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Change in Thermal Energy Practice Problems

$$Q = m \times \Delta T \times C$$

$$Q = Sm \Delta T$$

Change in thermal energy = mass x change in temperature x specific heat

$$\text{Joules} = \text{kg} \times ^\circ\text{C} \times (\text{J/Kg} \cdot ^\circ\text{C})$$

****Show all your work (formulas & numbers) and make sure you label your answer! Round all answers to 2 decimal places in necessary.****

1. Find the change in thermal energy of a 20-kg wooden chair that warms from 15° to 30° if the specific heat of wood is 700 J/Kg°C. **Show your answer in scientific notation rounded to 2 decimal places.** (6 Points)
2. Find the change in thermal energy of a 35000-g wooden chair that warms from 20° to 55° if the specific heat of wood is 700 J/Kg°C. **Show the conversion ratio to change g → kg before you calculate the energy change** (6 Points)
3. The air in a living room has a mass of 72.5 kg and a specific heat of 1010 J/Kg°C. What is the change in thermal energy of the air when it warms from 15° to 30°? (4 Points)
4. The air in a gym has a mass of 570 kg and a specific heat of 1010 J/Kg°C. What is the change in thermal energy of the air when it warms from 20° to 55°? (4 Points)
5. The air in a car has a mass of 30 kg and a specific heat of 1010 J/Kg°C. What is the change in thermal energy of the air when it warms from 30° to 45°? **Show your answer in scientific notation rounded to 2 decimal places.** (6 Points)



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6. You have a piece of aluminum that has a mass of 15.45 kg. Aluminum has a specific heat of $900 \text{ J/Kg}^\circ\text{C}$. What is the change in thermal energy of the aluminum when it warms from 17° to 48° ? (4 Points)

7. Copper has a specific heat of $387 \text{ J/Kg}^\circ\text{C}$. There is a piece that has a mass of 27 kg and it is warmed from 23° to 63° . What is the change in thermal energy of the copper? **Show your answer in scientific notation rounded to 2 decimal places.** (6 Points)

8. 1563 g of water (specific heat = $4184 \text{ J/Kg}^\circ\text{C}$) is heated from freezing (0°C) to boiling (100°C). What is the change in thermal energy? **Show the conversion ratio used to change g $\rightarrow$ kg before you calculate the energy change.** (6 Points)

9. How much energy is needed to heat 836 g of sand, which has a specific heat of $664 \text{ J/(kg }^\circ\text{C)}$ from 30°C to 50°C ? **Show the conversion ratio used to change g $\rightarrow$ kg before you calculate the energy change.** (6 Points)

10. The temperature of a block of iron, which has a specific heat of $450 \text{ J/Kg}^\circ\text{C}$, increases by 3°C when 2775 J of energy are added to it. What is the mass of this block of iron? (4 Points ~ solve for mass, label in kg, round to 2 decimal places.)



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FORCE HOMEWORK

Solve the following Force problems. Show your work (formulas, math, answers, & labels).

Round all answers to 2 decimal places. **NO FORMULA or NO MATH = NO CREDIT.**

$$F = m \times A \qquad m = \frac{F}{A} \qquad A = \frac{F}{m} \qquad W = mg$$

$$\text{N} = 1 \text{ kg} \cdot \text{m/s}^2 \qquad \text{gravity on Earth} = 9.8 \text{ m/s}^2$$

1. A box is being pushed by two stellar science students, one on each side of the box. Dalton is pushing the box with a force of 10 N to the left. Andre is pushing the box with a force of 15 N to the right. Who is the stronger individual and what is the net force and direction on the box. Three questions to answer! (Draw a picture to help you. Use arrows to represent the forces.)
2. An 85 kg mass has acceleration of 5.56 m/s^2 . What is the net force? **Express your answer in scientific notation rounded to 2 decimal places.**
3. What force is exerted on a 1500 kg car accelerating at a rate of 15.5 m/s^2 ? **Express your answer in scientific notation rounded to 2 decimal places.**
4. Pirate Black Beard digs a hole to bury his treasure. He moves a total of 46 kg of sand at a rate of 0.75 m/s^2 . How much force did he use?
5. A force of 4.1 N is applied to a basketball that has mass of 600 g. What was its acceleration? (**Show how to convert 600 g $\rightarrow$ kg before you calculate the acceleration! Use a conversion ratio.**)
6. Pro wrestler The Rock pins Stone Cold Steve Austin with 24 N of force and accelerated him 0.172 m/s^2 . What is Austin's mass?
7. A force of 254.45 N is applied to an object that accelerates at a rate of 5.9 m/s^2 . What is the mass of the object?



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FORCE HOMEWORK

8. How much force is needed to accelerate a 72 kg rider on a 200 kg Harley Davidson to 4 m/s^2 ?
9. If a 60 kg person on a 15 kg sled is pushed with a force of 300 N, what will be person's acceleration?
10. What force is needed to accelerate a 4000 kg car to 3.6 m/s^2 ?
If a 160 kg driver is added, what is the force necessary? (2 questions = 2 calculations!!)
11. A 62 kg skater hits a wall with a force of 300 N. What was his **acceleration** when he hit the wall?
12. What is the weight of an object (on earth) that has a mass of 45 kg?
13. The value of gravitational pull on the moon is 1.6 m/s/s . What is the weight of a 75 kg astronaut on the moon?
14. A physical science textbook has a mass of 2.2 kg. What is the weight (in Newtons) on the Earth? What is the weight (in Newtons) on Mars ($g = 3.7 \text{ m/s}^2$) *This problem has 2 calculations... 1 for Earth and 1 for Mars!!*
15. The elevator in the new office building warns that it can safely lift 300 kg at one time. If John (852 N), Betty (531 N), Robert (749 N) and Alice (610 N) all get in the elevator at once, can the elevator safely carry them up to the third floor? Show all work.