Instructions

- You have a maximum of 2 hours to write this exam.
- Supplies required: calculator, paper, and ruler

Multiple Choice

Each question has a single best answer. Make your choice by circling the letter beside your answer. (18 x 1 mark each = 18 marks)

1. In Western history, the first recorded scientist to propose that Earth revolved around the Sun was
   a. Galileo
   b. Copernicus
   c. Ptolemy
   d. Aristarchus

2. Sperm and egg cells are referred to as
   a. gametes
   b. zygotes
   c. diploid cells
   d. homologous cells
3. Which of the following elements has a total of six electrons in its valence shell?
   a. nickel
   b. chromium
   c. sulphur
   d. bromine

4. Jupiter, Saturn, Neptune, and Uranus are considered a family known as
   a. the galactic planets
   b. gas giant planets
   c. terrestrial planets
   d. solar planets

5. What is the azimuth of Polaris when observed from Winnipeg, Manitoba?
   a. 0°
   b. 15°
   c. 35°
   d. 50°

6. An example of a naturally occurring diatomic molecule is
   a. gold
   b. copernicium
   c. carbon dioxide
   d. hydrogen gas

7. Twelve coulombs of electric charge travels through a resistor which uses 24 joules of energy. What is the potential difference across the resistor?
   a. 2 J/C
   b. 12 J/C
   c. 36 J/C
   d. 288 J/C

8. Ernest Rutherford is credited for the discovery of
   a. the moons of Jupiter
   b. the nucleus of the atom
   c. deoxyribonucleic acid (DNA)
   d. the piezoelectric effect
9. Human egg cells are produced in the
   a. ovaries
   b. vagina
   c. cervix
   d. uterus

10. The unit for measuring electric current is the
    a. joule
    b. ohm
    c. ampere
    d. tesla

11. The diagram below represents
    a. an atom of magnesium
    b. a molecule of sodium
    c. an alkali metal
    d. a chalcogen

12. How long does it take the Moon to revolve around Earth?
    a. 24 hours
    b. 27 days
    c. 12 days
    d. 1 week

13. A mother is homozygous recessive for a sex-linked trait. Which statement is true?
    a. Half of her daughters will display the dominant phenotype.
    b. All of her daughters will display the recessive phenotype.
    c. All of her sons will display the dominant phenotype.
    d. All of her sons will display the recessive phenotype.
14. Stars such as our Sun produce their energy
   a. through the nuclear fission of helium into hydrogen
   b. through the nuclear fusion of hydrogen into helium
   c. through the nuclear fission of hydrogen into helium
   d. through the combustion of hydrocarbons

15. A diploid human cell contains
   a. 64 chromosomes
   b. 23 pairs of chromosomes
   c. 46 pairs of chromosomes
   d. 23 chromosomes

16. A rod that has been negatively charged touches an electroscope.
   a. Negative charges move out of the electroscope.
   b. Positive charges move out of the electroscope.
   c. Negative charges move into the electroscope.
   d. Positive charges move into the electroscope.

17. A metal that can be hammered into thin sheets demonstrates the property called
   a. malleability
   b. conductivity
   c. ductility
   d. lustre

18. Which scientist contributed to the first periodic table?
   a. Tycho Brahe
   b. Dimitri Mendeleev
   c. Aristotle
   d. Isaac Newton
Name: ______________________________________________

Matching

Place a letter in the pace provided that gives the best match.

(18 x 0.5 marks each = 9 marks)

___ insulator a. discovered the moons of Jupiter
___ astrolabe b. contain genes
___ Bohr c. developed a model of electron orbitals
___ chromosome d. the protons in a nucleus
___ halogen e. chlorine
___ Galileo f. does not conduct electricity
___ Punnett square g. provides only one path for electrical current
___ light year h. a vertical coordinate
___ series circuit i. the distance that light travels in 365 Earth days
___ atomic number j. the movement of electrons through a conductor
___ current k. a model for predicting genotypes
___ neutron l. female gonad
___ joule m. found in the nucleus of an atom
___ potassium n. an alkali metal
___ electroscope o. detects electric charge
___ altitude p. claimed that Earth orbited the Sun
___ ovaries q. Arabic instrument for observing stars
___ Copernicus r. unit of energy
Short Answer (29 marks)

1. There are two hydro meter readings shown below. One meter reading is for July and the other is for August. (4 marks)

   July: ❌❌❌❌

   August: ❌❌❌❌

   a. What is the energy reading for July and August? Show the units. (2 marks)

   ________________________________________________________________

   ________________________________________________________________

   b. What is the energy consumption between July and August in this example? (1 mark)

   ________________________________________________________________

   c. If the cost for energy were $0.24 per kilowatt hour, what will this household pay for energy? (1 mark)

   ________________________________________________________________

   ________________________________________________________________

2. Name two types of asexual reproduction. For each type, name one species that uses the method. (4 marks)

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________
3. Identify the following elements by name and symbol. (5 marks)
   a. This element is the lightest in existence. _______________
   b. This element is the most reactive non-metal. _______________
   c. The atomic mass of this element is approximately 32. _______________
   d. This element contains two more protons than nickel. _______________
   e. On the periodic table, this element is located on the fourth period and the second family. _______________

4. What is a phenotype? How is it different from a genotype? (3 marks)
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

5. What is a geosynchronous orbit, and how does it benefit telecommunications systems? (2 marks)
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

6. What is a nebula, and how does it form a star? (3 marks)
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

7. Fill in the blanks in the following sentences about cell division. (5 marks)
   Mitosis takes place in _______________ cells, while meiosis occurs in _______________ cells. Mitosis produces two _______________ cells, while meiosis produces a total of ____ cells, each with a _______________ chromosome count.
8. Use the Energuide symbol below to answer the following questions. (3 marks)

![Energuide Symbol]

a. How much energy would be used by this appliance in a typical month of use?
____________________________________________________________________
____________________________________________________________________

b. If you were paying 7.5 cents per kWh for electrical energy in your area, what would it cost to use this appliance for three months?
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Diagrams and Long Answers (44 marks)

1. In a species of dog, the gene for long hair (H) is dominant over the gene for short hair (h). A licensed breeder mates a long-haired male (Hh) with a long-haired female (Hh). (7 marks)
   a. Draw a Punnett square showing the potential genotypes of this pairing’s offspring. (1 mark)
b. What are the possible genotypes of the offspring? In what percentages are they predicted to appear? (3 marks)

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______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

c. What phenotypes will the puppies display, and in what percentage? (2 marks)

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

d. How can the breeder alter the pairing to ensure that only long-haired puppies are born? (1 mark)

______________________________________________________________________

2. Draw a Bohr atom of fluorine. (6 marks)

   a. Draw the atom, labelling the nucleus and one of the electrons. (2 marks)

   b. How many neutrons are there in fluorine? ______________________ (1 mark)

   c. What is the mass number for fluorine? ______________________ (1 mark)

   d. To what family does fluorine belong? ______________________ (1 mark)

   e. What is one trait shared by this family? ______________________ (1 mark)
3. Use the diagram below to answer the following questions. (5 marks)

![Diagram of an electrical circuit with a battery, ammeters, and light bulbs]

a. Are the three bulbs connected in series or parallel? ______________________
b. What is the reading in A2? ______________________
c. What is the total current in the circuit? ______________________
d. The three light bulbs all have the same resistance. What is the voltage across each of the light bulbs? ______________________
e. Draw an arrow on the diagram indicating the direction of electron flow. The arrow should point away from the negative terminal of the battery and towards the positive terminal.

4. Use the diagram below to answer the following questions. (5 marks)

![Diagram of a negatively charged rod and a conductor]

a. Draw the charge distribution for the conditions shown on the conductor. (2 marks)
b. How would you give the conductor a permanent charge without moving the charged rod? (1 mark)

______________________________________________________________________
______________________________________________________________________

c. What charge would be left on the conductor after completing part (b)? (1 mark)

______________________________________________________________________
______________________________________________________________________

d. What name is given to this method of charging an object? (1 mark)

______________________________________________________________________

5. Describe how seasons are produced in the Northern Hemisphere. (4 marks)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

6. Why are you unlikely to find snow in countries along the equator? (2 marks)

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________________________________________________________________________
________________________________________________________________________

7. What is the purpose of mitosis and meiosis within the human body? (2 marks)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
8. Darren has been observing a newly discovered comet through his telescope. (8 marks)
a. Using the data provided in the table below, plot a graph showing the position of this new comet over the months of April to October. (5 marks – 1 mark for title, 4 marks for graph)

<table>
<thead>
<tr>
<th>Observation Date</th>
<th>Comet’s Azimuth</th>
<th>Day within Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1</td>
<td>102.0</td>
<td>0</td>
</tr>
<tr>
<td>April 15</td>
<td>95.0</td>
<td>15</td>
</tr>
<tr>
<td>May 1</td>
<td>88.0</td>
<td>30</td>
</tr>
<tr>
<td>May 15</td>
<td>84.0</td>
<td>45</td>
</tr>
<tr>
<td>May 30</td>
<td>83.0</td>
<td>60</td>
</tr>
<tr>
<td>June 14</td>
<td>84.0</td>
<td>75</td>
</tr>
<tr>
<td>June 29</td>
<td>87.0</td>
<td>90</td>
</tr>
<tr>
<td>July 14</td>
<td>92.0</td>
<td>105</td>
</tr>
<tr>
<td>July 29</td>
<td>98.0</td>
<td>120</td>
</tr>
<tr>
<td>August 13</td>
<td>99.0</td>
<td>135</td>
</tr>
<tr>
<td>August 28</td>
<td>91.0</td>
<td>150</td>
</tr>
<tr>
<td>September 12</td>
<td>85.0</td>
<td>165</td>
</tr>
<tr>
<td>September 27</td>
<td>80.0</td>
<td>180</td>
</tr>
</tbody>
</table>

Title: ___________________________________________________

Azimuth of Comet (90 Degrees = East)
b. When Darren shows his data table to Karen, she exclaims that he must have made an error, because the comet is clearly changing the direction of its revolution around the Sun. How might Darren defend his observations? (3 marks)

______________________________________________________________________  
______________________________________________________________________  
______________________________________________________________________  

9. What are five indicators of a chemical change? (5 marks)

______________________________________________________________________  
______________________________________________________________________  
______________________________________________________________________  
______________________________________________________________________  
______________________________________________________________________  