PART A: MULTIPLE CHOICE

I: Reproduction

1. Mitosis produces

A) two identical cells with paired chromosomes.
B) two non-identical cells with paired chromosomes.
C) four identical cells with single chromosomes.
D) four non-identical cells with single chromosomes.

2. Which series of events represent the correct sequence of events occurring in mitosis?

A) chromosomes replicate, chromosomes line up, chromosomes separate, cytoplasm divides
B) chromosomes line up, chromosomes separate, chromosomes replicate, cytoplasm divides
C) cytoplasm divides, chromosomes replicate, chromosomes line up, chromosomes separate
D) chromosomes replicate, chromosomes separate, cytoplasm divides, chromosomes line up

3. The cell cycle best refers to the sequence of events

A) in mitosis.
B) in meiosis.
C) from one cell division to the next cell division.
D) all of the above.

4. _____ is used by organisms for the purpose of sexual reproduction.

A) budding
B) meiosis
C) binary fission
D) regeneration

5. The process by which a unicellular organism divides by mitosis into two equal halves is termed

A) spore formation.
B) vegetative propagation.
C) regeneration.
D) binary fission.

6. John's mom is growing flowers from pieces of flower root belonging to her neighbour. This would be an example of asexual reproduction by the process of

A) budding.
B) grafting.
C) vegetative propagation.
D) binary fission.

7. The production of multicelled plants by growing them from a few cells in a test tube containing growth substances is reproduction by

A) cuttings.
B) tissue culture.
C) grafting.
D) budding.

8. To grow roses, the stem from one kind of rose is attached to the rootstock of a different kind of rose. This represents asexual reproduction by the process of

A) grafting.
B) cuttings.
C) tissue culture.
D) budding.

9. Choose the true statement. Meiosis forms

A) identical cells with diploid chromosomes.
B) non-identical cells with haploid chromosomes.
C) identical cells with haploid chromosomes.
D) non-identical cells with diploid chromosomes.

10. Which application applies only to mitosis?

A) gamete formation
B) sexual reproduction
C) formation of haploid cells
D) formation of diploid cells

11. Which set of conditions most accurately compare mitosis and meiosis?

A) Mitosis – forms haploid cells
Meiosis – forms diploid cells

B) Mitosis – one cell division
Meiosis – two cell divisions

C) Mitosis – cells non-identical
Meiosis – cells all identical

D) Mitosis – sex cell formation
Meiosis – body cell formation

12. One advantage of asexual reproduction is that

A) the offspring will be superior to the parent.
B) the offspring will always be well adapted to its environment.
C) offspring will be identical.
D) many offspring can be produced in a short time.

13. Animals such as fish which practise external fertilization produce high numbers of gametes. The likely purpose would be to

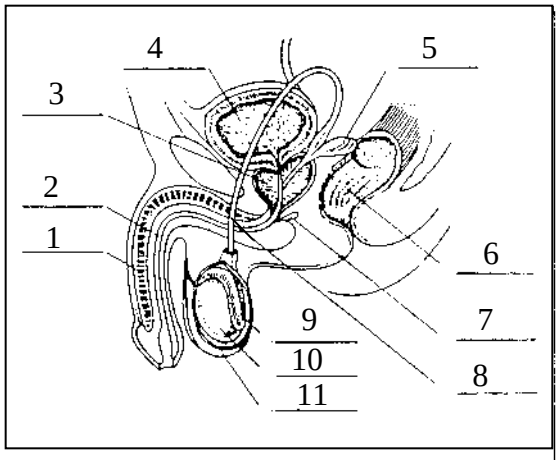
A) make up for fertilization occurring in an unprotected environment.
B) produce large numbers of offspring.
C) provide food for predators.
D) two of the above are correct.

14. The function of the epididymis in the male reproductive system is to

A) produce sperm.
B) transport sperm.
C) store sperm.
D) regulate sperm temperature.

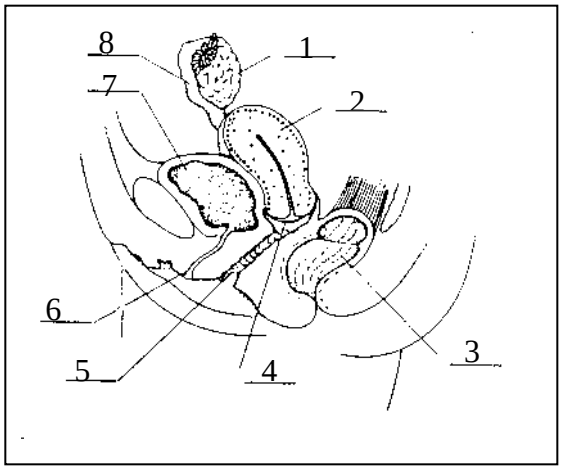
15. Part #8 on the accompanying diagram is the

A) vas deferens.
B) epididymis.
C) urethra.
D) seminal vesicle.



16. Part #5 on the accompanying diagram is the

A) vagina (birth canal).
B) cervix.
C) fallopian tube.
D) urethra.



17. The ovary produces the female hormones

A) LH and estrogen.
B) FSH and progesterone.
C) FSH and LH.
D) estrogen and progesterone.

18. Which one of these is haploid?

A) zygote
B) fetus
C) gamete
D) embryo

19. The early multicelled stage in the development of an unborn organism is described as a(n)

A) ovary.
B) fetus.
C) gamete.
D) embryo.

20. During pregnancy, the baby develops within the mother's

A) fallopian tubes.
B) cervix.
C) uterus.
D) ovary.

21. A human with sex chromosomes XY would represent a

A) diploid male.
B) diploid female.
C) haploid male.
D) haploid female.

22. Ralph can roll his tongue. His mother and sister cannot. The gene for tongue rolling (R) is dominant. Ralph's genotype would be _____ and his sister's genotype would be _____.

A) RR, Rr
B) Rr, rr
C) RR, rr
D) Rr, rR

23. The actual messages for a trait which are coded onto DNA would describe a

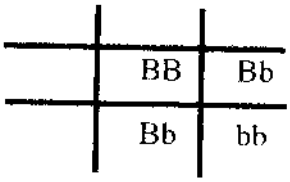
A) phenotype.
B) genotype.
C) dominant trait.
D) recessive trait.

24. A _____ is a spontaneous change occurring to the DNA coding a particular trait.

A) replication
B) duplication
C) reduction division
D) mutation

25. In mice, black coat colour (B) is completely dominant to white coat colour (b). Study the Punnett Square to determine the genotypes of the parents.

A) BB and Bb
B) Bb and Bb
C) Bb and bb
D) bb and Bb



II: Atoms and Elements

26. The study of the properties of matter defines

A) physics.
B) chemistry.
C) biology.
D) engineering.

27. Alchemists were persons who

A) discovered new elements.
B) tried to convert base metals into gold.
C) believed the world was flat.
D) believed the Earth was the centre of the universe.

28. The four element theory developed by the ancient Greeks suggested that all matter represented some combination of

A) Earth, air, fire and rock.
B) metal, rock, air and fire.
C) sun energy, Earth, air and water.
D) Earth, fire, air and water.

29. Dalton's atomic model suggested that an atom was composed of

A) solid indestructible spheres.
B) a positive nucleus embedded with negative electrons.
C) a positive nucleus with orbiting negative electrons.
D) neutral spheres with orbiting negative electrons.

30. The discovery of the electron was the result of the work of

A) Rutherford.
B) Dalton.
C) Thompson.
D) Bohr.

31. In the neutral atom,

A) protons = electrons.
B) protons = neutrons.
C) neutrons = electrons.
D) all of the above are correct.

32. The kind of element is determined by the number of _____ with an atom.

A) protons
B) neutrons
C) electrons
D) isotopes

33. The element with Bohr electron configuration of 2, 8, 3 would be

A) sodium.
B) magnesium.
C) aluminum.
D) silicon.

34. Symbols for elements are the same in all countries because

A) all symbols are taken from Latin.
B) all symbols are taken from English.
C) it allows scientists in all countries to communicate more easily.
D) elements do not change over time.

35. Atomic mass is determined according to

A) the difference between number of protons and electrons in an atom.
B) the difference between number of protons and neutrons in an atom.
C) the sum of number of protons and electrons in an atom.
D) the sum of number of protons and neutrons in an atom.

Refer to your Periodic Table to answer the next two questions.

36. One atom of the element Fluorine will have

A) 9 protons and 19 neutrons.
B) 9 neutrons and 19 protons.
C) 9 neutrons and 10 protons.
D) 9 protons and 10 neutrons.

37. If the element oxygen gained two protons, it would become like

A) boron.
B) neon.
C) sodium.
D) potassium.

38. In order to make an atom become positively charged, you must

A) add protons.
B) remove protons.
C) add electrons.
D) remove electrons.

39. The number of neutrons in one atom of sodium is

A) eleven.
B) twelve.
C) twenty-three.
D) thirty-four.

40. The charges of subatomic particles are

A) protons = positive, neutrons = negative, electrons = neutral
B) protons = negative, neutrons = neutral, electrons = positive
C) protons = neutral, neutrons = positive, electrons = negative
D) protons = positive, neutrons = neutral, electrons = negative

41. The family of elements called halogens include

A) fluorine and chlorine.
B) neon and argon.
C) oxygen and sulphur.
D) nitrogen and phosphorus.

42. The original Periodic Table was designed by

A) Dalton.
B) Thompson.
C) Bohr.
D) Mendeleev.

43. Elements with _____ electron(s) in their outer shell will be chemically inactive.

A) one
B) three
C) four
D) eight

44. The alkali metal family of elements will have _____ electrons in their outer shell.

A) one
B) two
C) seven
D) eight

45. A _____ of a _____ is any substance made of two or more different atoms joined together.

A) molecule, element
B) element, molecule
C) molecule, compound
D) compound, molecule

46. When tested, an unknown element proves to be a good electrical conductor, malleable, shiny and solid. It would most likely be

A) silicon
B) astinine
C) carbon
D) lithium

47. Which compound contains 4 elements and eight atoms?

A) NH_4NO_3
B) $NaHCO_3$
C) $MgCrO_4$
D) $LiC_2H_3O_2$

48. All metals tend to _____ when reacting with other elements.

A) gain electrons
B) lose electrons
C) gain protons
D) lose protons

49. Which one of these does NOT represent a physical property?

A) ability to rust
B) melting point
C) lustre
D) density

50. Evidence of chemical change may include

A) temperature change.
B) release of heat.
C) production of a precipitate.
D) all of the above may indicate chemical change

III: The Nature of Electricity

51. Static electricity is the result of

A) protons moving into an object.
B) electrons moving into an object.
C) neutrons moving into an object.
D) electrons moving into an object while protons move out.

52. The fluid model of static charge was proposed by

A) Lavoisier.
B) Watt.
C) Franklin.
D) Volta.

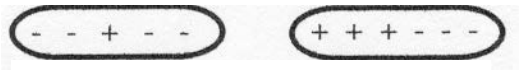
53. If an object is given a positive charge, a neutral object brought close to it without touching will

A) be repelled.
B) be attracted.
C) not be affected.
D) attract and then repel.

54. Which set of diagrams would be correct for a positive and a negative charge?

NO Correct Answer

A) 

B) 

C) 

D) 

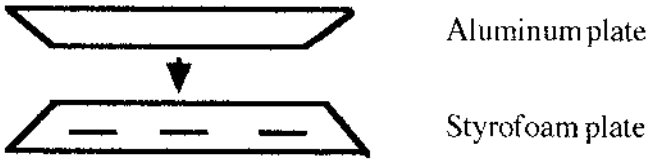
55. Which group would be good electrical conductors?

A) metals
B) non-metals
C) noble gases
D) all of the above

56. An object is attracted to both a neutral and negative rod. Its charge could be

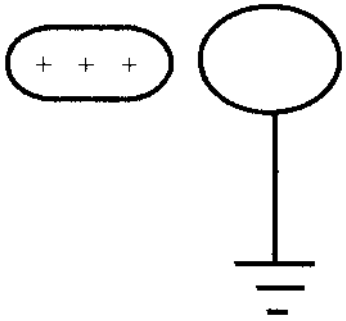
A) positive.
B) negative.
C) neutral.
D) either positive or neutral.

57. When an aluminum plate is placed on the negatively charged Styrofoam plate of an electrophorus,



A) charge flows into the air.
B) charge flows onto the Styrofoam plate.
C) the electrons on the aluminum plate are redistributed.
D) the protons on the aluminum plate are redistributed.

Refer to the following diagram to answer question 58.

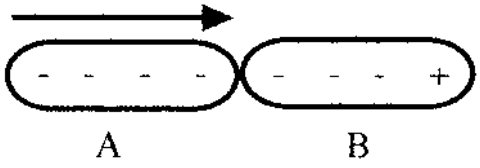


58. A grounded neutral object is brought into contact with a positively charged object. In response, _____will _____ the grounded object.

A) protons, enter
B) protons, leave
C) electrons, enter
D) electrons, leave

59. Negative object A is brought into contact with Object B. The charge on Object B would be the result of

A) friction.
B) grounding.
C) induction.
D) conduction.



60. A device used to store static charge is a

A) capacitor.
B) battery.
C) lightning rod.
D) generator.

61. You rub your feet across a carpet as you walk towards the kitchen. In the kitchen, you get a shock when you touch a water tap. The shock is the result of

A) chemical reaction.
B) induction.
C) proton transfer.
D) grounding.

62. Electric discharge can be the result of

A) gain in protons.
B) gain of electrons.
C) loss of protons.
D) two of the above.

63. A permanent charge by conduction can be achieved in a tin can by

A) touching a negative rod to a grounded tin can.
B) touching a negative rod to an insulated tin can.
C) bringing a negative rod close to a grounded tin can.
D) bringing a negative rod close to an insulated tin can.

64. Which one of these represents an application of electrostatics?

A) photocopier
B) vacuum cleaner
C) fridge magnet
D) power saw

65. Four objects, A, B, C and D are each charged. A is attracted to B, while C repels D. A also repels D. Which response could show the charge on each other?

A) A negative, B negative, C positive, D positive
B) A negative, B positive, C negative, D, negative
C) A positive, B positive, C negative, D positive
D) A positive, B negative, C positive, D negative

66. If you were to compare a garden hose to an electrical wire, then increasing the pressure in the hose would be like increasing the _____ in the wire.

A) current
B) electrical potential (voltage)
C) resistance
D) charge

67. Using the formula I = Q/t, charge would be calculated as

A) It
B) Q / t
C) I / Q
D) Qt

68. Photoelectric energy is energy produced by changing _____ energy into electrical energy.

A) thermal
B) light
C) chemical
D) mechanical

69. A generator would be an example of turning _____ energy into electrical energy.

A) solar
B) thermal
C) radiant
D) magnetic

70. Which of these affect resistance in a conductor?

A) kind of material
B) length of material
C) thickness of material
D) all affect resistance

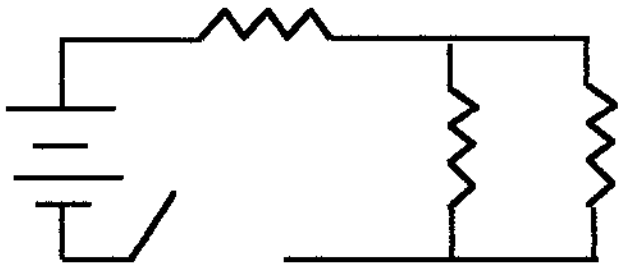
71. Based on the formula V = E / Q, which relationship is correct?

A) As energy increases, voltage decreases.
B) As energy increases, voltage increases.
C) As charge increases, voltage increases.
D) As charge increases, voltage stays the same.

72. Use Ohm's Law to calculate the voltage in a circuit where resistance = 12 Ohms and the current = 15 Amps.

A) .8 Volts
B) 1.25 Volts
C) 3 Volts
D) 180 Volts

73. The circuit indicated in the diagram has



A) two parallel resistors, one series resistor, a one cell battery and a closed switch.
B) two series resistors, one parallel resistor, a two cell battery and an open switch.
C) two parallel bulbs, one series bulb, a one cell battery and an open switch.
D) two parallel resistors, one series resistor, a two cell battery and an open switch.

74. Two bulbs, X and Y are connected in parallel to a battery. If a third bulb "Z" is added in parallel, Bulb x will

A) glow only half as brightly.
B) glow twice as brightly as before.
C) glow as brightly as before.
D) go out.

75. _____ is defined as energy per unit time.

A) Voltage
B) Charge
C) Current
D) Power

PART B: EXTENDED ANSWERS

I: Reproduction

1. Describe TWO similarities and two differences between mitosis and meiosis.

Similarities: Both are types of cell division, Chromosomes replicate before division, both used for reproduction

Differences: Mitosis: Daughter cells are identical and diploid
Meiosis: Daughter cells are different and haploid

2. Define and give an example of:

a) regeneration: Growing a whole new organism from a piece of parent. (Starfish)

b) grafting: Attaching one organism to another. (Apple trees)

c) Budding A new organism grows as an outgrowth from parent, breaks off when mature (hydra)

d) binary fission Single celled organism divides in two. (bacteria)

3. Compare haploid cells to diploid cells by completing these questions.

a) Definitions: Diploid – Full set of chromosomes, Haploid – Half-set of chromosomes

b) Process by which each is formed: Diploid = Mitosis, Haploid = Meiosis

c) Use in the body: Diploid = Somatic (body cells), Haploid = Gametes (sex cells)

4. Explain the role of each hormone in the menstrual cycle.

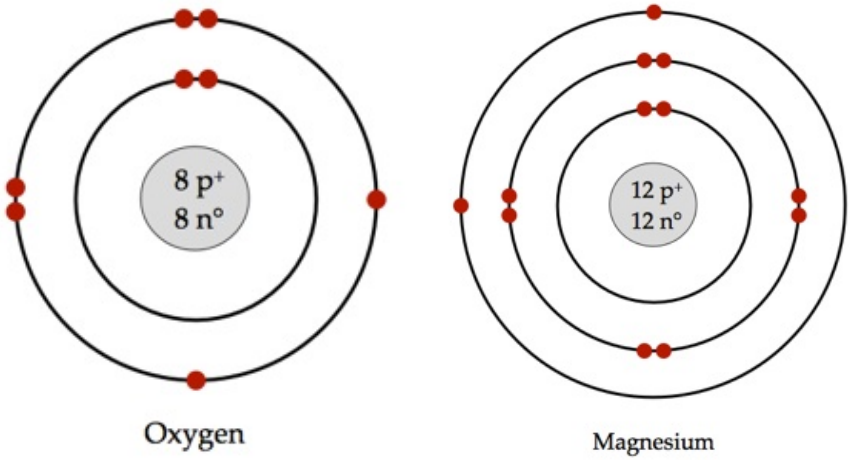
   a) FSH – Stimulates the follicle to develop an egg
   b) Estrogen – Stimulates production of LH, thickens uterine lining.
   c) LH – Causes ovulation
   d) Progesterone – Prepares uterus for pregnancy

III: Atoms and Elements

1. Compare protons and electrons in terms of location, charge, size and who discovered them.

	Location	Size	Charge	Discoverer
Protons	Nucleus	1amu (bigger)	+	Rutherford
Electrons	Orbits/Shells	0amu (small)	-	Thomson

2. Draw a Bohr atomic model for Oxygen and Magnesium. On each diagram indicate the correct number and location for all three types of subatomic particle.



Oxygen Magnesium

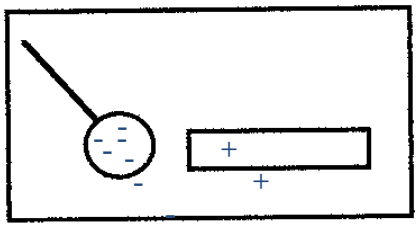
3. Suggest why the symbol for
   a) Calcium is Ca instead of C - C is already used for Carbon
   b) Gold is Au instead of G – Comes from the latin word for gold (Aurum)

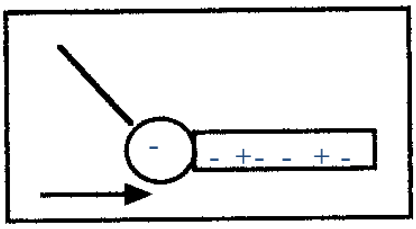
3. In terms of their electron arrangement, explain why the Noble gases are chemically inactive.
   The have a full outer (valence) shell
4. Identify two properties common to all non-metals.
   - Brittle, non-conductive, dull, not magnetic, not ductile, etc.
6. How is a molecule of an element different from the molecule of a compound?
   Molecule of an element is made of the same kind of atoms (ie, O_2, H_2)

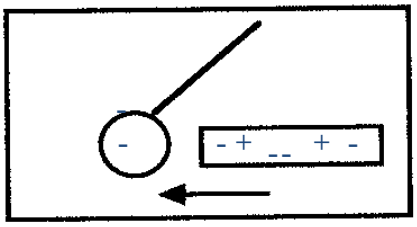
   Molecule of a compound is made of different kinds of atoms (CO_2, N_2O_5)

IV. The Nature of Electricity

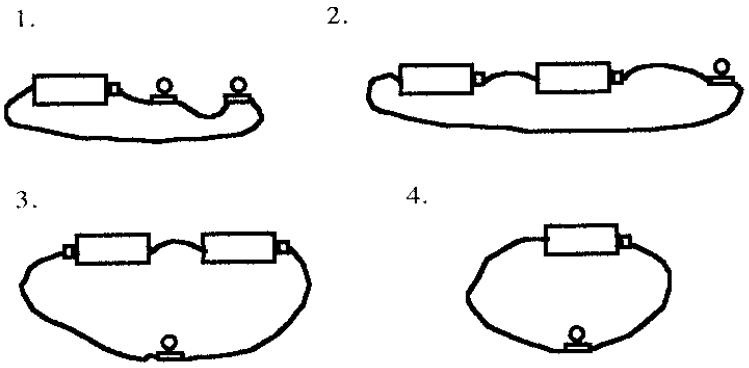
1. In terms of changes to the atoms, explain what causes a substance to become:
   a) positively charged - loses electrons
   b) negatively charged – gains electrons.
2. In the first diagram, a neutral electroscope is brought near a positive rod. The last two diagrams show the events which follow. Place all appropriate "+" and "-" signs required to indicate the charges and their locations on each object.

1. 

2. 

3. 

4. Answer questions below related to these diagrams. Assume all cells and all bulbs to be identical.



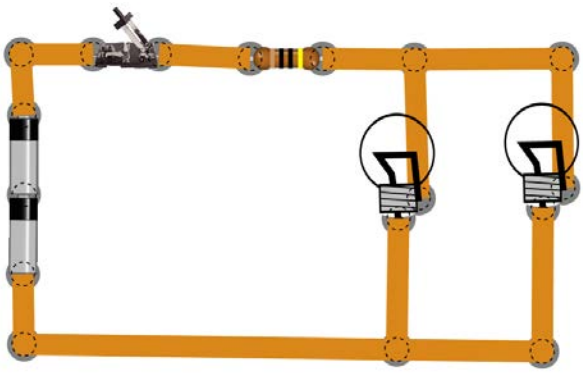
a) Are these series or parallel circuits? Series

b) Which circuit should not light up the bulb at all? #3

c) In which circuit will the bulb burn most brightly? #2

d) If one of the bulbs in circuit #1 burns out, what will happen to the other one? Goes out

4. Draw a schematic diagram showing a circuit powered by two cells in series which are connected to two light bulbs in parallel and a resistor in series. One switch controls the light bulbs and resistor.



5. An air conditioner, rated at 2000 W, is used for 5 hours a day for 90 days a year. If electric energy costs $.07/kwh, calculate the annual cost of cooling the building. Show work, answer and unit.

P = 200W = 2kW

t = (5hr)(90days) = 450hr

Cost = Power x Time x Price

= (2kW)(450hr)($0.07)

= $63.00