Review Package KEY

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Science 10 – Chemistry

Name: KEY
Date: ______________

Physics (Part 1) Unit Review Package

Vocabulary: Referring to your notes and textbook, define each of the following vocabulary terms in a complete sentence:

1. Acceleration	**The change in velocity of an object over time, measured in meters per second per second or meters per second squared (m/s^2).**
2. Gravity	**Force that attracts objects downwards (on Earth, it causes objects to accelerate at $9.81 m/s^2$ downwards).**
3. Heat energy	**The energy of transferred from a hotter system to a colder system, when the two systems are in contact, measured in joules (J)**
4. Kinetic energy	**The energy of an object as a result of its movement, measured in joules (J).**
5. Mass	**The amount of material inside of an object, measured in kilograms (kg).**
6. Potential Energy	**The energy of an object as a result of its position, stresses, or charge, measured in joules (J).**
7. Specific Heat Capacity	**The amount of energy needed to raise the temperature of 1g of a substance by 1C, measured in J/gC**
8. Temperature	**The average kinetic energy of the atoms or molecules in the system**
9. Weight	**A force created by a mass experiencing gravity**
10. Velocity	**The change in position of an object over time, measured in meters per second (m/s).**

Knowledge:

Identify the following as either potential energy or kinetic energy.

Scenario	Type of Energy
11. A bicyclist coasting down a hill reaches the bottom of the hill.	Potential Energy
12. An amusement park ride stops at the top.	Potential Energy
13. A bowling ball rolling down the alley.	Kinetic Energy
14. An archer with his bow drawn.	Potential Energy
15. Sitting in the top of a tree.	Potential Energy
16. A bowling ball sitting on the rack.	Potential Energy

17. What is the formula for kinetic energy? What do the symbols in the formula mean? What are the units for measuring kinetic energy?

$$KE = \frac{1}{2} m v^2$$

Kinetic Energy (J)

Mass (kg)

Velocity (m/s)

18. What is the formula for potential energy? What do the symbols in the formula mean? What are the units for measuring potential energy?

$$PE = mgh$$

Potential Energy (J)

mass (kg)

gravity (m/s²)

height (m)

19. What is the formula for heat energy? What do the symbols in the formula mean? What are the units for measuring heat energy?

$$Q = mc\Delta T$$

specific heat capacity (J/g°C)

Heat Energy (J)

mass (g)

change in temperature (°C)

20. Missy Diwater, the former platform diver for the Ringling Brother's Circus had a kinetic energy of 15,400 J just prior to hitting the bucket of water. If Missy's mass is 58 kg, then what is her velocity before hitting the water?

$KE = 15400\ J$ (3sf)

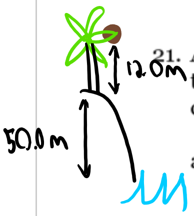
$m = 58\ kg$ (2sf)

$v = ?$

$$v = \sqrt{\frac{KE}{\frac{1}{2}m}} = \sqrt{\frac{15400}{\frac{1}{2}(58)}} = \sqrt{531.034...}$$

$v = 23.044...$

$v = \boxed{23\ m/s}$



21. A coconut of mass 0.870 kg is growing 12.0 m above the ground on a palm tree. The tree is right at the edge of a cliff whose height is 50.0 m above the sea. Calculate the potential energy of the coconut relative to:

a) The ground

$m = 0.870\ kg$ (3sf)

$h = 12.0\ m$ (3sf)

$g = 9.81\ m/s^2$ (3sf)

$PE = ?$

$$PE = mgh = (0.870)(9.81)(12.0) = 102.4164 = \boxed{102\ J}$$

b) Sea level

$m = 0.870\ kg$ (3sf)

$h = 12.0 + 50.0 = 62.0\ m$ (3sf)

$g = 9.81\ m/s^2$ (3sf)

$PE = ?$

$$PE = mgh = (0.870)(9.81)(62.0) = 529.1514 = \boxed{529\ J}$$

22. The potential energy of a 48 kg cannon ball on the Moon is 14500 J. How high was the cannon ball above the Moon's surface to have this much potential energy?

$m = 48\ kg$ (2sf)

$PE = 14500\ J$ (2sf)

$g = 1.62\ m/s^2$ (3sf)

$h = ?$

$$h = \frac{PE}{mg} = \frac{14500}{(48)(1.62)} = 186.4711... = \boxed{190\ m}$$

23. The kinetic energy of a golf ball is measured to be 143.3 J. If the golf ball has a mass of about 0.047 kg, what is its velocity?

$KE = 143.3\ J$ (4sf)

$m = 0.047\ kg$ (2sf)

$v = ?$

$$v = \sqrt{\frac{KE}{\frac{1}{2}m}} = \sqrt{\frac{143.3}{...}}$$

$v = 78.088...$

$v = \boxed{78\ m/s}$

$m = 0.047\ kg$ (2sf)

$v = ?$

$v = \sqrt{\frac{KE}{\frac{1}{2}m}}$

$= \sqrt{\frac{143.3}{\frac{1}{2}(0.047)}}$

$= \sqrt{6097.87...}$

$v = \boxed{78\ m/s}$

24. The greatest velocity that a meteoroid can have and still be pulled down to Earth's surface is 7.0×10^4 m/s. If a meteoroid traveling with this velocity has a kinetic energy of 2.56×10^{13} J, what is its mass?

$v = 7.0 \times 10^4\ m/s$ (2sf)

$KE = 2.56 \times 10^{13}\ J$ (3sf)

$m = ?$

$m = \frac{KE}{\frac{1}{2}v^2}$

$= \frac{2.56 \times 10^{13}}{\frac{1}{2}(7.0 \times 10^4)^2}$

$m = 73142.85...$

$m = \boxed{73000\ kg}$

25. A piano with a mass of 272 kg is teetering on the edge of a 30.6 m balcony. If it falls off the balcony, what is its velocity as it hits the ground?

① Find PE:

$m = 272\ kg$ (3sf)

$h = 30.6\ m$ (3sf)

$g = 9.81\ m/s^2$ (3sf)

$PE = ?$

$PE = mgh$

$= (272)(9.81)(30.6)$

$= 81650.592$

$= 81700\ J$

② Find v: (3sf)

$KE = 81650.592$

$m = 272\ kg$ (3sf)

$v = ?$

$v = \sqrt{\frac{KE}{\frac{1}{2}m}}$

$= \sqrt{\frac{81650.592}{\frac{1}{2}(272)}}$

$= \sqrt{600.372}$

$= 24.502...$

$= \boxed{24.5\ m/s}$

26. Explain the three environmental effects of human energy transformation.

Human energy transformation results in three main environmental effects:

1. **<u>Pollution</u> – collecting and using sources of energy causes the release of chemicals, light, sound, heat and other agents which negatively affect living organisms**
2. **<u>Habitat Destruction</u> – collecting and using sources of energy causes the destruction of habitat which organisms need to survive**
3. **<u>Carbon Dioxide Production</u> – the combustion of fossil fuels releases CO2 into the atmosphere; some of this is absorbed into the oceans and causes them to become more acidic, some remains within the atmosphere where it enhances the natural greenhouse effect and contributes to climate change**

27. A softball is thrown straight upwards into the air at 24.5 m/s, with a kinetic energy of 60.5 J. How high will the ball fly?

① Find m:

$v = 24.5\ m/s$ (3sf)

$KE = 60.5\ J$ (3sf)

$m = ?$

$m = \frac{KE}{\frac{1}{2}v^2}$

$= \frac{60.5}{\frac{1}{2}(24.5)^2}$

$= 0.20158...$

$= 0.202\ kg$

② Find h:

$m = 0.20158...\ kg$ (3sf)

$PE = 60.5\ J$ (3sf)

$g = 9.81\ m/s^2$ (3sf)

$h = ?$

$h = \frac{PE}{mg}$

$= \frac{60.5}{(0.20158...)(9.81)}$

$= 30.593...$

$= \boxed{30.6\ m}$

$= 0.202\,kg$

$= \boxed{30.6m}$

28. A 15.75g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

$m = 15.75g$ (4sf)

$Q = 1086.75\,J$ (6sf)

$\Delta T = T_f - T_i = 175 - 25 = 150°C$ (3sf)

$c = ?$

$$c = \frac{Q}{m\Delta T}$$

$$= \frac{1086.75}{(15.75)(150)}$$

$= 0.46$

$= \boxed{0.460\ J/g°C}$

29. How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

$Q = ?$

$m = 10.0g$ (3sf)

$\Delta T = T_f - T_i = 55 - 22 = 33°C$ (2sf)

$c = 0.90\ J/g°C$ (2sf)

$Q = mc\Delta T$

$= (10.0)(33)(0.90)$

$= 297$

$= \boxed{3.0 \times 10^2\ J}$

30. What mass of water will change its temperature by 3 °C when 525 J of heat is added to it? The specific heat of water is 4.18 J/g °C.

$m = ?$

$\Delta T = 3\,°C$ (1 sf)

$Q = 525\ J$ (3 sf)

$c = 4.18\ J/g°C$ (3 sf)

$m = \frac{Q}{c\Delta T}$

$= \frac{525}{(4.18)(3)}$

$m = 41.866...$

$\boxed{m = 40\ g}$

31. A 100 g mass of tungsten at 100.0°C is placed in 200 g of water (heat capacity of 4.18 J/g °C) at 20.0°C. The mixture has a final temperature of 21.6°C. Calculate the specific heat of tungsten.

1 TUNGSTEN: Loses Heat

$m = 100\ g$ (1 sf)

$c = ?$

(1 dp)

$\Delta T = T_f - T_i = 21.6 - 100.0 = -78.4\,°C$ (3 sf)

2 WATER: Gains Heat

$m = 200\ g$ (1 sf)

$c = 4.18\ J/g°C$ (3 sf)

(1 dp)

$\Delta T = T_f - T_i = 21.6 - 20.0 = 1.6\,°C$ (2 sf)

$-m_1 c_1 \Delta T_1 = +m_2 c_2 \Delta T_2$

$-(100)c(-78.4) = (200)(4.18)(1.6)$

$\frac{\cancel{7840}c}{\cancel{7840}} = \frac{1337.6}{7840}$

$c = 0.17061...$

$\boxed{c = 0.2\ J/g°C}$

32. A 10 kg piece of zinc (heat capacity of 0.388 J/g °C) at 71°C is placed in a container of water (heat capacity of 4.18 J/g °C). The water has a mass of 20.0 kg and has a temperature of 10.0°C before the zinc is added. What is the final temperature of the water and zinc?

1 ZINC: Loses Heat

$m = 10\ kg \xrightarrow{\times 1000} 10\,000\ g$ (3 sf)

$c = 0.388\ J/g°C$ (3 sf)

$\Delta T = T_f - T_i = T_f - 71$

2 WATER: Gains Heat

$m = 20.0\ kg \xrightarrow{\times 1000} 20\,000\ g$ (3 sf)

$c = 4.18\ J/g°C$ (3 sf)

$\Delta T = T_f - T_i = T_f - 10.0$

$-m_1 c_1 \Delta T_1 = m_2 c_2 \Delta T_2$

$-(10\,000)(0.388)(T_f - 71) = (20\,000)(4.18)(T_f - 10.0)$

$-3880(T_f - 71) = 83600(T_f - 10.0)$

$-\cancel{3880T_f} + 275480 = 83600T_f - 836000$

$+3880T_f \qquad +3880T_f$

$275480 = 87480T_f - \cancel{836000}$

$+836000 \qquad +\cancel{836000}$

$\frac{1111480}{87480} = \frac{\cancel{87480}T_f}{\cancel{87480}}$

$T_f = 12.7055...$

$\boxed{T_f = 12.7\,°C}$

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