Test review for energies, forces and work

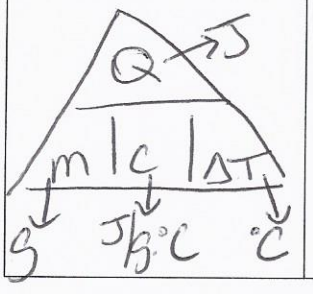
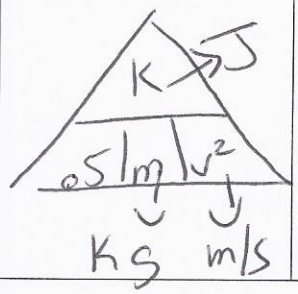
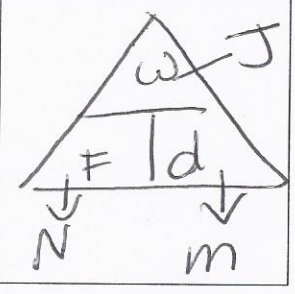
1. Definitions: define the following words:

Accelerating force	force which causes object to move in direction force was applied
Decelerating force	force which slows down or stops an object.
Diversion	changing direction of an object

2. What is the difference between mass and weight?

Mass is the matter you are made up of & does not vary. Weight can vary & depends on gravitational force

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

Q=mcΔT	K= .5mv^2	P=mgh	W= Fd
			

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

IT= FT-ΔT FT= IT+ΔT

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

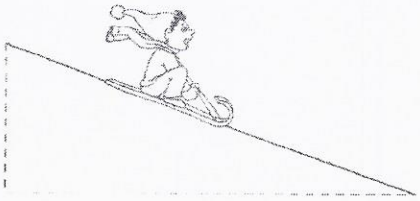
700 km	6 000 g	45 kg	15 km/h	17 cm
m	kg	N	m/s	m
×1000	÷ 1000	× 9.8 N/kg	$\left(\frac{15 \times 1000}{3600}\right)$	÷ 100
700 000 m	6kg	440N	4.2 m/s	.17cm

6. 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

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

7. 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)

8. Below is a picture of a girl going down a slide. Which answer best describes the relationship between kinetic, potential and mechanical energy?

A) As she slides down the potential energy decreases the kinetic energy increases which will cause the mechanical energy to vary throughout the motion.

B) As she slides down the potential energy increases the kinetic energy decreases which will cause the mechanical energy to vary throughout the motion.

C) As she slides down the potential energy decreases the kinetic energy increases and the mechanical energy will be constant throughout the motion.

D) As she slides down the potential energy increases the kinetic energy decreases and the mechanical energy will be constant throughout the motion.

9. 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) $\sin 75 = \frac{x}{60.0} = 58\,N$

$3.0 \times 9.8 = 29\,N$ ← yes can lift

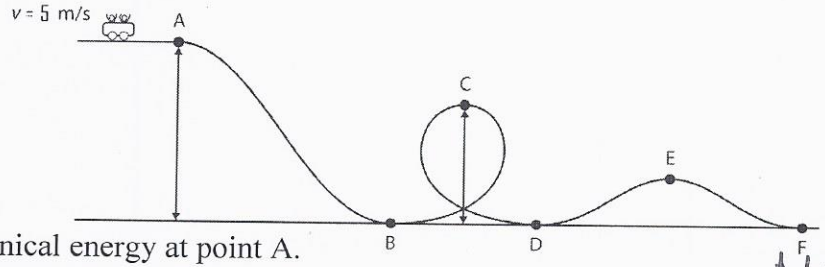
10. What was the distance travelled if a boy used 500 000 J of energy with a force of 150 N for a jog?

$d = \frac{W}{F}$ $\frac{500000}{150} = 3000\,m$

11. What is vinegar's specific heat if 40.0 g was heated for 8 minutes and had a temperature change of 24.0°C to produce 500.0 J of heat?

$C = \frac{Q}{m\Delta T}$ $\frac{500.0}{40.0 \times 24.0} = 0.521\ J/g \cdot °C$

12. 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.

$K = .5mv^2$ $.5 \times 555 \times (5.00)^2$ $6940\ J$

$P = mgh$ $555 \times 9.8 \times 3$ $163\,000\ J$

ME $163\,000 + 6940$ $170\,000\ J$ 1.70×10^5

13. What was the mass of water if it absorbed 3 005 J of heat with an original temperature of 20.0°C and a final temperature of 27.0°C?

$m = \frac{Q}{C\Delta T} = \frac{3005}{4.19 \times (27.0 - 20.0)} = 1.02 \times 10^2\ g$

14. How much work does the gravitational force acting on a skier represent if the skier weighs 55 kg and travels 4.0 km down a hill with a 10.0° angle?

$W = Fd$ $55 \times 9.8 = 540\ N$ $\left(\sin 10.0 = \frac{x}{540}\right) \times 4000 = 3.8 \times 10^5\ J$

15. A van travels at a speed of 30.0 km/h with a kinetic energy of 7 700 J. What is the van's mass?

$m = \frac{K}{.5v^2}$ $\frac{7700}{.5 \times (8.33)^2} = 220\ kg$ $\left(\frac{30.0 \times 1000}{3600}\right)$ 8.33

16. What is the force used when a man pulls a boy with an effective force of 85 N at an angle of 22°?

$\cos 22 = \frac{85}{x} =$ 92 N

17. What is the force applied if a boy used 5 005 J of work while skating for 400.0 m?

$F = w/d \quad \frac{5005}{400.0} =$ 12.51 N

18. What is the force applied when a man uses 50.0 N of effective force at a 45° angle when pulling a recycling bin?

$\cos 45 = \frac{50.0}{x} =$ 71 N

19. How much work was done when a boy pulled a sled for 60.0 m with a force of 10.0 N at a 10.0° angle?

$W = Fd \quad \left(\cos 10 = \frac{x}{10}\right) \times 60.0 =$ 591 J

20. A rock weighs 15 kg and has a potential energy of 200.0 J. What height is it found at?

$h = \frac{P}{mg} \quad \frac{200.0}{15 \times 9.8} =$ 1.4 m

21. A truck weighing 12 000 kg has 85 000 J of kinetic energy. What is the speed it is travelling at?

$v^2 = \frac{K}{.5m} \quad \frac{85000}{.5 \times 12000} = \sqrt{14.166...} =$ 3.8 m/s

22. Explain if each person will be able to lift their luggage weighing 20.0 kg off the floor if they both are lifting the luggage at a 25°, but person 1 is using 305 N of force and person 2 is using 505 N of force.

$\sin 25 = \frac{x}{305} =$ 130 N

NO

$\sin 25 = \frac{x}{505} =$ 210 N

YES

$20.0 \times 9.8 =$ 196 N

23. A person is pulling a box along the floor with a force of 60.0 N at an angle of 60.0° to the horizontal. What is the effective force?

$\cos 60.0 = \frac{x}{60.0} =$ 30.0 N

24. What is the magnitude of the effective force of a box weighing 50.0 kg sliding down an inclined plane at a 40.0° angle?

$50.0 \times 9.8 = 490\,N$ $\quad \sin 40.0 = \frac{x}{490} = 762\,N$

25. A person is pulling a bag along the floor with a force of 55 N at an angle of 43° to the horizontal. What is the effective force?

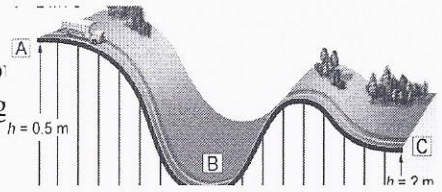
$\cos 43 = \frac{x}{55} = 40\,N$

b- If the bag weighs 15 kg, can he pick it up?

$15 \times 9.8 = 150\,N$

$\sin 43 = \frac{x}{55} = 38\,N$ No too weak.

26. 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 energ



a- What is the potential energy of point A?

$P = mgh \quad .5 \times 9.8 \times 1.5 = 2\,J$

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

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

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

When at rest PE is the same as KE at full speed. Full PE = 0 KE = Full ME Full KE = 0 PE = Full ME

27. 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 7 120 J of energy to the water.

What was the final temperature of the water?

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

$\Delta T = \frac{Q}{mc} = \frac{7120}{125 \times 4.19} = 13.6\,^\circ C$

$FT = IT + \Delta T$

$22.0 + 13.6$

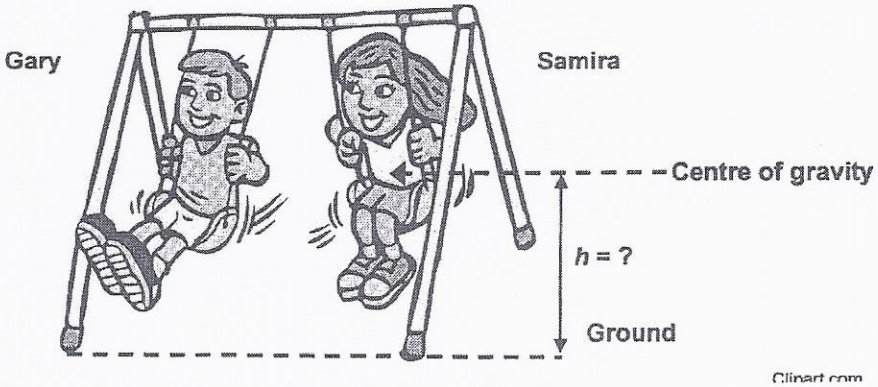
$= 35.6\,^\circ C$

28. 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)

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

29. 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, Gary's kinetic energy is 126 J while Samira's gravitational potential energy is 180 J.

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) $V^2 = \frac{K}{.5m}$ $\frac{126}{.5 \times 28} = \sqrt{9} =$ 3m/s

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

30. 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 87 kg and exerts a force equal to his weight and pulls his daughter for 1.0 km. How much work is done by brad?

$87 \times 9.8 = 850N$ $W = Fd$

$\left(\cos 47 = \frac{x}{850}\right) \times 1000$

580 000 J

5.8×10^5 J