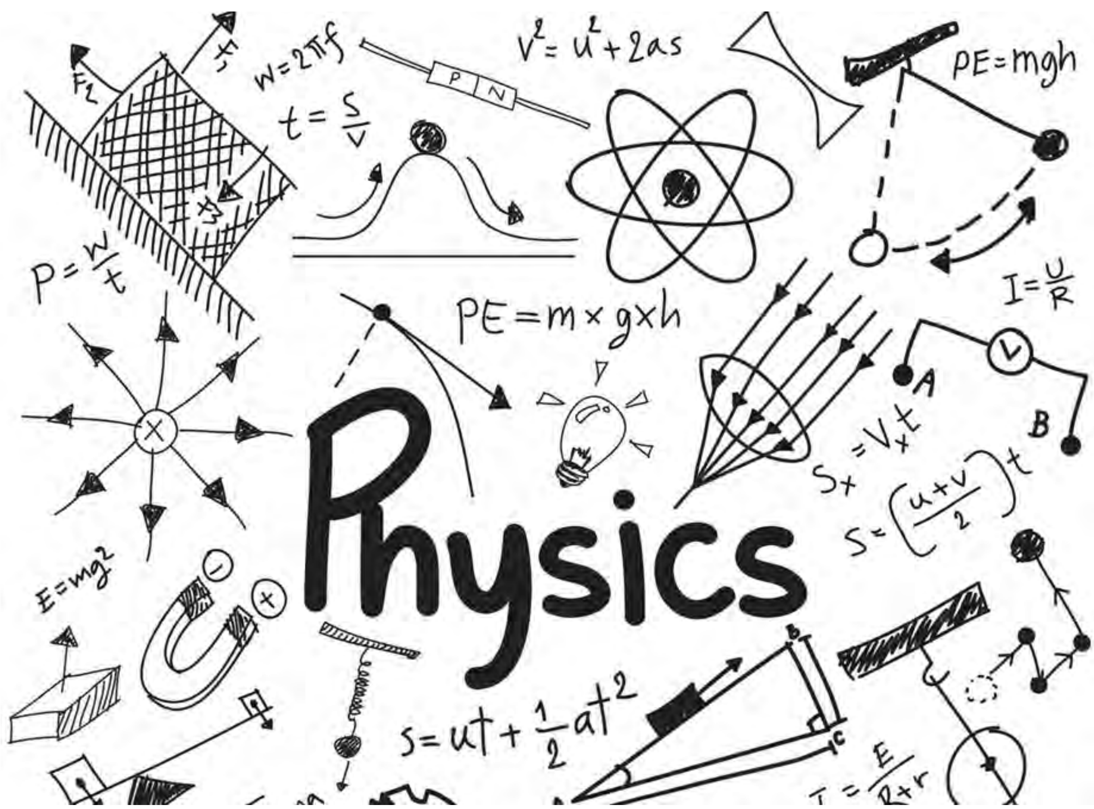
SCIENCE 10

FINAL EXAM REVIEW BOOK 3



ENERGY IS CONSERVED, AND ITS TRANSFORMATION CAN AFFECT LIVING THINGS AND THE ENVIRONMENT.

NAME: ____________________ BLOCK: ____________

Practice Questions: (Your solutions should be organized similar to the example problem. Show all your steps please)

1. A cheetah can run briefly with a speed of 31.0 m/s. Suppose a cheetah with a mass of 47.0 kg runs at this speed. What is the cheetah's kinetic energy?

$v = 31.0\ \frac{m}{s}$
$m = 47.0\ kg$
$E_K = ?$

$E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(47.0)(31.0)^2 =$
$= 22584\ J$

22.6 kJ

2. A ping pong ball has a mass of about 2.45 grams. Suppose that Forrest Gump hits the ball across the table with a speed of about 4.00 m/s. What is the ball's E_k?

$m = 2.45\ g = 0.00245\ kg$
$v = 4.00\ m/s$
$E_K = ?$

$E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(0.00245)(4.00)^2$
$= 0.0196\ J = 19.6\ mJ$

3. The largest land predator is the male polar bear, which has a mass of around 500.0 kg. If the top speed of a male polar bear is 11.0 m/s, how much E_k does it have?

$m = 500.0\ kg$
$v = 11.0\ \frac{m}{s}$
$E_K = ?$

$E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(500.0)(11.0)^2 =$
$= 30\,250\ J$

30.3 kJ

4. Though slow on land, the leatherback turtle holds the record for the fastest water speed of any reptile. The largest leatherback yet discovered could swim at a speed of 9.78 m/s. If its E_k was 60,800 J, what was its mass?

$v = 9.78\ m/s$
$E_K = 60\,800\ J$
$m = ?$

$E_K = \frac{1}{2}mv^2$
$m = \frac{2E_K}{v^2} = \frac{2(60\,800)}{9.78^2} = 1271\ kg$

5. What is the E_k of a 1.00 kg hammer swinging at 20.0 m/s?

$m = 1.00\ kg$
$v = 20.0\ m/s$
$E_K = ?$

$E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(1.00)(20.0)^2$
$= 200\ J$

6. Japan's fasted high speed "bullet" trains, also known as the Shinkansen, travel at a speed of 88.9 m/s. It has an estimated mass of 480,000 kg. What is the maximum E_k of this train?

$v = 88.9\ m/s$
$m = 480\,000\ kg$
$E_K = ?$

$E_K = \frac{1}{2}mv^2$
$= \frac{1}{2}(480\,000)(88.9)^2$
$= 1\,896\,770\,400\ J = 1.9\ GJ$

7. If a falling snowflake has a speed of 0.92 m/s, and has 1.27 mJ of kinetic energy, what is its mass?

$v = 0.92\ \frac{m}{s}$
$E_K = 1.27\ mJ = 0.00127\ J$
$m = ?$

$E_K = \frac{1}{2}mv^2$

$m = \frac{2E_K}{v^2}$
$= \frac{2(0.00127)}{0.92^2}$
$= 0.00300\ kg = 3.0\ g$

8. The spring of a dart gun exerts a force on a 0.020 kg dart as it is launched from the gun with 4.00 J of E_k. At what velocity does the dart come out of the gun?

$m = 0.020\ kg$
$E_K = 4.00\ J$
$v = ?$

$E_K = \frac{1}{2}mv^2$

$\therefore v = \sqrt{\frac{2E_K}{m}}$
$= \sqrt{\frac{2(4.00)}{0.020}} = 20\ \frac{m}{s}$

9. What would happen to the amount of E_k if the mass of an object were to double, but its speed stayed the same?

IF $m \rightarrow 2m$, $E_K = \frac{1}{2} \cdot 2m v^2$

$E_K = \frac{1}{2}mv^2$ YOU GET 2x THE ENERGY

10. What would happen to the amount of E_k if the mass of an object were to stay the same, but its speed doubled?

IF $v \rightarrow 2v$ THEN $E_K = \frac{1}{2}m(2v)^2$
$= \frac{1}{2}m(4)v^2$
$= 4\left(\frac{1}{2}mv^2\right)$

YOU GET 4x THE ENERGY.

SC 10 POTENTIAL ENERGY PROBLEMS

KEY

Practice Questions: (Your solutions should be organized similar to the example problem. Show all your steps please)

1. A goat jumps up in the air and reaches a height of 39.0 m above the surface of the Earth. How much potential energy will the 31.0 kg goat have at this height?

$h = 39.0\,m$
$m = 31.0\,kg$
$g = 9.80\,N/kg$
$E_p = ?$

$E_p = mgh$
$= (31.0)(9.80)(39.0)$
$= 11848.2\,J = 11\,800\,J$ = $11.8\,kJ$

2. If a rock has 250 MJ of potential energy while sitting on the edge of a cliff 42.0 m above the valley floor, what is its mass?

$E_p = 250\,MJ$
$= 250\,000\,000\,J$
$h = 42.0\,m$
$g = 9.80$
$m = ?$

$E_p = mgh$
$\therefore m = \frac{E_p}{gh} = \frac{250\,000\,000}{9.8(42.0)}$
$= 607\,000\,kg$

3. The International Space Station is 405 km above the Earth's surface and has a mass of 419 000 kg. If the gravitational field strength is only 8.72 N/kg at this altitude, how much potential energy does the ISS have?

$h = 405\,km = 405\,000\,m$
$m = 419\,000\,kg$
$g = 8.72\,N/kg$
$E_p = ?$

$E_p = mgh$
$= (419\,000)(8.72)(405\,000)$
$= 1.48 \times 10^{12}\,J$ $= 1.48\,TJ$
$(1\,480\,000\,000\,000\,J)$

4. If you had a job lifting books from the floor up onto a bookshelf (h = 1.70 m), and the average book had a mass of 1.20 kg, and you had 1000 books to put away, how much extra potential energy would all those books have when you were done? Where did this energy come from?

$h = 1.70\,m$
$m = 1.20\,kg$ $\times 1000$
$g = 9.80\,N/kg$
$E_p = ?$

$E_p = mgh$
$= (1.20)(1000)(9.8)(1.70)$
$= 19992\,J$
$= 20.0\,kJ$

5. If 9.75 kJ of $\mathbf{E_p}$ was given to a lemon while lifting it, and the lemon had a mass of 218 g, how high was it lifted?

$E_p = 9.75$ kJ $= 9750$ J

$m = 218$ g $= 0.218$ kg

$g = 9.80$

$h = ?$

$E_p = mgh$

$h = \frac{E_p}{mg} = \frac{9750}{0.218(9.80)} = 4563$ m $= 4.56$ km

6. How high could a 60.0 kg pole vaulter get above the ground if she could convert 2975 J of energy into $\mathbf{E_p}$?

$m = 60.0$ kg

$E_p = 2975$ J

$g = 9.80$ N/kg

$E_p = mgh$

$\therefore h = \frac{E_p}{mg} = \frac{2975}{(60.0)(9.80)} = 5.0595$ m $= 5.06$ m

7. What is the mass of one chocolate chip if throwing it 2.10 m vertically into the air requires 68.5 mJ of energy? (ignoring energy lost to friction)

$h = 2.10$ m

$E_p = 68.5$ mJ $= 0.0685$ J

$g = 9.80$

$E_p = mgh$

$\therefore m = \frac{E_p}{gh} = \frac{0.0685}{(9.80)(2.10)} = 0.003328$ kg

3.33 g

8. An astronaut jumping on the moon could get his 140 kg of mass (body plus space suit) to a height of 1.73 m above the surface (measured to his center of mass). At this point, his $\mathbf{E_p}$ was only 412 J. What must the gravitational field strength be on the moon?

$m = 140$ kg

$h = 1.73$ m

$E_p = 412$ J

$g = ?$

$E_p = mgh$

$\therefore g = \frac{E_p}{mh} = \frac{412}{140(1.73)} = 1.7010$ N/kg

$= 1.70$ N/kg

9. If the mass of an object were to suddenly double, what would happen to it's $\mathbf{E_p}$?

$E_p = mgh$ DOUBLES

10. If the height of an object were to suddenly double, what would happen to it's $\mathbf{E_p}$?

$E_p = mgh$ DOUBLES

CONSERVATION OF ENERGY PROBS KEY

Formula:

$E_t = E_t'$	(total energy before = total energy after)
$E_k = E_p'$	(only kinetic E at bottom, only potential E at the top)
$\frac{1}{2}mv^2 = mgh$	(notice there is an "m" on either side, so divide both sides by m! Neat eh?)
$\frac{1}{2}v^2 = gh$	(now multiply both sides by 2)
$v^2 = 2gh$	(now take the square root of both sides)
$v = \sqrt{2gh}$	
$v = \sqrt{2(9.80)(21.0)}$	(substitute in the data values)
$v = 20.2879$	(calculate)
$v = 20.3$ m/s	(round off and add the units)

Practice Questions: (Your solutions should be organized similar to the example problem. Show all your steps please. Round to 3 digits)

1. A student is dropped. If they reach the floor at a speed of 3.20 m/s, from what height did they fall? (no students were harmed in the making of this problem.)

$E_T = E_T'$

$E_p = E_k'$

$mgh = \frac{1}{2}mv^2$

$h = \frac{\frac{1}{2}v^2}{g}$

$h = \frac{\frac{1}{2}(3.20)^2}{9.80}$

$= 0.522$ m

2. A heavy object is dropped from a vertical height of 8.00 m. What is its speed when it hits the ground?

$E_T = E_T'$

$E_p = E_k'$

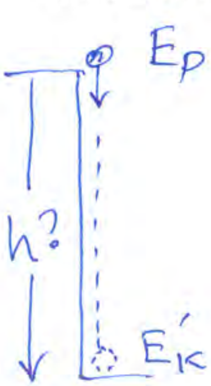
$mgh = \frac{1}{2}mv^2$

$v = \sqrt{2gh}$

$v = \sqrt{2(9.80)(8.00)}$

$v = 12.5 \frac{m}{s}$

3. A bowling ball is dropped from the top of a building. If it hits the ground with a speed of 37.0 m/s, how tall was the building?



$E_T = E_T'$

$E_p = E_k'$

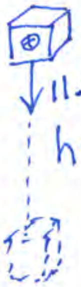
$mgh = \frac{1}{2}mv^2$

$h = \frac{\frac{1}{2}v^2}{g}$

$h = \frac{\frac{1}{2}(37.0)^2}{9.80}$

$h = 69.8$ m

4. A safe is hurled down from the top of a 135 m tall building at a speed of 11.0 m/s. What is its velocity as it hits the ground?



$E_K + E_P$

E_K'

$E_T = E_T'$

$E_K + E_P = E_K'$

$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv'^2$

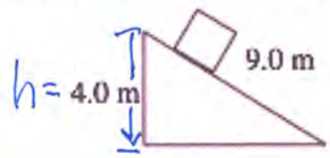
$v^2 + 2gh = v'^2$

$v' = \sqrt{v^2 + 2gh}$

$= \sqrt{11^2 + 2(9.8)(135)}$

$\boxed{= 52.6 \frac{m}{s}}$

5. A box slides down a frictionless ramp. If it starts at rest, what is its speed at the bottom? (assume the box started at the very top of the ramp)



$E_T = E_T'$

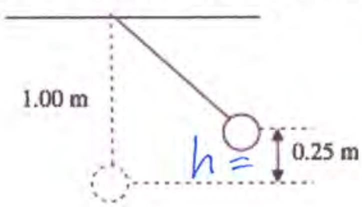
$E_P = E_K'$

$mgh = \frac{1}{2}mv^2$

$v = \sqrt{2gh}$

$v = \sqrt{2(9.80)(4.0)} = \boxed{8.85 \frac{m}{s}}$

6. A pendulum is dropped from the position shown, 0.250 m above its equilibrium position. What is the speed of the pendulum bob as it passes through its equilibrium position?



$v = \sqrt{2gh}$

$= \sqrt{2(9.80)(0.250)}$

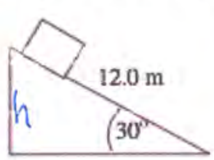
$\boxed{= 2.21 \frac{m}{s}}$

7. A box slides down a frictionless incline as shown. If the box starts from rest, what is its speed at the bottom? (assume the box started at the very top of the ramp)

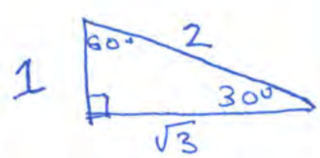
USE SIN30° TO GET

$h = 12.0 \sin 30°$

$h = 6.0\ m$



OR → SPECIAL △ RATIO

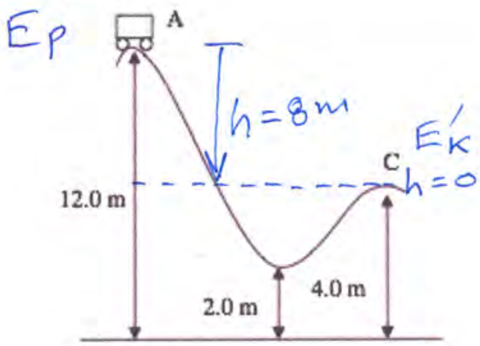


$v = \sqrt{2gh}$

$= \sqrt{2(9.80)(6.0)}$

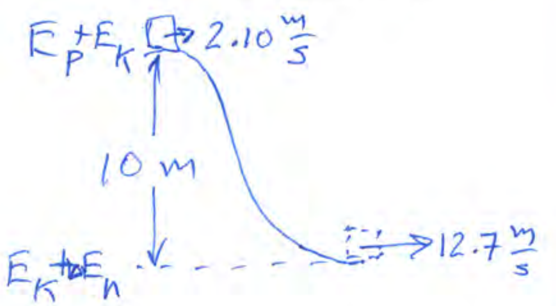
$\boxed{= 10.8 \frac{m}{s}}$

8. A roller coaster car starts from rest at point A. What is its speed at point C if the track is frictionless?



$$E_T = E_T'$$
$$E_p = E_K'$$
$$mgh = \frac{1}{2}mv^2$$
$$v = \sqrt{2gh}$$
$$= \sqrt{2(9.80)(8.00)}$$
$$\boxed{= 12.5\ \frac{m}{s}}$$

9. The roller coaster shown above has a mass of 525 kg and is travelling at 2.10 m/s at point A, and is later travelling at 12.7 m/s at the lowest point. How much energy was lost to heat on the trip down?

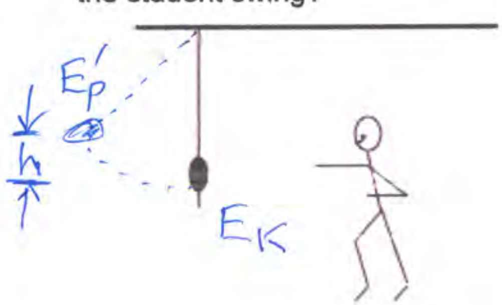


$$E_T = E_T'$$
$$E_p + E_K = E_K' + \Delta E_h$$
$$\Delta E_h = E_p + E_K - E_K'$$
$$= mgh + \frac{1}{2}mv^2 - \frac{1}{2}mv'^2$$
$$= 525(9.8)(10) + \frac{1}{2}(525)(2.10)^2 - \frac{1}{2}(525)(12.7)^2$$

$\Delta E_h =$ 10269 J

$$\boxed{10.3\ kJ}$$

10. An 80.0 kg student running at 3.50 m/s grabs a rope that is hanging vertically. How high will the student swing?



$$E_T = E_T'$$
$$E_K = E_p'$$
$$\frac{1}{2}mv^2 = mgh$$
$$h = \frac{\frac{1}{2}v^2}{g}$$
$$h = \frac{(3.50)^2}{2(9.80)} = \boxed{0.625\ m}$$

Science 10 Energy Unit Name: KEY Block: ____

THERMAL ENERGY PROBLEMS

Thermal energy (E_h) is an example of kinetic energy, as it is due to the motion of particles, with motion being the key. Thermal energy results in an object or a system having a temperature that can be measured. Thermal energy can be transferred from one object or system to another in the form of **heat.** Sometimes thermal energy is defined as the total internal energy of all the particles in a body. This would include the translational (sideways) kinetic energy that could be detected by a thermometer, as well as all the energies contained in the vibrations and rotations of particles that cannot be detected. This is why a mass can absorb energy and not increase its temperature (for example: when melting ice into liquid water, it will take in energy, but not change temperature until the liquid has formed, then the temperature will start to rise.)

To calculate the **total thermal energy, E_h,** of an object, use the following formula:

$$E_h = mCT$$

Where:

Mass (m) is measured in kilograms (kg)
Specific heat capacity (C) is measured in joules per kilogram per kelvin (J/kg·K)
Temperature (T) measured in kelvin (K)
E_h is measured in joules (J) [note, we use the subscript "h" (from "heat") for thermal energy because "t" will be used later for "total" energy. It's not quite right, but will do for now.]

It is rare to need to calculate the total thermal energy of an object. Most often we are interested in the increase or decrease of thermal energy. Heat is defined as the change in thermal energy (ΔE_h). Heating refers to an increase in thermal energy and cooling refers to a decrease in thermal energy.

To calculate the **change in thermal energy** (or heat) ΔE_h of an object, use the following formula:

$$\Delta E_h = mC\Delta T$$

2. What is the mass of a lead block if it takes 67 kJ to raise the temperature by 100.0°C

$m = ?$
$\Delta E_p = 67000\ J$
$\Delta T = 100°c$
$C = 129$

$\Delta E_h = mC\Delta T$

$m = \frac{\Delta E_p}{C\Delta T} = \frac{67000}{129(100)} = 5.19\ kg$

3. If a pile of snow with a mass of 525 kg loses 7.40 MJ of thermal energy during the night, how much will the temperature of the snow drop?

$C = 2090$
$m = 525$
$\Delta E_h = -7.4 \times 10^6\ J$
$\Delta T = ?$

$\Delta E_h = mC\Delta T$

$\Delta T = \frac{\Delta E_h}{mC} = \frac{-7400000}{525(2090)} = -6.7°C$ (DROPS)

4. What is the final temperature of 0.63 kg of water that releases 2290 joules of thermal energy? The water had an initial temperature of 48.2°C.

$m = 0.63\ kg$
$\Delta E_h = -2290\ J$
$t_i = 48.2°c$
$t_f = ?$

$\Delta T = \frac{\Delta E_h}{mC} = \frac{-2290}{0.63(4180)} = -0.86959°c$

$T_f = \Delta T + T_i = -0.86° + 48.2° = 47.3°$

5. What is the ***total*** thermal energy in a human body? Let's assume some things: The average specific heat capacity of a human body is approximately 3500 J/(kg·K) at normal conditions. The average human has a mass of 72.0 kg. Body temperature is normally 37.0 °C.

$C = 3500$
$m = 72$
$T = 37°c + 273.15$
$T = 310.15\ K$

$E_h = mCT$
$= (72)(3500)(310.15)$
$= 78{,}157{,}800\ J = 78\ MJ$

6. In his part time job as a blacksmith, Nathan was quenching (cooling) a 350 g iron horseshoe from 470.0 °C to 30.0 °C by plunging the horseshoe into a bucket of cold water. How much thermal energy was lost by the horseshoe?

$m = 350\ g = 0.350\ kg$
$T_1 = 470.0°c$
$T_2 = 30.0°c$
$C = 449$

$\Delta E_h = mC\Delta T$
$= (0.350)(449)(30.0 - 470.0)$
$= -69146\ J$
$= -69\ kJ$

The size of one kelvin and the size of one degree Celsius is the same on a thermometer, therefore the change in temperature (ΔT) can be measured in either kelvin or degrees Celsius and is defined as the difference between the final temperature T_f and the initial temperature T_i

$$\Delta T = T_f - T_i$$

The specific heat capacity can then be in (J/kg·K) or in (J/kg·°C).

Note: To earn full marks when solving science word problems, you must **Show your work.** Please refer to the problem solving steps given in class. Don't forget to convert units into the proper base units before calculating.

Example Problems:

1. How much energy would be required to raise the temperature of The One Ring from 30.0°C to 1 064°C (the melting point of gold) when Gollum releases it into the lava of Mt. Doom? Let's assume the ring has a mass of 5.0 g.

   Solution:
   For all these problems we will need the specific heat capacity of each substance. Sometimes it will be given to you, but if not, look it up. C for gold is 129 J/kg°C
   m = 5.0 g = 0.0050 kg
   C = 129 J/kg°C
   T_i = 30.0°C
   T_f = 1 064°C

   $\Delta E_h = mC\Delta T$
   $= (0.0050)(129)(1\ 064 - 30.0)$
   $= 666.93$
   $= 667$ J

   6

Practice Questions: (Your solutions should be organized similar to the example problem. Show all your steps please)

Use the specific heat capacity table here: goo.gl/65gAMu

1. How much heat energy is required to warm 3.5 kg of water from 16°C to 96°C?

m = 3.5 kg
C = 4180 $\frac{J}{kg°C}$
t_f = 96°C
t_i = 16°C

$\Delta E_h = mC\Delta T = mC(T_f - T_i)$
$= (3.5)(4180)(96-16)$
$= 1\ 170\ 400$ J
$= 1.2$ MJ

GAINS THE HEAT LOST IN QUESTION #6

7. If the bucket of water that Nathan (from the last question) contained 14.0 kg of water that had an initial temperature of 25.0 °C, how much would the water temperature increase when cooling the horseshoe?

$\Delta E_h = 69146$ J
$m = 14$ kg
$\Delta T = ?$
$c = 4180$

$$\Delta T = \frac{\Delta E_h}{mC} = \frac{69146}{14(4180)} = \boxed{1.18\ ^\circ C}$$

8. A standard gold bar, also referred to as gold ingot or gold bullion has a mass of 12.4 kg (what is known as 400 troy ounces). If the melting point of gold is 1063 °C, how much energy would be needed to bring one standard gold bar from room temperature of 20.0 °C to its melting point?

GOLD
$c = 129$
$m = 12.4$
$T_1 = 20$
$T_2 = 1063$

$$\Delta E_h = mC\Delta T = (12.4)(129)(1063 - 20) = 1\,668\,382.8 \text{ J} = \boxed{1.67 \text{ MJ}}$$

9. If two bars of copper and gold have equal masses of 250 g, and have equal starting temperatures, how much will their final temperatures differ by if 6.5 kJ of thermal energy is added to each of the bars?

COPPER
$c = 385$
$m = 0.250$
$\Delta E_h = 6500$
GOLD
$c = 129$

COPPER
$$\Delta T = \frac{\Delta E_h}{mC} = \frac{6500}{(0.250)385}$$
$\Delta T = 67.53\ ^\circ C$

GOLD
$$\Delta T = \frac{6500}{(0.250)(129)}$$
$\Delta T = 201.55\ ^\circ C$

DIFFERENCE IN FINAL TEMPS:
$201.55 - 67.53 = 134.02\ ^\circ C = \boxed{134\ ^\circ C}$

10. Milan started a fire in her fireplace which has a granite surround with a mass of 240 kg. If the granite started at 18.0 °C, how much energy was needed to raise its temperature to 32.0 °C?

GRANITE
$c = 790$
$m = 240$
$T_1 = 18.0$
$T_2 = 32.0$

$$\Delta E_h = mC\Delta T = (240)(790)(32.0 - 18.0) = 2\,654\,400 \text{ J} = \boxed{2.7 \text{ MJ}}$$

ANSWER KEY Isotopes and Ions

Name of ion	Symbol	Number of Protons	Number of Electrons	Net charge
lithium ion	**Li^{+}**	**3**	**2**	**1+**
potassium ion	**K^{+}**	19	18	1+
magnesium ion	Mg^{2+}	**12**	**10**	**2+**
chloride ion	**Cl^{-}**	**17**	**18**	**1–**
fluoride ion	**F^{-}**	9	**10**	1–
oxide ion	O^{2-}	**8**	**10**	**2–**
iodide ion	I^{-}	**53**	**54**	**1–**
scandium ion	**Sc^{3+}**	**21**	**18**	**3+**
sulphide ion	**S^{2-}**	**16**	18	2–
selenide ion	Se^{2-}	**34**	**36**	**2–**
nitride ion	**N^{3-}**	7	10	3–
aluminum ion	Al^{3+}	**13**	**10**	**3+**
carbide ion	**C^{4-}**	**6**	10	4–
calcium ion	**Ca^{2+}**	**20**	**18**	**2+**
phosphide ion	**P^{3-}**	**15**	**18**	**3–**

2. Answers are in boldface.

Name of Isotope	Symbol	Mass Number	Number of Protons	Number of Neutrons
hydrogen-3	$^{3}_{1}H$	3	1	2
scandium-49	**$^{49}_{21}Sc$**	**49**	**21**	**28**
cobalt-60	$^{60}_{27}Co$	**60**	**27**	**33**
nitrogen-15	**$^{15}_{7}N$**	**15**	**7**	**8**
uranium-238	$^{238}_{92}U$	**238**	**92**	**146**
iodine-129	$^{129}_{53}I$	**129**	**53**	**76**
barium-135	**$^{135}_{56}Ba$**	**135**	56	79
strontium-86	**$^{86}_{38}Sr$**	86	**38**	48
oxygen-18	$^{18}_{8}O$	**18**	**8**	**10**
carbon-14	**$^{14}_{6}C$**	**14**	**6**	**8**

3. The oxygen isotopes have the same number of electrons and the same number of protons. The number of neutrons does not affect reactivity. How elements form compounds is dictated primarily by the valence electrons.

BLM 2-44, Isotopes

1. D
2. A
3. B
4. C
5. B
6. C

BLM 2-46, Half-Life and Radioisotope Dating

1. (a) Half-life is the time needed for half of a sample of a radioisotope to decay.
   (b) 5730 years
   (c) (i) 50% (ii) 25% (iii) 12.2%
   (d) (i) 55% (ii) 30% (iii) 15%
   (e) (i) 7500 years (ii) 13 000 years (iii) 26 000 years
   (f) After 50 000 years there is insufficient parent isotope remaining to be able to detect it.
2. (a) Potassium-40 can exist hot molten rock, while argon-40, the daughter isotope, escapes from the molten rock because it is a gas.
   (b) By radioactive decay of potassium-40
   (c) 1.3 billion years (or 1300 million years)
   (d) (i) 50 nanograms of potassium and 50 nanograms of argon-40
   (ii) 25 nanograms of potassium and 75 nanograms of argon-40
   (iii) 12.5 nanograms of potassium and 87.5 nanograms of argon-40
3. (a) lead-207 decays into uranium-235
   (b) 710 million years (equivalent to one half-life)
   (c) Estimated age is 5.68 billion years (Claire's analysis gave 5.55 billion years).
   (d) (i) About 5 half-lives (ii) 3.125% remains
   (e) Although the method cannot be used to date rocks older than 3 billion years, the method would still be able to demonstrate that the rocks were at least that age.
   (f) Carbon-14 has a half-life in the hundreds of years and there would be no detectable amount present in the rocks, making carbon-14 dating unable to date the rock.

BLM 2-47, Chapter 7 Quiz

1. A
2. B
3. D
4. D
5. B
6. C
7. C
8. B
9. B
10. C
11. F
12. A
13. D
14. G
15. B

16. E
17. (a) They are made of the same number of protons (19).
    (b) They have different numbers of neutrons (20 and 21).
    (c) Potassium-40 is heavier because the extra neutron that it has increases the mass of the nucleus.
18. (a) 100 micrograms
    (b) 50 micrograms
    (c) 6.25 micrograms
19. (a) $^{211}_{87}Fr$
    (b) $^{239}_{93}Np$
    (c) $^{24}_{12}Mg^*$

BLM 2-48, Unit 2 Test

1. D
2. A
3. B
4. D
5. D
6. D
7. A
8. B
9. D
10. A
11. H
12. G
13. E
14. L
15. J
16. A
17. F
18. K
19. C
20. I
21.

Name of Isotope	Symbol	Mass Number	Number of Protons	Number of Neutrons
scandium-49	$^{49}_{21}Sc$	**49**	**21**	**28**
cobalt-60	$^{60}_{27}Co$	**60**	**27**	**33**
nitrogen-15	$^{15}_{7}N$	**15**	**7**	**8**

22.

Name of Ion	Symbol	Number of Protons	Number of Electrons	Net Charge
oxide ion	O^{2-}	**8**	**10**	**2–**
iodide ion	I^{-}	**53**	**54**	**1–**
scandium ion	Sc^{3+}	**21**	**18**	**3+**