

Science 30

Released Items

2012 Released Diploma Examination Items



Government
of Alberta ■

Alberta ■

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Introduction

The questions presented in this booklet are from the June 2008 Science 30 Diploma Examination. This material, along with the program of studies, Subject Bulletin, Assessment Highlights, and the June 2008 Diploma Examination results, can provide insights that will assist you with decisions relative to instructional programming.

These examination items are released by the Assessment Sector. They may be used by the classroom teacher as an examination, a quiz, or a review for students.

Additional Documents

The Assessment Sector supports the instruction of Science 30 in classrooms with the following documents available online.

- [Science 30 Assessment Highlights](#)
available at education.alberta.ca
From the home page, follow this path:
Teachers > (Additional Programs and Services) Diploma Exams > Assessment Highlights. A general description of characteristics of student responses, including strengths and areas for improvement, as noted by the assessment standards team leader and the examiner for the January and June 2012 Science 30 Diploma Examinations.
- [School Reports and Instructional Group Reports](#)
available at <https://phoenix.edc.gov.ab.ca/login>
Detailed statistical information on provincial, group, and individual student performance on the entire examination.
- [Science 30 Information Bulletin and Science 30 Information Bulletin – Archived Curriculum Standards and Example Questions](#)
available at education.alberta.ca
From the home page, follow this path:
Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins. Contain information about the diploma examinations for the upcoming school year, sample questions, assessment samples for classroom use with student exemplars, and scoring criteria.
- [Science 30 Previous Examinations](#)
Previous exams have been released for Science 30, including an interactive version of the January 2008 and January 2009 diploma examinations.
From the home page, follow this path:
education.alberta.ca/students/exams/answerkeys.aspx
and
www.tools4teachers.ab.ca/t4t/
and
<https://questaplus.alberta.ca>

Science 30 Diploma Examination June 2008— Blueprint Summary

Key: MC—Multiple Choice; NR—Numerical Response

	Diff.*	Key	K	STS	Skill
MC 1	0.723	B	A2.2k		
MC 2	0.774	D	A1.4k		
MC 3	0.709	B	A2.3k		
MC 4	0.853	B	A1.4k		
MC 5	0.649	A	A3.1k		
MC 6	0.847	D	A3.2k		
MC 7	0.783	C	A3.5k		
MC 8	0.788	C	B2.6k		
MC 9	0.804	B	B2.6k		
MC 10	0.584	A		B2.1sts	
MC 11	0.325	B	B1.1k		
MC 12	0.679	D			B1.2s
MC 13	0.850	C	B1.4k		
MC 14	0.417	B			B1.1s
MC 15	0.844	D	C2.5k		
MC 16	0.547	A			A3.3s
MC 17	0.557	C	B1.3k		
MC 18	0.943	B	B2.1k		
MC 19	0.625	C	B3.1k		
MC 20	0.468	C			D2.1s
MC 21	0.735	D	A2.3k		
MC 22	0.927	B	A3.8k		
MC 23	0.709	B	C2.1k		
MC 24	0.488	D	C2.4k		
MC 25	0.713	B	D2.5k		
MC 26	0.553	B	C1.7k		C1.3s
MC 27	0.794	C	D2.3k		
MC 28	0.481	C	C1.5k		
MC 29	0.697	C	C1.6k		C1.2s

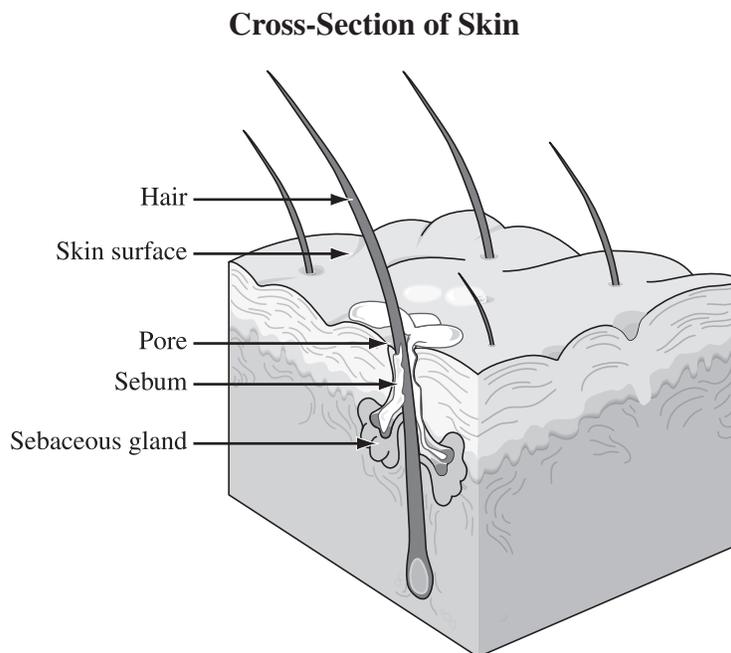
	Diff.*	Key	K	STS	Skill
MC 30	0.508	C	C1.9k		
MC 31	0.639	D	C2.10k		
MC 32	0.928	A	C2.4k		C2.2s
MC 33	0.500	C			D1.3s
MC 34	0.480	B	D1.5k		
MC 35	0.717	B	D2.4k		
MC 36	0.917	D	D2.4k		
MC 37	0.677	C	D2.3k		
MC 38	0.635	B	C1.11k		
MC 39	0.787	B			C1.2s
MC 40	0.679	D	C1.2k		
NR 1	0.617	4.47	B1.3k		B1.3s
NR 2	0.536	2431			A1.3s
NR 3	0.835	1246*	A1.4k		
NR 4	0.709	1267*	C2.2k		
NR 5	0.691	1.15	C2.6k		C2.1s
NR 6	0.854	4123			C1.1s
NR 7	0.748	49.6	C1.6k		C1.3s
NR 8	0.704	3.70 or 3.7	C1.4k		C1.3s
NR 9	0.693	1.01 or 101			D1.3s
NR 10	0.641	3412	B2.5k		
NR 11	0.905	782	C1.6k		C1.3s
NR 12	0.584	15.1			D2.3s

*Difficulty—proportion of students answering the question correctly

Science 30 Diploma Examination June 2008, Part B— Released Items

Use the following information to answer the first four questions.

Skin contains sebaceous glands that produce an oil called sebum, which has a low pH.



1. The low pH of sebum aids in the
 - A. clotting of blood
 - B. prevention of infection
 - C. process of skin-cell mitosis
 - D. transport of materials into the body

Numerical Response

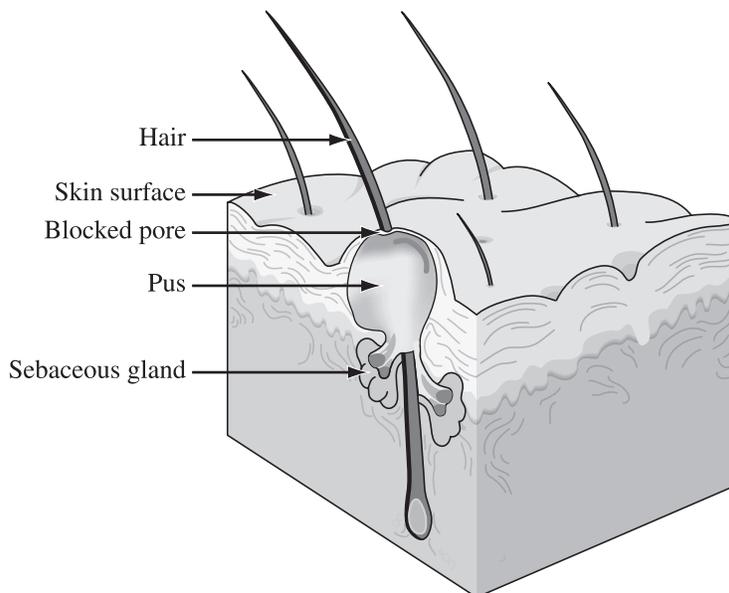
1. The pH of a sebum solution that has a hydronium ion concentration $[\text{H}_3\text{O}^+(\text{aq})]$ of 3.4×10^{-5} mol/L is _____.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

Use the following additional information to answer the next two questions.

Acne occurs when skin pores become blocked and sebum builds up, as shown below. Bacteria grow in a blocked pore, leading to the formation of pus as the body tries to destroy the growing bacteria.

Cross-Section of Skin with Infection



2. Which of the following blood components protects body cells from bacteria and also leads to the formation of pus?
 - A. Platelets
 - B. Hemoglobin
 - C. Red blood cells
 - D. White blood cells

3. Blood components that are capable of engulfing and destroying bacteria are called
 - A. antibodies
 - B. macrophages
 - C. helper T cells
 - D. suppressor T cells

Use the following information to answer the next question.

An oral prescription drug that is used to control acne passes from the digestive system into the bloodstream and eventually into the heart.

Structures of the Heart

- 1 Pulmonary artery
- 2 Vena cava
- 3 Right ventricle
- 4 Right atrium

Numerical Response

2. After leaving the digestive system, the order in which an oral prescription drug in the bloodstream passes through the structures of the heart numbered above is _____, _____, _____, and _____.

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

4. Which component of blood initiates the clotting process to seal a wound?
- A. Plasma
 - B. Platelets
 - C. Red blood cells
 - D. White blood cells

Use the following information to answer the next question.

Components of the Circulatory System

- 1 Red blood cells
- 2 Platelets
- 3 Capillaries
- 4 White blood cells
- 5 Arterioles
- 6 Plasma

Numerical Response

3. The components listed above that are transported through the body during blood circulation are numbered _____, _____, _____, and _____.

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

5. A woman's egg cell and a man's sperm cell each contain
- A. 23 chromosomes
 - B. 46 chromosomes
 - C. 23 pairs of chromosomes
 - D. 46 pairs of chromosomes
6. In humans, the free earlobe trait, *E*, is dominant to the attached earlobe trait, *e*. Which of the following rows identifies the genotypes of a man and a woman who both have free earlobes and whose child has attached earlobes?

Row	Man's Genotype	Woman's Genotype
A.	<i>EE</i>	<i>EE</i>
B.	<i>EE</i>	<i>Ee</i>
C.	<i>Ee</i>	<i>EE</i>
D.	<i>Ee</i>	<i>Ee</i>

7. If a nitrogen base sequence on a particular strand of DNA is AAG, then on the complementary strand of DNA the sequence is
- A. GGC
 - B. CCT
 - C. TTC
 - D. TTA

Use the following information to answer the next question.

During the summer, there are large numbers of mosquitoes in the Arctic. Mosquitoes can sense electromagnetic radiation that has wavelengths ranging from 10^{-5} m to 10^{-9} m.

Types of Electromagnetic Radiation

- 1 Radio wave
- 2 Microwave
- 3 Infrared
- 4 Visible
- 5 Ultraviolet
- 6 X-ray
- 7 Gamma

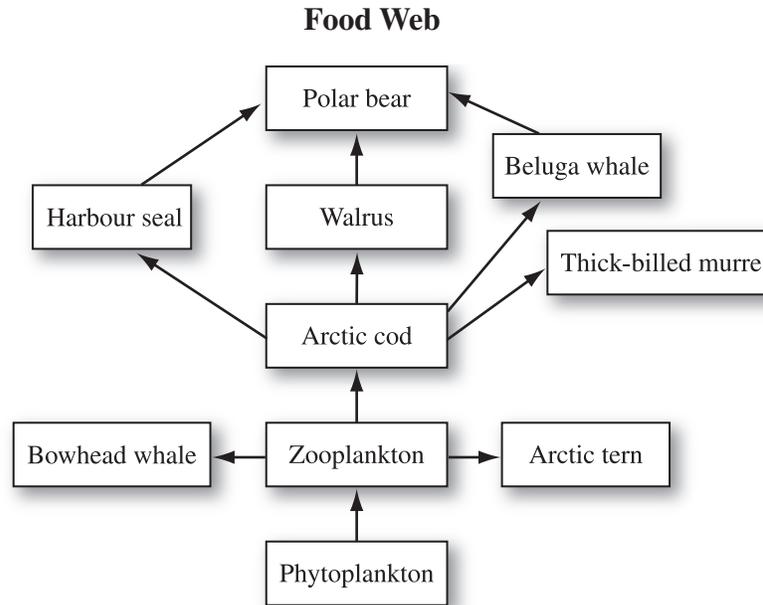
Numerical Response

4. The types of electromagnetic radiation numbered above that mosquitoes **cannot** detect are _____, _____, _____, and _____.

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

Polychlorinated biphenyls (PCBs) have been discovered in bodies of water in the Arctic. PCBs are known to accumulate in the tissues of organisms.



8. Which of the following rows identifies the expected relative concentrations of PCBs in the tissues of three of the organisms shown in the food web above?

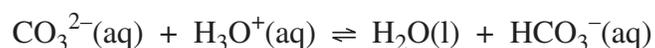
Row	Low PCB Concentrations	Moderate PCB Concentrations	High PCB Concentrations
A.	Beluga whale	Arctic cod	Polar bear
B.	Arctic cod	Zooplankton	Phytoplankton
C.	Arctic cod	Harbour seal	Polar bear
D.	Beluga whale	Thick-billed murre	Walrus

9. The process that results in differing concentrations of persistent contaminants such as PCBs at different trophic levels within a food web is called
- bioconservation
 - biomagnification
 - biodiversification
 - biocontamination

10. Much of the ultraviolet radiation emitted by the sun is absorbed by the ozone layer in Earth's upper atmosphere. Some of the ultraviolet radiation that penetrates the atmosphere may cause
- A. DNA to mutate
 - B. acids to form in the atmosphere
 - C. photochemical smog to form in Earth's atmosphere
 - D. the biological oxygen demand of aquatic systems to increase

Use the following information to answer the next three questions.

A Reaction That Occurs in Northern Lakes



11. In the equation above, two substances that act as bases by accepting a proton are
- A. $\text{H}_3\text{O}^+(\text{aq})$ and $\text{H}_2\text{O}(\text{l})$
 - B. $\text{CO}_3^{2-}(\text{aq})$ and $\text{H}_2\text{O}(\text{l})$
 - C. $\text{H}_3\text{O}^+(\text{aq})$ and $\text{HCO}_3^-(\text{aq})$
 - D. $\text{CO}_3^{2-}(\text{aq})$ and $\text{HCO}_3^-(\text{aq})$
12. A lake on eastern Baffin Island has a pH of 6.25. If the pH indicator thymol blue is added to a sample of water from the lake, then the colour of the resulting solution will be
- A. red
 - B. blue
 - C. orange
 - D. yellow
13. The ability to resist changes in pH is a property of
- A. a base
 - B. an acid
 - C. a buffer
 - D. an indicator

Use the following information to answer the next question.

In warm months, the volume of water that evaporates from Arctic lakes is greater than the volume of water that is returned as precipitation. The loss of water results in an increase in the concentration of dissolved salts such as sodium chloride in the lake.

14. A conclusion that can be drawn from the information above is that the conductivity of water from Arctic lakes is *i* in autumn than in spring. The conductivity of the water changes because sodium chloride is *ii* compound.

The statements above are completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	higher	a molecular
B.	higher	an ionic
C.	lower	a molecular
D.	lower	an ionic

Use the following information to answer the next question.

A polar bear's hair transfers electromagnetic radiation (EMR) to the polar bear's skin. One of the wavelengths transmitted has a frequency of 1.13×10^{17} Hz.

15. The information above shows that the form of EMR that is transmitted by a polar bear's hair is
- A. radio
 - B. visible
 - C. infrared
 - D. ultraviolet

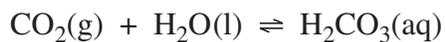
Use the following information to answer the next question.

In polar bears, normal pigmentation is dominant, whereas albinism (no pigmentation) is recessive.

- 16.** If a male polar bear who is homozygous for normal pigmentation mates with an albino female, then what is the probability that a particular offspring will be albino?
- A.** 0%
 - B.** 25%
 - C.** 50%
 - D.** 100%

Use the following information to answer the next question.

Carbon dioxide scrubbers remove $\text{CO}_2(\text{g})$ from the air in a spacecraft. If the level of $\text{CO}_2(\text{g})$ in a spacecraft becomes too high, water in an astronaut's blood will react with the $\text{CO}_2(\text{g})$ to form $\text{H}_2\text{CO}_3(\text{aq})$, as represented by the following equation.



17. If the concentration of $\text{H}_2\text{CO}_3(\text{aq})$ in blood increases, then the pH of the blood will *i* , causing the blood to become more *ii* .

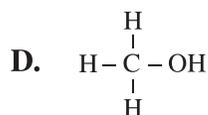
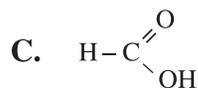
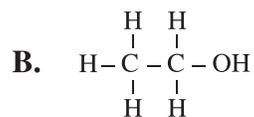
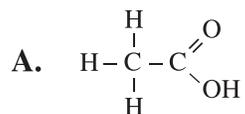
The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	increase	acidic
B.	increase	basic
C.	decrease	acidic
D.	decrease	basic

Use the following information to answer the next three questions.

The National Aeronautics and Space Administration (NASA) is researching the use of ethanol and hydrazine as fuels for space vehicles.

18. Which of the following structural formulas represents ethanol?



19. The main pollutants that are produced during the combustion of hydrocarbon fuels such as ethanol are

- A. furans
- B. phosphates
- C. carbon oxides
- D. chlorofluorocarbons

Use the following additional information to answer the next question.

To analyze the combustion efficiency of ethanol and hydrazine, NASA scientists compared the temperature of gases that are produced from the combustion of equal volumes of ethanol and hydrazine.

20. In the above experiment, the temperature of the gases produced is the *i* variable, and the type of fuel tested is the *ii* variable.

The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	manipulated	responding
B.	manipulated	controlled
C.	responding	manipulated
D.	responding	controlled

Use the following information to answer the next question.

Results from an experiment indicate that space travel reduces the ability of helper T cells to function.

21. Given the information above, it could be hypothesized that helper T cells in astronauts' blood would be less able to
- A. engulf and destroy antigens
 - B. turn off the immune response
 - C. store information about the identity of antibodies
 - D. communicate information between macrophages and B cells

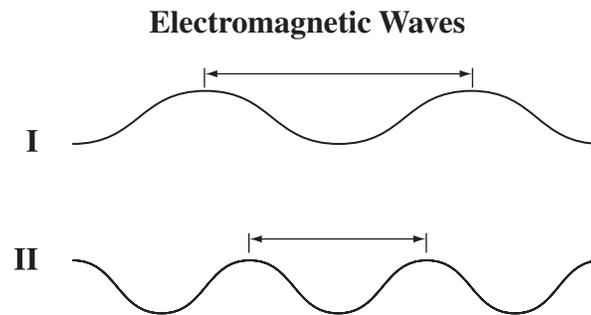
Use the following information to answer the next question.

While in space, astronauts are exposed to harmful forms of electromagnetic radiation (EMR), which, in some cases, can alter the order of bases in DNA molecules.

22. The exposure of DNA to EMR can result in
- A. synapsis
 - B. mutation
 - C. replication
 - D. biomagnification

Use the following information to answer the next question.

Two different waves travel through space toward the space station.



23. When compared with wave II, wave I has a *i* wavelength and has *ii* energy.

The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	longer	higher
B.	longer	lower
C.	shorter	higher
D.	shorter	lower

Use the following information to answer the next two questions.

To reduce exposure to harmful electromagnetic radiation (EMR), an astronaut wears a space helmet with a visor that has a protective coating. Waves of EMR that pass through this coating vibrate in a single plane.

24. The protective coating on the visor causes EMR to be
- A. reflected
 - B. refracted
 - C. diffracted
 - D. polarized

Numerical Response

5. If the EMR that passes through the coating on the visor has a wavelength of 2.60×10^{-10} m, then the frequency of this EMR is _____ $\times 10^{18}$ Hz.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

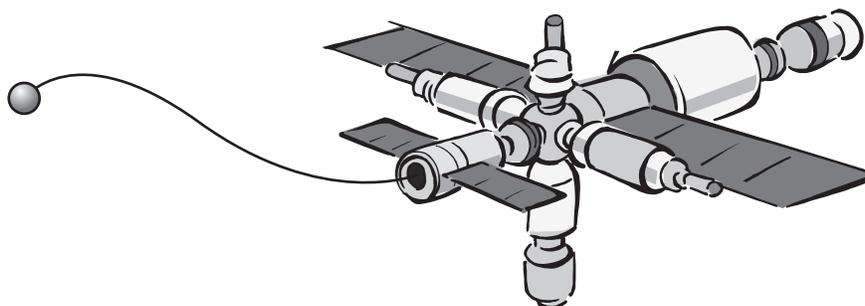
25. Researchers hope to develop a space vehicle engine that is powered by nuclear fission reactions. Nuclear fission reactions involve the
- A. combining of nuclei with smaller masses to make a nucleus with a larger mass
 - B. splitting of a nucleus with a larger mass to make nuclei with smaller masses
 - C. absorbing of a helium atom by the nucleus of an element
 - D. absorbing of an electron by the nucleus of an element
26. If a particular engine can generate 150 MW of power, then the energy the engine can produce in one day is
- A. 3.60×10^{13} J
 - B. 1.30×10^{13} J
 - C. 5.40×10^{12} J
 - D. 2.25×10^{12} J

27. Photovoltaic cells are commonly used on space vehicles. The energy conversion that occurs during the operation of a photovoltaic cell is
- A. mechanical to electrical
 - B. electrical to mechanical
 - C. solar to electrical
 - D. electrical to solar

Use the following information to answer the next question.

Scientists have theorized that a long conducting wire attached to the International Space Station would generate electrical energy.

Space Station with Conducting Wire Attached



28. To generate electricity using a long conducting wire, the space station must be *i* relative to a *ii* field.

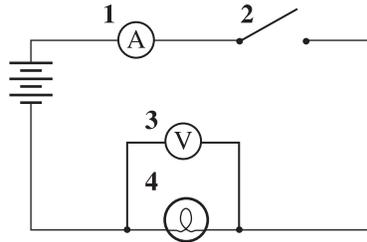
The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	stationary	magnetic
B.	stationary	gravitational
C.	moving	magnetic
D.	moving	gravitational

Use the following information to answer the next three questions.

Electrical energy produced at a research facility is stored in a battery that is connected to a simple circuit, as shown below.

Simple Circuit



29. In the circuit shown above, the ammeter is connected in *i* , and the voltmeter is connected in *ii* .

The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	parallel	parallel
B.	parallel	series
C.	series	parallel
D.	series	series

Numerical Response

6. Match each of the parts of the circuit numbered above with its purpose, as given below.

Part: _____
 Purpose: **Converts energy** **Measures current** **Interrupts current** **Measures voltage**

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Numerical Response

7. If the ammeter reads 4.15 A and the resistance of the device labelled 4 is 2.88Ω , then the power rating of the device labelled 4 is _____ W.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

30. A transformer is used to change
- A. resistance in an AC circuit
 - B. resistance in a DC circuit
 - C. voltage in an AC circuit
 - D. voltage in a DC circuit

Use the following chart to answer the next question.

	Mass	Radius
Earth	5.98×10^{24} kg	6.37×10^6 m
Mars	6.42×10^{23} kg	3.40×10^6 m

Numerical Response

8. Given the information above, the magnitude of the gravitational field strength experienced by an object located on the surface of Mars is _____ N/kg.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

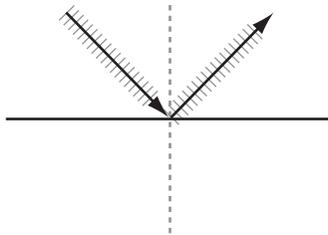
31. Through the use of a *i* , astronomers have determined that light from most stars is *ii* , which provides evidence that the universe is *iii* .

The statement above is completed by the information in row

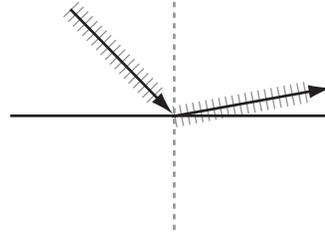
Row	<i>i</i>	<i>ii</i>	<i>iii</i>
A.	radio telescope	blue-shifted	contracting
B.	radio telescope	red-shifted	expanding
C.	spectroscope	blue-shifted	contracting
D.	spectroscope	red-shifted	expanding

32. Some waves from space pass through measuring instruments, whereas others are reflected. Which of the following diagrams represents a reflected wave?

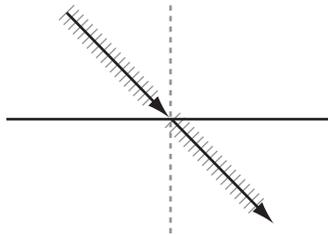
A.



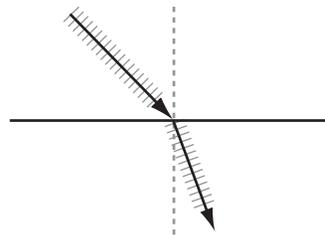
B.



C.



D.



Use the following information to answer the next two questions.

Current and Potential Global Use of Renewable Energy Sources

Energy Source	Current Use ($\times 10^{18}$ J/a)	Predicted Use ($\times 10^{18}$ J/a)
Hydro	10.1	50
Biomass	50.1	250
Solar	0.2	1 600
Wind	0.2	600
Geothermal	2.0	5 000

33. Which of the following energy sources is predicted to experience the **greatest percentage** increase?
- A. Geothermal
 - B. Biomass
 - C. Solar
 - D. Wind

Numerical Response

9. According to the information above, the current global use of hydro per year, expressed in scientific notation, is $a.bc \times 10^{19}$ J. The values of a , b , and c are , , and .
- a b c

(Record all **three-digits** of your answer in the numerical-response section on the answer sheet.)

34. *Coal from Alberta can be described as being cleaner than coal from other parts of Canada because it has a lower i content, which results in reduced ii .*

The statements above are completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	sulfur	greenhouse gas emissions
B.	sulfur	acid deposition
C.	carbon	greenhouse gas emissions
D.	carbon	acid deposition

35. *Geothermal energy is a i source of energy. In geothermal energy plants, ii drives turbines.*

The statements above are completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	renewable	liquid water
B.	renewable	water vapour
C.	non-renewable	liquid water
D.	non-renewable	water vapour

Use the following information to answer the next question.

Products of the Internal Combustion Engine

- 1 Thermal energy
- 2 Kinetic energy
- 3 CO₂(g)
- 4 NO_x(g)

Numerical Response

- 10.** Match each product listed above with its description given below. Use each number only once.

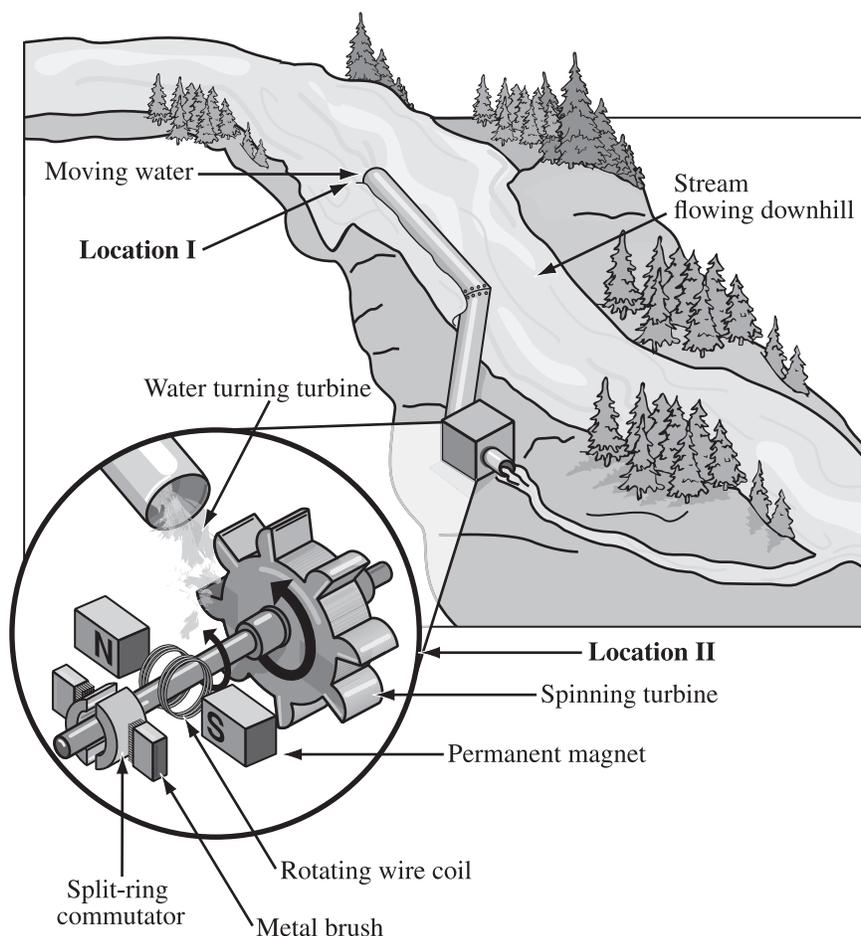
Product:	_____	_____	_____	_____
Description:	Contributes to the greenhouse effect	Component of photochemical smog	Waste output energy	Useful output energy

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next four questions.

Mobile power plants, such as the one illustrated below, are used in remote locations. Flowing water turns a turbine, which then moves a coil of wire through a magnetic field.

Mobile Power Plant



36. The type of mobile power plant illustrated above is

- A. biomass
- B. geothermal
- C. wind power
- D. hydro power

37. Which of the following rows identifies the **main** form of energy at locations I and II in the illustration on the previous page?

Row	Location I	Location II
A.	Thermal	Thermal
B.	Thermal	Kinetic
C.	Kinetic	Kinetic
D.	Kinetic	Thermal

38. The components that connect to the spinning turbine in the illustration on the previous page form a

- A. transformer
- B. generator
- C. ammeter
- D. motor

39. *As the rotating wire coil in the illustration on the previous page moves between the permanent magnets, both i field and ii field are produced.*

The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	a magnetic	a gravitational
B.	a magnetic	an electric
C.	an emission	a gravitational
D.	an emission	an electric

Use the following information to answer the next question.

The fields that are used in a motor are vector fields.

40. According to the information above, fields that are used in a motor have both *i* and *ii* .

The statement above is completed by the information in row

Row	<i>i</i>	<i>ii</i>
A.	mass	volume
B.	mass	direction
C.	magnitude	volume
D.	magnitude	direction

Numerical Response

11. If a mobile power plant is capable of producing electricity with a voltage of 230 V and a current of 3.40 A, then the power produced is _____ W.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

Numerical Response

12. It is estimated that the submerged turbines in a tidal power-generation system could convert a potential power of 24.0 GW into 3.63 GW of electrical power. The estimated efficiency of the submerged turbines in the tidal power-generation system is _____%.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

*You have now completed the examination.
If you have time, you may wish to check your answers.*

