thousands of years and must be isolated

D releases large amounts of carbon dioxide as it decays

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18 **Some events that occur in a coal-fired generating station are listed below. 1 Steam spins a turbine that is connected to a generator 2 Coal is burned in a boiler 3 The generator converts kinetic energy into electrical energy 4 High-pressure steam is produced The order in which the events occur, from first to last, is _____ Record your answer as a four-digit number.**

ANSWER _____

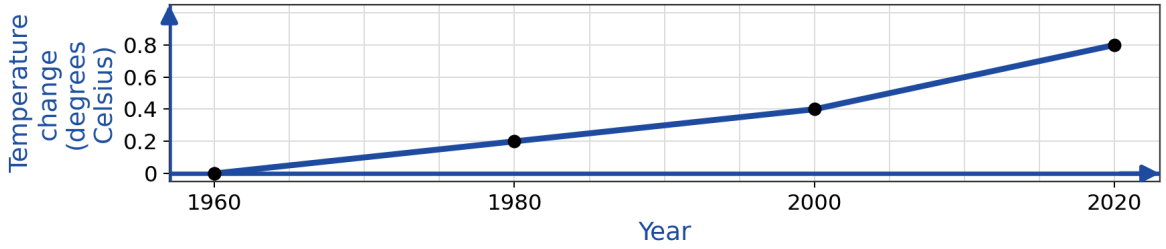
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**19** **A photovoltaic cell in a solar panel converts**

- **A** chemical energy directly into electrical energy
- **B** thermal energy directly into electrical energy
- **C** kinetic energy directly into electrical energy
- **D** radiant energy directly into electrical energy

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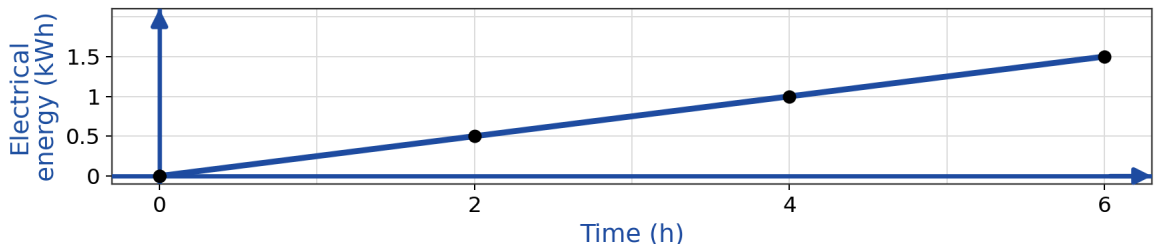
**20** **The simplified graph below shows global temperature change over time. The temperature change shown for 2020, in degrees Celsius, is**




- **A** 0.0
- **B** 0.2
- **C** 0.4
- **D** 0.8

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**21** **The graph below shows electrical energy produced by a solar panel against time. The total electrical energy produced after 6.0 h, in kW·h, is _____**




ANSWER _____

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**22** **An advantage of using nuclear fusion, rather than nuclear fission, as an energy source for generating electricity is that**

A fusion fuel is abundant, and its products are not highly radioactive

B fusion already supplies most of the electricity used in the world

C fusion reactions operate at room temperature

D fusion reactors require no containment structure

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**23** **Burning biomass for energy is often considered to be nearly carbon neutral because**

- **A** biomass contains no carbon
- **B** burning biomass releases oxygen into the atmosphere
- **C** the carbon dioxide released was absorbed from the atmosphere by the plants as they grew
- **D** biomass produces no ash or smoke when it burns

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**24** **Geothermal energy is most practical as a major energy source in regions where**

- **A** rainfall is high throughout the year
- **B** large coal deposits are located nearby
- **C** the population density is very low
- **D** hot rock or magma is close to the surface of the Earth

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25 **Per unit of electrical energy generated, the fuel that releases the greatest mass of carbon dioxide when burned is**

A Natural gas

B Coal

C Petroleum

D Biomass

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# ANSWER KEY

1. A
2. B
3. A
4. B
5. C
6. D
7. B
8. B
9. A
10. 3
11. C
12. 4.5
13. B
14. D
15. 36
16. A
17. C
18. 2413
19. D
20. D
21. 1.5
22. A
23. C
24. D
25. B

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