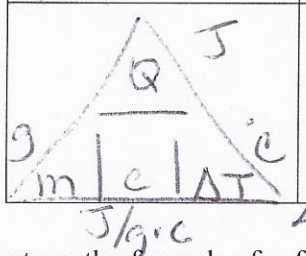
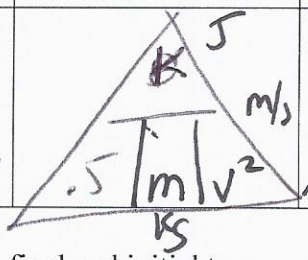
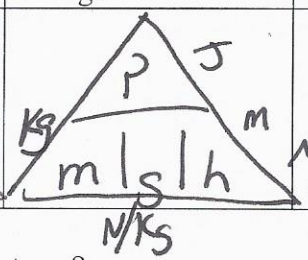
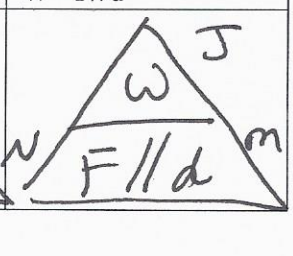
Test review for energies, forces and work

1. For each formula, make the triangle and give the unit for each variable.

Q=mcΔT	K= .5mv^2	P=mgh	W= F//d
			

2. What are the formulas for final and initial temperatures?

IT = FT − ΔT FT = IT + ΔT

3. Conversions: convert the first box to the box below it.

700 km	6 000 g	45 kg	15 km/h	17 cm
m ×1000	kg ÷1000	N ×9.8N/kg	m/s $\frac{15 \times 1000}{3600}$	m ÷100
700 000 m	6kg	440 N	4.2 m/s	.17cm

4. Calculate the gravitational pull of a fictional planet if a 510 g golf ball was hit 35 meters high with 42 000 J of energy.

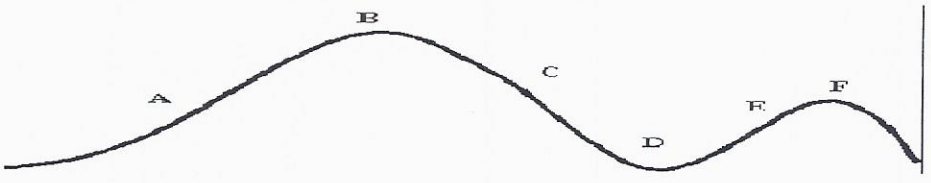
A) 2.4 N/kg B) 240 N/kg C) 2.4 x 10^3 N/kg D) 2.9 x 10^4 N/kg

$g = \frac{P}{mh}$ $\frac{42\,000}{(.51 \times 35)} =$

5. Substance A has a higher specific heat than substance B. Which requires the most energy to heat equal masses of A and B to the same temperature?

A) Substance A C) Both require the same amount of heat.
B) Substance B. D) Answer depends on the density of each substance.

Use the picture below to answer questions 6-8.



A) A B) B C) D D) F

6. Which letter on the diagram represents the place where the cars on the roller coaster would have the most potential energy? B

7. When would the cars have the fastest speed? D

8. Where would kinetic energy be equal to the potential energy? A + C

9. Nathan is sitting on his sled, sliding down a snowy hill. The hill is angled at 20° from the ground. Nathan and the sled weigh 350°N. Which of the arrows best represents the direction of the effective force acting on Nathan and the sled?

A) B) C) D)

10. If 59.1 g of pure metal uses 890.9 J of energy to heat it from 26.1°C to 59.6°C, identify the metal.

Specific heat capacities of some metals

Metal	Specific heat capacity (J/g·C)
Aluminum	**0.897**
Chromium	**0.45**
Cobalt	**0.64**
Copper	**0.385**

$C = \frac{Q}{m\Delta T}$ $\frac{890.6}{(59.1 \times (59.6 - 26.1))}$

11. Two students were performing an experiment on heat energy. They poured 125 g of water into a calorimeter. The temperature of the water was 22.0°C. The students then placed a small electric heating element into the water. The heating element transferred 7120 J of energy to the water.

What was the final temperature of the water?

$\Delta T = \frac{Q}{mc}$ $\frac{7120}{(125 \times 4.19)} = 13.6°C$ $FT = IT + \Delta T$ $22.0 + 13.6 =$

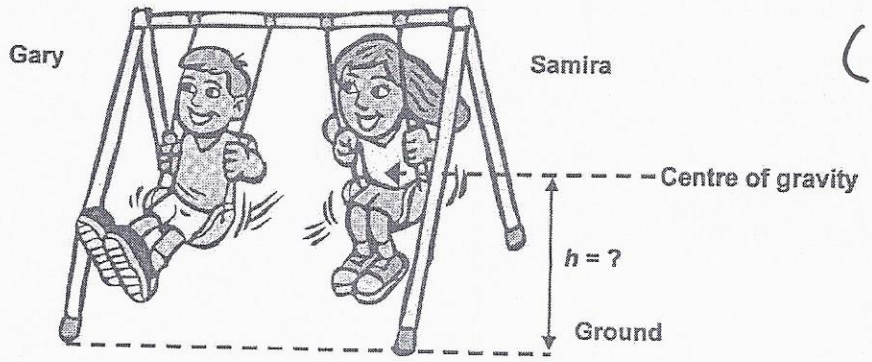
A) 8.4°C B) 13.6°C C) 35.6°C D) 79.0°C

12. Karina decided to make herself some French fries as a snack. In order to cook her French fries, the temperature of the oil must be 190°C. Karina pours 1.4 kg of oil, that is originally at a temperature of 23°C, into a deep fryer. It takes 390 446 J of energy to heat the oil. What is the specific heat of the oil used?

A) 1.67 J/(g•°C) B) 12.12 J/(g•°C) C) 1 670 J/(g•°C) D) 12 120 J/(g•°C)

$C = \frac{Q}{m\Delta T}$ $\frac{390\,446}{(1400 \times (190 - 23))} = 1.67$

13. Gary and Samira are swinging on separate swings, as illustrated below.



Gary has a mass of 28 kg and Samira has a mass of 23 kg. At a certain moment in time,

a) What is Gary's speed at this moment in time?
b) How high above the ground is Samira's center of gravity at this moment in time?

a) $v^2 = \frac{2K}{.5m}$ $\sqrt{\frac{126}{(.5 \times 28)}}$ = 3.0 m/s

$h = \frac{P}{mg}$ $\frac{180}{(23 \times 9.8)}$ = .80 m

14. Brad is pulling his daughter Ashley on a sleigh. The rope is at an angle of 47° with the horizontal. Brad has a mass of 67 kg and exerts a force equal to his weight and pulls his daughter for 3.0 km. How much work is done by brad?

$67 \times 9.8 = 660$ N

$W = F \parallel d$

$\cos 47 = \frac{x}{660} \times 3000 = 1.4 \times 10^6$ J

15. Carl is pulling his younger sister on a sled with a force of 60.0 N at a 75° angle.
a- What is the effective force used when pulling the sled?
b- If the sled's mass is 3.0 kg when his sister is in it, could they be lifted off the ground?

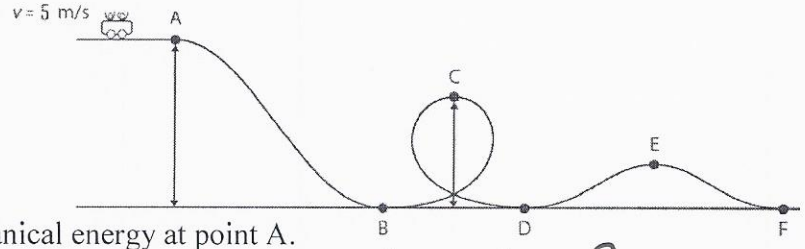
a) $\cos 75 = \frac{x}{60.0} = 16$ N

b) $3.0 \times 9.8 = 29$ N

$\sin 75 = \frac{x}{60.0} = 58$ N

Yes can lift 58 N which is more than 29 N.

16. Roger gave the following account of a roller-coaster ride:
"I tried a brand-new ride at a science centre. There's a computer screen that tells you how much the car and the people in it weigh and how high and fast you travel. You get into the car and they strap you in. The car has a mass of 555 kg. At the top, it moves horizontally at a speed of 5.00 m/s. Then you drop 30.0 m, make a loop 20.0 m into the air and finish by riding over an 8.0-m hill. I don't remember our maximum speed or our speed at the top of the loop, but the ride was fantastic!"



Calculate the mechanical energy at point A.

$P = mgh$

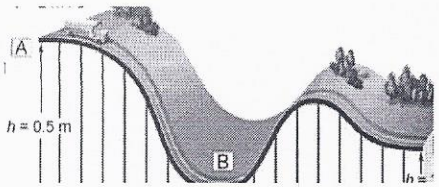
$555 \times 9.8 \times 30.0 = 163000$ J +

$K = .5mv^2$

$.5 \times 555 \times 5.00^2 = 6940$ J

$= 1.70 \times 10^5$ J

17. Jessica builds a model track for her little brother.
She places a toy bus weighing 0.5 kg at point A . The b
travels the entire route with no further addition of
energy.



a- What is the potential energy of point A?

$P = mgh = .5 \times 9.8 \times .5 =$ 2J

b- If the velocity of the bus at point B is 3.13 m/s, calculate its kinetic energy.

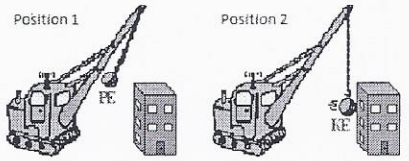
$K = .5mv^2 \quad .5 \times .5 \times 3.13^2 =$ 2J

c- What is the relationship between the energy values calculated in A and B? Explain.

full kin = 0 pot
full pot = 0 kin
∴ full kin = full pot

mechanical never changes

18. A bulldozer will be used to bulldoze a building. In Position 1, the bulldozer has a height of 2 500 cm and weighs 125 kg. What is the speed that the bulldozer will hit the building as seen in position 2?



$K = P = mgh$

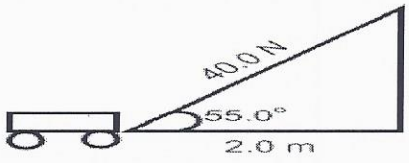
$v^2 = \frac{mgh}{.5m}$

$\frac{125 \times 9.8 \times 25}{(.5 \times 125)}$

$= 22 \text{ m/s}$

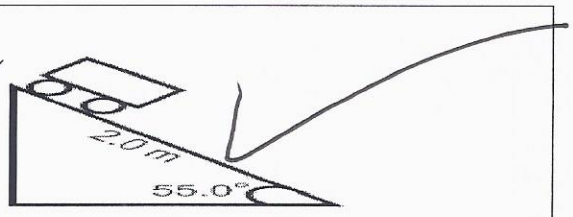
19. If each of the carts illustrated weighs 60.0 N and travels a distance of 2.0 m, ~~in which~~ situation will more work be done?

$W = Fd\cos\theta$



$\cos 55 = \frac{x}{40.0} \times 2.0$

$= 46\text{J}$



$55 \cdot 0 = \frac{x}{60.0} \times 2.0$

$= 98\text{J}$

$\frac{7.5 \times 1000}{3600} = 2.1 m/s$

20. A crane carries a metal tube weighing 70.5 kg 110.5 m above ground at a speed of 7.5 km/h. What is the metal tube's mechanical energy?

$K = .5mv^2$ $\quad P = mgh$

$.5 \times 70.5 \times 2.1^2$ $\quad 70.5 \times 9.8 \times 110.5$

$= 160\ J + = 76300J = 76500J$

21. What is the maximum height the ball below can reach if the ball weighs 620 g is travelling at a speed of 35 km/h?

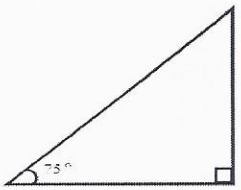
$h = \frac{P}{mg}$ $\quad h = \frac{.5mv^2}{mg}$ $\quad \frac{.5 \times .62 \times 9.7^2}{.62 \times 9.8}$

$P = K$ $\quad \frac{35 \times 1000}{3600} = 9.7 m/s$ $\quad 4.8m$

22. Fred is pulling his younger sister on a sled with a force of 90.0 N at a 75° angle.

a- What is the effective force used when pulling the sled?

$\frac{C75}{90.0} = \frac{x}{} = 23N$



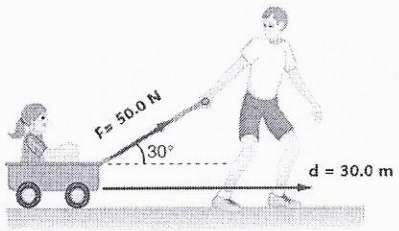
b- If the sled's mass is 8.0 kg, will it be lifted off the ground?

$8.0 \times 9.8 = 78N$ $\quad \frac{S75}{90.0} = \frac{x}{} = 87N$ $\quad$ Yesshe can lift...

23. What is the force a man is using when he is pulling a cart with an effective force of 45.0 N at a 40.0° angle?

$\frac{C40.0}{45.0} = \frac{}{x} = 58.7N$

24. What is the effective force used when Nathan pulls his sister Kim in a wagon for 30.0 m? /4



$\frac{C30.0}{C30} = \frac{}{50.0} = \frac{x}{} = 43.3N$ $\quad 40N$