

**Enrolling in IB Physics Year 1 - Summer Work (9th grade review!) Name: \_\_\_\_\_**

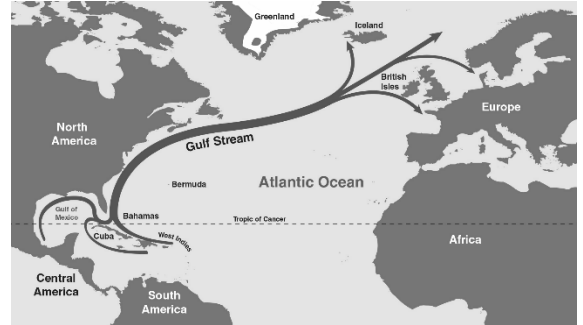
1. What is the property of an object to resist changes in its motion called? (1pt)
2. Distance traveled per unit time is called \_\_\_\_\_. (1pt)
3. Please briefly describe the difference between mass and weight. (4pts)
4. What do we call a quantity that describes an object's speed plus direction? (1pt)
5. If you are moving in a circle while moving at constant speed, are you accelerating? In a sentence or two, explain WHY or WHY NOT. (4pts)
6. In terms of forces, what does it mean for an object to be in equilibrium? (2pts)
7. If an object is moving to the right while sliding on a rough surface, then in what direction does the friction act upon the object? (1pt)
8. In making a scientific hypothesis, we claim that the hypothesis must be falsifiable to be scientific. What do we mean by the term, "falsifiable?" (2pts)

9. Why do we call the support force acting on an object by a surface the “normal” force? What does “normal” mean in this case? (2pts)
10. If Bobby pushes on a box with a force of 20 N to the right and Gabriel pushes to the left on the box with a force of 13 N to the left, what is the net force? (Include magnitude, direction, and unit). (3pts)
11. Jimmy pushes on a crate with a force of 35 N. However, the crate does not accelerate, as it moves at constant velocity. How is this possible? What are we missing from the picture? (3pts)
12. True or False: If Kiki touches a cold table’s surface, heat flows from the cold surface to her hand making her hand colder. Why? (1pt)
13. True or False: It is possible for a moving object to be in equilibrium. If true, offer an explanation. If false, say why not. (2pts)
14. The measure of disorder or chaos in a system is what scientists call the system’s \_\_\_\_\_:  
(1pt)
- a. Energy
  - b. Entropy
  - c. Heat
15. An egg may fall and break. However, it does not magically put itself back together like Humpty Dumpty and rise to its original height. This is because \_\_\_\_\_ always increases. (1pt)
16. Which feels colder to the touch at 45 degrees Fahrenheit, a sweater made of wool or a sweater made of platinum? Explain your answer using the following terminology: Conductor, Heat. (3pts)



17. Heat transfer by means of the movement of particles with a material, like an iron skillet in contact with a stove, is called \_\_\_\_\_. (1pt)
18. The transfer of heat via the transmission of electromagnetic waves is called \_\_\_\_\_: (1pt)
- Convection
  - Conduction
  - Radiation

19. Heat transfer by means of the movement of fluid, as occurs when the Gulf Stream ocean current carries heat from the Gulf of Mexico to Northwest Europe, is called \_\_\_\_\_: (1pt)
- Radiation
  - Conduction
  - Insulation
  - Convection



20. Explain one reason why solid ice tends to float on liquid water and not the other way around using the word “density.” (2pts)

21. Why does Seattle, on the Pacific Ocean, have a milder climate than Kansas City, which is in the interior of the country but further South than Seattle? In your answer, use the following terminology: Specific Heat Capacity. (2pts)



22. What units do we use to measure heat? (1pt)
- Joules
  - Calories
  - calories
  - Kilograms
  - A, B, C, but not D

23. Does it make sense to say that an object’s temperature is -5 K? Why or why not? (1pt)

24. What causes heat to flow? (1pt)
- Thermal Energy
  - Temperature Difference
  - Coldness

Questions are worth 3 points, one for using the correct equation (setting up the problem correctly), one for solving correctly, and one for using the correct sign (direction) and units on the answer. You may use a calculator.

$$W = Fd$$

$$P = W/t$$

$$F = ma$$

$$PE_g = mgh$$

$$KE = (1/2)mv^2$$

$$W_T = \Delta KE$$

25. A child pulls a sled up a snow-covered hill. The mass of the child is 45 kg. The child does 405 J of work on the sled. If the child walks 15 m up the hill, how large of a force must the child exert on the sled? (3pts)
26. If a runner exerts 350 J of work to make 125 W of power, how long did it take the runner to do the work? (3pts)
27. How much power does it take to lift 30.0 kg 10.0 m high in 5.00 s? (3pts)
28. How high up is a 3.00 kg object that has 300 J of energy? (3pts)
29. How fast must a 1000 kg car be moving to have a kinetic energy of 2000 J? (3pts)

Questions are worth 3 points, one for using the correct equation (setting up the problem correctly), one for solving correctly, and one for using correct sign (direction) and units. Question 4 is worth 6 points. You may use a calculator.

$$P = mv$$

$$Ft = mv_2 - mv_1$$

$$m_1v_1 = -m_2v_2$$

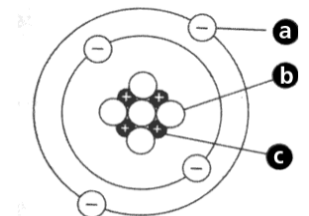
$$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$$

$$m_1v_1 + m_2v_2 = (m_1 + m_2)v_3$$

30. A 2.5 kg cart and a 3.0 kg cart are at rest next to each other. A spring is released between them and the heavier cart goes 2.0 m/s to the right. What is the velocity of the lighter cart? (3pts)
31. A 10 g bullet is shot from a 2.6 kg gun with a velocity of 450 m/s. What is the recoil velocity of the gun? (3 pts)
32. An 8 kg block sliding 5 m/s to the right collides inelastically with a 12 kg block sliding 4 m/s to the left. What is the velocity of the pair after the collision? (3 pts)
33. A 1 kg basketball is moving toward a brick wall with a velocity of -25 m/s. The same basketball bounces off the brick wall and begins moving away with a velocity of 20 m/s. (a) Find the change in momentum of the basketball, (b) the impulse on the basketball, and (c) the Force acting on the basketball if it was in contact with the wall for 0.002 seconds. (6 pts)

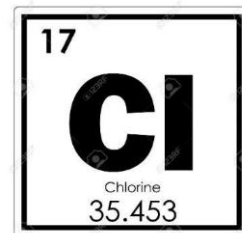
34. Fill in the blanks. (7 pts)

	Subatomic particle	Charge	Relative Mass	Location in atom
a		-1		
b		0	1	
c	proton			nucleus



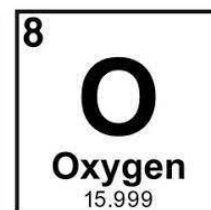
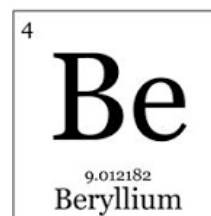
35. Looking at the element chlorine (see image), answer the following: (5 pts)

- What is the atomic symbol? \_\_\_\_\_
- What is the atomic number? \_\_\_\_\_
- How many protons does it have? \_\_\_\_\_
- How many electrons does it have? \_\_\_\_\_
- How many neutrons does it usually have? \_\_\_\_\_



36. Calculate the number of subatomic particles in each of the following ions using the pictures below: (6 pts)

	protons	neutrons	electrons
Be <sup>2-</sup>			
O <sup>3+</sup>			



37. Which statement best defines radioactive isotopes? (1 pt)

- Isotopes that are stable
- Isotopes that are unstable
- Atoms with a positive or negative charge

38. Which of these is not a type of ionizing radiation? (1 pt)

- Alpha particles
- Beta particles
- Zeta particles
- Gamma rays

39. Match the type of radiation to the thinnest material that can stop each type of radiation by **drawing a line segment** connecting them. (3 pts)

- |                           |       |
|---------------------------|-------|
| a. Thick lead or concrete | alpha |
| b. Paper                  | beta  |
| c. Wood                   | gamma |

40. The half-life of Rn is 6 days. After how many days is the amount remaining  $\frac{1}{4}$  of the original amount? (1 pt)

- 2 days
- 12 days
- 32 days
- 4 days

41. On the periodic table, group 18 (the furthest on the right-hand side), which includes Helium (He) is known as the? (1 pt)

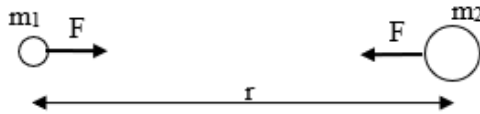
- Alkali earth metals
- Transitional metals
- Noble gasses
- Metalloids

42. How many electrons can be in the 1<sup>st</sup> shell of an atom (s1)? (1 pt)
- 4
  - 8
  - 16
  - 2
43. When an element is heated, it emits a distinctive glow, which can be seen with a spectrometer. This is called the \_\_\_\_\_: (1 pt)
- Heat
  - Rainbow
  - Atomic light show
  - Atomic spectrum
44. Distinguish between atomic number and mass number. (2 pts)
45. An atom has 43 electrons, 56 neutrons, and 43 protons. What is the approximate atomic mass in atomic mass units? Show your work. (2 pts)
46. If someone kept getting the words "isotope" and "ion" confused, how would you explain the difference to them? (2 pts)
47. If you double the net force acting on an object, what happens to that object's acceleration? (1pt)
48. If the net force on an object is to remain the same, what happens to the object's acceleration if we quadruple its mass? (1pt)

49. The gravitational force by the Earth on the Moon is the force that keeps the Moon in orbit about the Earth. Does the Moon also exert a force on the Earth? How do you know? (What evidence is there to support this?) In terms of magnitude, how are the forces related? (3pts)
50. Suppose Robert and Mike pull on a sleigh. Robert pulls on the sleigh with a force of 30N to the East and Mike pulls on the sleigh with a force of 25N to the West. Draw a force diagram to represent the situation. What is the net force acting on the sleigh? (4pts)
51. According to Newton's Universal Law of Gravitation, what would happen to the gravitational force between the Earth and the Moon if the distance between their centers were doubled? (1pt)
52. If a projectile is launched from an angle of 15 degrees with respect to the horizontal, and the projectile is launched from the same height as it lands, what other launch angle will produce the same horizontal range? Which of the two launch angles will produce the greatest altitude? (2pts)
53. If the launch and landing heights are the same, what angle maximizes horizontal range? What angle maximizes vertical altitude? (2pts)
54. When Paul is pulled to the Earth by gravity, Paul pulls up on the Earth with a force equal in magnitude. True or false and why? (2 pts)

55. When the net force acting on an object is zero, the acceleration the object experiences is also zero. True or false and why? (2 pts)
56. From the following list of five terms, which TWO quantities affect the air resistance experienced by a moving body through the air? (2 pts)
- force
  - gravity
  - velocity
  - surface area
  - happiness
57. When a skydiver's weight is balanced by the force of air resistance acting against him, we say that he has reached \_\_\_\_\_. (1 pt)
- a state of bliss
  - terminal velocity
  - escape speed
  - maximum acceleration
58. If you stand on a scale in an elevator that is accelerating downward, the reading on the scale would be: (1 pt)
- higher than your weight at rest
  - lower than your weight at rest
  - the same as your weight at rest
  - none of the above
59. Is there gravity in space? Circle **Yes** or **No** and explain. (2 pt)
60. Explain the weirdness of water and its importance here on Earth. (4 pt)

$$F = G \frac{m_1 m_2}{r^2}$$



$$G = 6.67 \times 10^{-11} \text{ N m}^2 / \text{kg}^2$$

Variable	Symbol
t	time taken
s	distance travelled
u	initial velocity
v	final velocity
a	acceleration

Table 1.2.1 - Variables used in uniformly accelerated motion equations

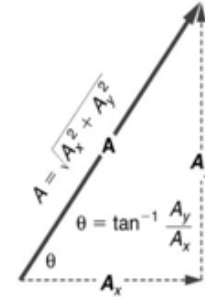
$$v = u + at$$

$$s = \left(\frac{u+v}{2}\right) t$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2} at^2$$

$$s = vt - \frac{1}{2} at^2$$



Equations

$$A_x = A \cos \theta$$

and

$$A_y = A \sin \theta$$

are used to find the perpendicular components of a vector—that is, to go from  $A$  and  $\theta$  to  $A_x$  and  $A_y$ . Equations

$$A = \sqrt{A_x^2 + A_y^2}$$

and  $\theta = \tan^{-1}(A_y/A_x)$  are used to find a vector from its perpendicular components—that is, to go from  $A_x$  and  $A_y$  to  $A$  and  $\theta$ . Both processes are crucial to analytical methods of vector addition and subtraction.

**To receive full credit for each problem, include a labeled sketch, identification of each variable, the equations used, show the substitution, and box your final answer with units. For the purpose of these problems, neglect air resistance.**

61. A 3 kg mass and a 4 kg mass are 3 m apart. How much is the force of gravity of each one on the other? (3 pts)

62. A projectile is projected horizontally (at zero degrees) at 5 m/s off a cliff that is 10 m high.

a. **How much time will it take to hit the ground?** (3 pts)

b. **Where will it land in relation to the base of the cliff?** (3 pts)

63. A ball is thrown with an initial velocity of 20 m/s at angle of  $40^\circ$  to the horizontal.  
c. How long will the ball stay in the air (assume it strikes the ground at the same height it was launched)? (3 pts)

d. How far will the ball go before hitting the ground? (3 pts)

e. What will be the maximum height of the ball? (3 pts)

64. A projectile is launched from the surface of the Earth at a 45 degree angle at 10,000 m/s.  
Where will it land? The radius of the Earth is approximately 6,378,000 meters near the equator.  
(3 pts)

$$F = \frac{kq_1q_2}{d^2}$$

$$d = \sqrt{\left(\frac{kq_1q_2}{F}\right)}$$

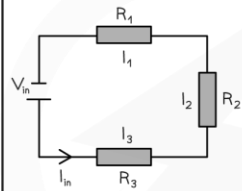
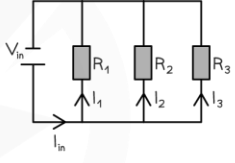
$$q_1 = \frac{(F)(d^2)}{(k)(q_2)}$$

$$q_2 = \frac{(F)(d^2)}{(k)(q_1)}$$

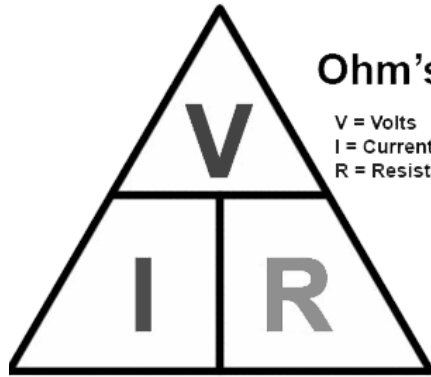
$$k = 9 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$$

⊕ proton charge  $e = 1.6 \times 10^{-19}$  coulombs

⊖ electron charge  $-e = -1.6 \times 10^{-19}$  coulombs

	Series	Parallel
<b>Circuit</b>		
<b>Voltage</b>	$V_{in} = V_1 + V_2 + V_3$	$V_{in} = V_1 = V_2 = V_3$
<b>Current</b>	$I_{in} = I_1 = I_2 = I_3$	$I_{in} = I_1 + I_2 + I_3$
<b>Resistance</b>	$R_{total} = R_1 + R_2 + R_3$	$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

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### Ohm's Law

V = Volts  
I = Current (in Amps)  
R = Resistance (in Ohms)

$$V = I \cdot R \quad (\text{volts} = \text{amps times ohms})$$

$$I = \frac{V}{R} \quad (\text{amps} = \text{volts divided by ohms})$$

$$R = \frac{V}{I} \quad (\text{ohms} = \text{volts divided by amps})$$



### P, Power

Measured in watts W  
Is the amount of work done

### I, Current

Measured in amps A  
Is rate of flow of charge

### V, Voltage

Measured in volts V  
Difference of electric potential

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*Make sure to write the equations, show the substitutions, and write out all of the work for each problem, including units..*

65. Explain the relationship between electricity and magnetism. [2]
66. A 1500 W appliance is connected to a 150 volt source. How much current does it draw? [2]
67. A 9 volt battery is connected to a circuit that needs a current of 1.5 A. How much resistance should be used to get the appropriate current? [2]
68. Suppose that two point charges, each with a charge of +2 Coulombs are separated by a distance of 2 meters. (a) Will they attract or repel? \_\_\_\_\_ (b) Determine the magnitude of the electrical force between them. [3]

69. Two charged spheres are 3 meters apart from each other. The blue sphere has a charge of +0.0002 C and is attracting the red sphere with a force of 600 Newtons. Determine charge of the red sphere. Remember to indicate if it is positive or negative. [2]

70. Determine the quantity of charge on a plastic tube which has been rubbed with animal fur and gained  $4 \times 10^9$  electrons. [2]

71. Explain how magnets work. [4]

72. The fundamental force underlying all chemical reactions is [1] \_\_\_\_\_

- A) gravitational.
- B) nuclear.
- C) centripetal.
- D) electrical.
- E) none of the above

73. The force that binds atoms together to form molecules is [1] \_\_\_\_\_

- A) gravitational.
- B) nuclear.
- C) electrical.
- D) centripetal.
- E) none of the above

74. A fundamental rule of electricity is that [1] \_\_\_\_\_

- A) like kinds of charges repel.
- B) unlike kinds of charges attract.
- C) both of these
- D) neither of these

75. In an electrically neutral atom the number of protons in the nucleus is equal to the number of \_\_\_\_\_
- A) electrons that surround the nucleus. [1] \_\_\_\_\_
  - B) neutrons in the nucleus.
  - C) both electrons and neutrons.
  - D) none of the above
76. To become a negative ion, an atom must [1] \_\_\_\_\_
- A) lose an electron.
  - B) gain an electron.
  - C) lose a proton.
  - D) gain a proton.
77. To become a positive ion, an atom must [1] \_\_\_\_\_
- A) lose an electron.
  - B) gain an electron.
  - C) lose a proton.
  - D) gain a proton.
78. Compare and contrast electromagnetism and gravity. Give at least two ways they are similar and at least two ways they are different. [4]
79. Charge carriers in a metal are electrons rather than protons because electrons are [1] \_\_\_\_\_
- A) negative.
  - B) smaller.
  - C) loosely bound.
  - D) none of the above
80. Rub electrons from your hair with a comb and the comb becomes [1] \_\_\_\_\_
- A) negatively charged.
  - B) positively charged.
  - C) discharged.

81. To think of electric potential difference we are thinking about [1] \_\_\_\_\_  
A) current.  
B) voltage.  
C) resistance.
82. Electrons flow in a wire when there is [1] \_\_\_\_\_  
A) an imbalance of charges in the wire.  
B) a potential difference across its ends.  
C) a difference in potential energy across its ends.  
D) none of the above
83. To connect a pair of resistors so their *equivalent resistance* (the single resistor having their combined value) will increase, connect them in [1] \_\_\_\_\_  
A) series.  
B) parallel.  
C) either of these
84. To connect a pair of resistors so their *equivalent resistance* (the single resistor having their combined value) will be least, connect them in [1] \_\_\_\_\_  
A) series.  
B) parallel.  
C) either of these
85. The source of all magnetism is [1] \_\_\_\_\_  
A) tiny pieces of iron.  
B) ferromagnetic materials.  
C) moving electric charge.  
D) none of the above
86. Whereas electric charges can be isolated, magnetic poles [1] \_\_\_\_\_  
A) can also.  
B) cannot.  
C) gather in clusters.  
D) none of the above
87. Surrounding every moving electron is [1] \_\_\_\_\_  
A) a magnetic field.  
B) an electric field.  
C) both of these  
D) neither of these

88. When current reverses direction in a wire, the surrounding magnetic field [1] \_\_\_\_\_
- A) also reverses direction.
  - B) becomes momentarily stronger.
  - C) contracts.
  - D) expands.

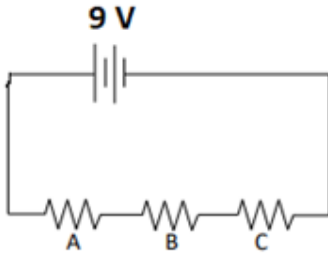
89. Describe how a motor works. Include a labeled diagram. [3]

90. Describe how a generator works. Include a labeled diagram. [3]

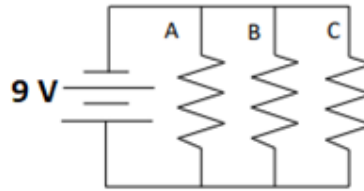
91. Describe how an electromagnet works. Include a labeled diagram. [3]

92. Explain what is meant by electromagnetic induction and give an example of how it is commonly used. [3]

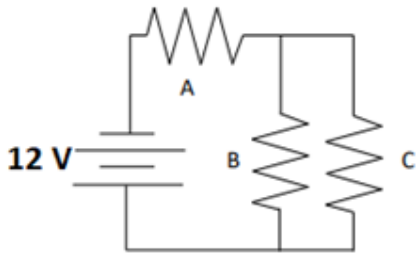
93–96. Fill in the blanks. Show your work, attached if needed. [8] A = 3 ohm, B = 6 ohms, C = 9 ohms



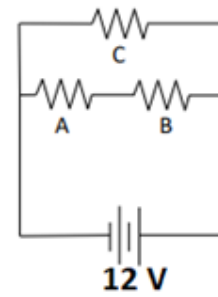
Resistor	$\Omega$	V	A
A			
B			
C			
<b>Total</b>			



Resistor	$\Omega$	V	A
A			
B			
C			
<b>Total</b>			



Resistor	$\Omega$	V	A
A			
B			
C			
B + C			
<b>Total</b>			



Resistor	$\Omega$	V	A
A			
B			
A + B			
C			
<b>Total</b>			

