Physical Science 1st Semester Final Exam Review

Mixed Word Problem Practice

Measurement	Symbol	Unit
Distance	**d**	**m**
Time	**t**	**s**
Velocity	**v (or s)**	**m/s**
Mass	**m**	**g or kg**
Acceleration	**a**	**m/s^2**
Weight	**w**	**Newton (N)**
Force	**F**	**N**
Volume	**V**	**cm^3 or mL**
Heat	**Q**	**J**
Specific heat	**c**	**J/g °C**
Temperature	**T**	**K or °C**
Current	**I**	**Amperes (A)**
Resistance	**R**	**Ohms (Ω)**
Voltage	**V**	**Volts (V)**
Energy	**KE or PE**	**Joules (J)**

Solve the following problems. *Show your work with units.*

1. During a race, a runner runs at a speed of 6 m/s. 2 seconds later, she is running at a speed of 10 m/s. What is the runner's acceleration? Show your work.

   Vf = 10m/s **a = $\frac{Vf - Vi}{t}$** **$\frac{(10\ m/s - 6m/s)}{2s}$** → **2 m/s^2**
   Vi = 6m/s
   t = 2s

2. If you ride your bike at an average speed of 4 km/h and need to travel a total distance of 28 km, how long will it take you to reach your destination? Show your work.

   avg. v = 4 km/h **v = $\frac{d}{t}$ OR t = $\frac{d}{v}$** **$\frac{28\ km}{4\ km/h}$** →**it will take you 7 hours**
   total d = 28 km
   t =?

3. A tow truck exerts a net horizontal force of 1050 N on a 760-kilogram car. What is the acceleration of the car during this time? Show your work.

   F = 1050 N **F= m*a OR a = $\frac{F}{m}$** **$\frac{1050N}{760\ kg}$** → **1.38 m/s^2**
   m = 760 kg
   a = ?

4. The mass of a newborn baby is 3.5 kilograms. What is the baby's weight? (The acceleration due to gravity at Earth's surface is 9.8 m/s^2.) Show your work.

   m = 3.5 kg **W = m*g** **3.5 kg * 9.8 m/s^2** → **34.3 N**
   g = 9.8 m/s^2
   w = ?

5. A small engine causes a 0.3-kg model airplane to accelerate at a rate of 11 m/s^2. What is the net force on the model airplane? Show your work.

   F = ? **F= m*a** **0.3 kg * 11 m/s^2** → **3.3 N**
   m = 0.3 kg
   a = 11 m/s^2

6. A worker uses a cart to move a load of bricks weighing 680 N a distance of 10 m across a parking lot. If he pushes the cart with a constant force of 209 N, what amount of work does he do? Show your work.

   F = 209 N **W = F*d** **209 N * 10 m** → **2090 J**
   d = 10 m
   W = ?

7. A girl lifts a 160-N load to a height of 1 m in 0.5 s. What power does the girl produce? Show your work.

F = 160 N **P = W/t OR (f*d)/t** **(160 N * 1 m)/0.5 s →** **320 W**
d = 1 m
t = 0.5 s
P = ?

8. The input force of a pulley system must move 8.0 m to lift a 3000-N engine a distance of 2.0 m. What is the IMA of the system? Show your work.

IMA = ? **MA = De/Dr** **8.0 m / 2.0 m →** **4**
De **= 8.0 m**
Dr **= 2.0 m**

9. A 20-N force applied to the handle of a door produces a 44-N output force. What is the AMA of the handle? Show your work.

Fr = 44 N **MA = Fr/Fe** **44 N / 20 N →** **2.2**
Fe = 20 N
MA = ?

10. What is the kinetic energy of a 72.0-kg sky diver falling at a terminal velocity of 79.0 m/s? Show your work.

KE = ? **KE = ½*m*v^2** **(½)(72.0 kg)(79.0 m/s)^2**
m = 72.0 kg **= (36) * (6241) →** **224, 676 J**
v = 79.0 m/s

11. A 0.47-kg squirrel jumps from a tree branch that is 3.5 m high to the top of a bird feeder that is 1.2 m high. What is the change in gravitational potential energy of the squirrel? (The acceleration due to gravity is 9.8 m/s^2.) Show your work.

GPE = ? **GPE = mgh** **(0.47 kg)(9.8 m/s^2)(2.3 m) →** **10.59 J**
m = 0.47 kg
g = 9.8 m/s^2
h = 3.5 m – 1.2 m = 2.3 m

12. A small dog is trained to jump straight up a distance of 1.2 m. How much gravitational potential energy does the 7.2 kg dog need to jump this high? (The acceleration due to gravity is 9.8 m/s^2.) Show your work.

GPE = ? **GPE = mgh** **(7.2 kg)(9.8 m/s^2)(1.2 m) →** **84.67 J**
m = 7.2 kg
g = 9.8 m/s^2
h = 1.2 m

13. How many kilojoules of heat must be transferred to a 480-g aluminum pizza pan to raise its temperature from 22°C to 234°C? The specific heat of aluminum in this temperature range is 0.96 J/g·°C. Show your work.

Q = ? **Q = mcΔT** **(480 g)(0.96 J/g·°C)(212 °C) →** **97689.6 J**
m = 480 g
c = 0.96 J/g·°C
ΔT = 234°C - 22°C = 212 °C

14. As 390 g of hot milk cools in a mug, it transfers 30,000 J of heat to the environment. What is the temperature change of the milk? The specific heat of milk is 3.9 J/g°C. Show your work.

Q = 30,000 J **ΔT = Q/mc** **30,000 J / (390g)(3.9 J/g °C) → 30,000J / 1521 J/°C →** **19.72 °C**
m = 390 g
c = 3.9 J/g·°C
ΔT = ?

15. What is the acceleration of a car that goes from 20 km/h to 100 km/h in 2 hours?

a = ? **a = Vf – Vi / t** **100 km/h – 20 km/h / 2 hrs →** **40 km/h**
Vf = 100 km/h
Vi = 20 km/h
t = 2 hrs

16. An object moves 20 km in 5 h, what is its speed?

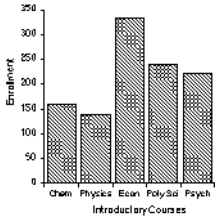
v = ? **v = d/t** **20 km / 5 hr →** **4 km/hr**
d = 20 km
t = 5 hr

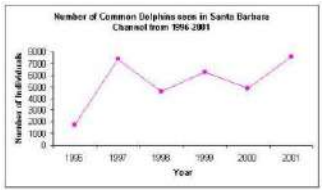
17. If the force on an object is 14 N and the object has a mass of 3.5 kg what is its acceleration?

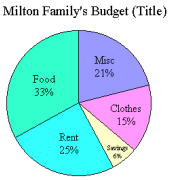
F = 14 N **F = m*a OR a = F/m** **14N / 3.5kg →** **4 m/s^2**
m = 3.5 kg
a = ?

Physical Science 1st Semester Final Exam Review

Unit 1 (Science Skills) and Unit 2 (Motion and Forces)

1. Sketch an example of each of the following graphs:
   a. Bar Graph
   

   b. Line Graph
   

   c. Circle Graph
   

2. What are the basic steps of the scientific method?
   Ask a question, Make an observation, Develop a hypothesis, Test Hypothesis, Record Data, Analyze Results, and Draw Conclusion
3. What happens when the data in an experiment does not support the hypothesis?
   The researcher must go back, revise the hypothesis, and test the hypothesis with an experiment again.
4. Define scientific law: **a statement that summarizes a pattern found in nature**
5. Define scientific theory: **a well-tested explanation for a set of observations or experimental results**
6. Define model: **a representation of an object or event**
7. Scientific Notation Practice:
   a. Write the following in scientific notation
      A. 0.00567 **5.67×10^{-3}** B. 520000 **5.2×10^{5}** C. 0.0008976 **8.976×10^{-4}**
      D. 98700 **9.87×10^{4}** E. 0.04681 **4.681×10^{-2}**

   b. Write the following in standard notation
      A. 6.5×10^{-4} **.00065** B. 7.23×10^{4} **72300** C. 6.42×10^{-6} **.00000642**
      D. 1.2300×10^{4} **12300** E. 4.58×10^{-8} **.0000000458**

8. Metric Practice: *Convert the following items.* ***K H Da B D C M***
   a. 4.2 cm = **42** mm
   b. 520 L = **5.20** hL
   c. 0.000523 Kg = **52.3** cg
   d. 725 mm = **.725** m
   e. 25 cm = **.0025** hm
   f. 0.0045 dag = **0.045** g

9. Displacement
   a. Define displacement: **the straight-line distance from the start point to the end point.**
   b. A toy car is rolled uphill 2 meters before it slows, stops, and begins to roll back down the hill. It rolls for 6 meters before stopping. What is the car's displacement? **2 m uphill** ↑ **6 m downhill** ↓ **6m – 2m = 4 m downhill**
   c. You leave your house and run 5 km north, 3 km west, 8 km south, and 3 km east. What is your total displacement? W E S
      8 km south – 5 km north = 3 km South
      3 km east – 3 km west = 0 km
      So the total displacement is **3 km South**.

10. What does the slope of the line on a distance time graph show? **speed**
11. What does the slope of the line on a speed time graph show? **acceleration**
12. A horizontal line on a distance-time graph shows an object is **not moving**.
13. An upward sloping line on a distance-time graph shows an object is **speeding up**.
14. A downward sloping line on a distance-time graph shows an object is **slowing down**.
15. Speed and acceleration: *Show your work for all calculations.*
    a. What is the speed of a runner who travels 75 m in 5 s? v = d/t → 75m/5s = **15 m/s**
    b. How long does it take a car going 14 m/s to travel 125 m? t = d/v → 125m/14m/s = **8.93s**
    c. What is the acceleration if it takes 4 seconds to increase your speed from 2 m/s to 6 m/s?
       a = (vf – vi)/t → (6m/s-2m/s)/4s = **$1 m/s^2$**

d. An object traveling at 80 m/s takes 15 s to come to a stop, what is its acceleration?
   $a = (v_f - v_i)/t$ → (0m/s-80m/s)/15s = **$-5.33 m/s^2$**
e. What are the three ways that an object can accelerate?
   By increasing speed, decreasing speed, and/or changing direction

16. What happens when an unbalanced force acts on an object? **The object moves or changes position**
17. What is the SI unit of force? **Newton (N)**

18. Friction (define and give an example of each):
    a. Static- **a friction force that acts on objects that are not moving (i.e. a book sitting on a desk).**
    b. Sliding – **a friction force that opposes the motion of an object as it slides over a surface (i.e. a lunch tray sliding across a table).**
    c. Rolling – **a friction force that acts on rolling objects, caused by the change in shape at the point of rolling contact (i.e. a skate board's wheels while traveling on the sidewalk).**
    d. Fluid – **a friction force that opposes the motion of an object through a fluid (i.e. a skydiver falling through the air).**

19. What forces act on falling objects? **Gravity & Air resistance**
20. What forces act on objects that are NOT moving? **Balanced forces**

21. Newtons Laws
    a. Describe Newton's 1st law - **AKA "the Law of Inertia"; an object at rest remains at rest and an object in motion remains in motion unless acted upon by a net force.**

    b. Describe Newton's 2nd law - **The relationship between an object's mass (*m*), its acceleration (a), and the applied force (*F*) is *F = ma*.**

    c. Describe Newton's 3rd law - **For every action there is an equal and opposite reaction.**

22. Compare the weight of the same object on the earth, moon, and Jupiter.
    Weight on the moon < Weight on earth < Weight on Jupiter
    This is due to the fact that gravity on the moon is less than gravity on earth because earth is bigger than the moon, and gravity on earth is less than gravity on Jupiter because Jupiter is bigger than earth.

23. What is the acceleration of an object with a 14 kg mass and a 14 N force acting on it? (Show work)
    F= m*a → so a = F/m → 14N/ 14kg = **$1 m/s^2$**

Physical Science 1st Semester Final Exam Review

Unit 3 (Work, Power, & Machines) and Unit 4 (Energy & Heat)

1. Work (write **yes** or **no** to indicate if work is done in the following situations)
   a. Lifting a book **YES**
   b. Carrying a book to your desk **NO**
   c. Pushing a shopping cart **YES**
   d. Holding weights over your head **NO**
   e. pushing on a wall **YES**
   f. kicking a ball **NO**

2. Work problems (SHOW WORK)
   a. How much work is done if 25 N of force is used to move a rock 5 m?
      F = 25 N *d = 5 m* W = F * d → 25N * 5m = **125 J**
   b. How high did you lift your 12 N sister if you did 48 J of work?
      W = 48 J *F = 12 N* d = W/F → 48J/12N = **4 m**
   c. If 70 J of work is needed to move an object 15 m what is its weight (force)?
      W = 70 J *d = 15 m* F = W/d → 70J/15m = **4.67 N**

3. What can a machine multiply? **A machine can multiply force.**

4. Mechanical Advantage problems (SHOW WORK)
   a. What is the mechanical advantage of a lever if you apply 14 N of force to lift a car that weighs 1400 N?
      Input Force = 14 N *Output Force = 1400 N* MA = F_R/F_E → 1400N/14N = **100**
   b. What is the mechanical advantage of a ramp that is 250 m long and 50 m high?
      Input distance = 250 m *Output distance = 50 m* MA = De/Dr → 250m/50m = **50**

5. What is efficiency? **Efficiency is the percentage of work input that becomes work output.**
6. Why is the efficiency of a machine always less than 100 percent? **Because there is always some friction.**

7. Give 2 examples of each simple machine:
   a. Inclined plane - **Ramp**
   b. Lever – **See saw, nutcracker, scissors**
   c. Wedge – **Axe, zipper**
   d. Wheel and axle – **Steering wheel**
   e. Screw – **Screwdriver, twist bottle cap**
   f. Pulley – **Flag pole, window blinds**

8. What is kinetic energy? *(Define and write the formula)* **Kinetic energy is the energy of motion. The formula for Kinetic Energy is: KE = 1/2mv^2** ***mass (kg), velocity (m/s)***

9. What is potential energy? *(Define and write the formula)* **Potential energy is energy that is stored as a result of position or height. The formula for Potential Energy is: PE = mgh** ***mass (kg), gravity (9.8m/s^2), height (m)***

10. What is the kinetic energy of a 15 kg rock rolling down a hill at 2.5 m/s? (SHOW WORK)
    Givens: *KE = ?* *m = 15 kg* *v = 2.5 m/s*
    KE = ½*m* v^2 → (½)(15kg)(2.5m/s)^2 = (7.5)(6.25) = **46.88 J**

11. What is the potential energy of a 1.25 kg book sitting on a shelf 4.5 meters high if gravity is 9.8 m/s^2? (SHOW WORK)
    Givens: *PE = ?* *m = 1.25 kg* *g = 9.8 m/s^2* *h = 4.5 m*
    PE = mgh → (1.25kg)(9.8 m/s^2)(4.5m) = **55.125 J**

12. Give 2 examples of each of the following types of energy
    a. Chemical: **gasoline, food**
    b. Elastic potential: **rubber band, bungee cord**
    c. Thermal: **bonfire, lit match**
    d. Nuclear: **nuclear power plant, sun, atom**
    e. Mechanical: **riding a bicycle, rowing a boat**
    f. Kinetic: **a cheetah running, a sprinter**
    g. Gravitational potential: **a book on a shelf, a roller coaster at the top of the ride**
    h. Electrical: **blender, radio**
    i.
13. What does the law of conservation of energy state? **Energy cannot be created or destroyed.**
14. When does the kinetic energy of a roller coaster increase the most? **At the bottom of the roller coaster.**
15. Where does a pendulum have the most potential energy? **At its highest point.** The most kinetic energy? **At its lowest point.**
16. Define heat: **the transfer of thermal energy from one object to another because of a temperature difference.**
17. Define temperature: **a measure of how hot or cold an object is compared to a reference point.**
18. As the temperature of an object increases what happens to the thermal energy? **The thermal energy increases.**
19. The specific heat of copper is 0.385 J/g°C. What is the energy needed to heat 2.75 g of copper from 14°C to 35°C?
    Givens: *Q = ?* *m = 2.75g* *c = 0.385 J/g°C* *ΔT = 35°C - 14°C = 21°C*
    Q = mcΔT → (2.75g)(is 0.385 J/g°C)(21°C) = **22.23 J**

20. Describe the three ways energy transfers.
    a. Conduction – **the transfer of thermal energy as a result of direct contact (touching); requires matter.**
    b. Convection – **the transfer of thermal energy through fluids such as liquids and gases; requires matter.**
    c. Radiation – **the transfer of thermal energy by waves moving through space; does not require matter.**

21. Which method of energy transfer does not need matter? **Radiation**
22. Which method(s) of energy transfer needs matter? **Conduction and Convection**

23. Define conductor. **A conductor is a material that transfers thermal energy easily. Metals are good conductors.**
24. Give two examples of conductors: **Metals such as copper, silver, gold, and iron.**

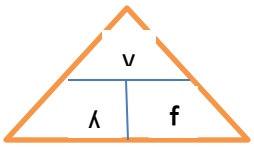
25. Define insulator. **An insulator is a material that is a poor conductor because it doesn't transfer thermal energy well. Plastic and wood are good insulators.**

26. Give two examples of insulators: **Rubber, plastic, wood, paper, fleece, fiber glass**

Physical Science 1st semester Final Exam Review

Unit 5 (Waves) and Unit 6 (Electricity & Magnetism)

1. Mechanical Waves
   a. What do all waves transfer? energy
   b. What is a transverse wave? A wave that causes a medium to vibrate perpendicular to the direction in which the wave travels. (Ex. Water wave)
   c. What is a longitudinal wave? A wave in which the vibration of the medium is parallel to the direction the wave travels. (Ex. Slinky)
   d. What is frequency? The number of complete cycles per unit time for a periodic motion.
   e. What is the unit of frequency? Hertz (Hz)
   f. How is amplitude measured? Maximum displacement of the medium from its rest position. The more energy a wave has the greater is its amplitude. Measure rest to crest OR trough to rest.
   g. How do you measure wavelength? Wave speed = Wavelength X frequency
      Crest to crest OR trough to trough



   h. Where is the crest of a wave? Highest point of the wave
   i. Where is the trough of the wave? Lowest point of the wave

2. Wave Behavior
   a. Give an example of refraction. A pencil bending the light when placed in a cup of water.
   b. Give an example of reflection. Looking at yourself in the mirror.
   c. Give an example of diffraction. A rainbow. Bending of a wave as it travels through an opening.
   d. Give an example of constructive interference. Putting two headphones in your ear increases the sound.
   e. Give an example of destructive interference. Removing one of the headphones is decreasing the sound.

3. Sound
   a. What medium does sound travel fastest in? solid
   b. What medium does sound travel slowest in? gas

4. Electromagnetic waves
   a. How do you find the speed of a wave? Speed = Wavelength x frequency

b. Explain light's wave-particle duality. Light behaves as both waves and particles.

c. Name the 7 different waves of the electromagnetic spectrum in order from longest to shortest wavelength.

Radio --- Microwaves --- Infrared --- Visible Light --- Ultraviolet rays --- X-rays --- Gamma rays

d. Name the 7 colors of visible light in order from longest to shortest wavelength.

Red --- Orange ---Yellow --- Green --- Blue--- Indigo Violet

e. What electromagnetic wave is used by cell phones? Radio

f. What electromagnetic wave is used to heat up food? Microwave

g. What electromagnetic wave is used to keep food warm? Infrared

h. What electromagnetic wave is used to treat cancer? Gamma rays

5. Electricity

a. What determines the strength of an electric field? The amount of charge and the distance between charges.

b. What happens if two like charges are brought near each other? They repel

c. What happens if two opposite charges are brought near each other? They attract

d. Describe each of the following ways that charges can transfer. Provide an example of each.

A. Induction: the transfer of charge without contact between materials (getting shocked when reaching for a door handle)

B. Conduction: the transfer of thermal with no overall transfer of matter, within a material or between materials that are touching (getting shocked when touching a door knob).

C. Friction: requires rubbing (shuffling your feet as your walk across the carpet)

e. What is direct current? A flow of electric charge in only one direction.

f. Give an example of where direct current is used. Battery

g. What is alternating current? A flow of electric charge that regularly reverses its direction.

h. Give an example of where alternating current is used. Flashlight, school and home

i. What three things affect the resistance of metal wires? Thickness, temperature, length

j. What could you do to a wire to reduce resistance? Longer length, cooler temperature, thinner wine

6. Ohm's Law (MUST SHOW WORK)
    a. The current in a microwave is 35.0 amps and the resistance is 14 ohms. What is the voltage?

        V = IR R = 14 ohms I = 35 amperes V = (35ohms) x (14amperes) = 490 V

    b. What is the current in a lamp that has a resistance of 25 ohms and uses 12 volts?

        V = IR R = 25 ohms V = 12 volts I = (12volts)/(25ohms) = 0.48 amperes

7. Magnetism
    a. What happens when two like poles are brought near each other? They repel

    b. What happens when two opposite poles are brought near each other? They attract

    c. What happens when you break a magnet in half? Creates 2 new magnets

    d. What is a permanent magnet? Poles stay aligned for a long period of time (i.e. lodestone)

    e. What is a temporary magnet? Poles do not stay aligned for a long period of time (i.e. nail)

    f. What creates a magnetic field? Moving electric charges

    g. What is a solenoid? Sketch a picture of a solenoid. A wire wrapped around a nail.

    h. What is a generator? Converts mechanical energy to electrical energy.