The Work Energy Theorem FEAT Impulse and Momentum:

1. A 4.0kg mass is sliding to the right at 2.0m/s on a level, frictionless surface. A 12N force acts to the right for 5.0m. What is the object’s speed after those 5.0m?

2. A 4.0kg mass is sliding to the right at 2.0m/s on a level, frictionless surface. A 3.0N force acts to the left for 2.0m. What is the object’s speed after those 2.0m?

3. A 4.0kg mass is sliding to the right at 2.0m/s on a level, frictionless surface. A 12N force acts at an angle of 32o above +x for 5.0m. What is the object’s speed after those 5.0m?

4.

30.0N

6.0m

2.0m

The object shown above has a mass of 6.0kg and is initially at rest at the bottom of an incline. A 30.0N force pushes the object, parallel to the surface, for a distance of 6.0m. Assuming negligible friction, find the final speed of the mass.

5.

2.0m

6.0m

40.0N

The object shown above has a mass of 6.0kg and is initially at rest at the bottom of an incline. A 40.0N force pushes the object, parallel to the surface, for a distance of 6.0m. Assuming a 15N frictional force exists between the mass and the surface, find the final speed of the mass.

6. A 250kg roller coaster cart crests a 12.0m high hill at 3.00m/s. As the cart rolls down and then back up to the top of the next 8.00m tall hill, 2.00x103J of energy is ***lost*** as heat. What is the speed of the cart at the top of the 8.00m hill.

7. A massive object has 880J of kinetic energy and 450J of potential energy. Then some stuff happens. After the stuff happens the object has 220J of kinetic energy and 640J of potential energy.

A. What is the net work (ΣW) performed on the object?

B. What is the total work performed by non-conservative forces?

C. What is the work performed by conservative forces?

D. What is the change in the objects total mechanical energy?

E. Where did the energy go?

8. A 620g mass slides down a ramp as shown below:

12.0m

6.0m/s

θ

The mass is initially at rest and friction does -7.00J of work as the block slides.

A. Draw the FBD for this block. B. What forces do work to the block?

C. What is the net work done to the block? D. What is the work done by friction?

E. What is the work done by gravity? F. What is the change in the objects potential energy?

G. What is the change in the objects height? H. What is θ?

9. A 620g mass slides down a ramp as shown below:

12.0m

6.0m/s

θ

The mass is initially at rest and 7.00J of heat is produced as the block slides down.

A. Draw the FBD for this block.

B. What forces do work to the block?

C. What is the net work done to the block?

D. What is the work done by friction?

E. What is the work done by gravity?

F. What is the change in the objects potential energy?

G. What is the change in the objects height?

H. What is θ?

10. Find the work done by gravity on a 120kg mass that free-falls, from rest, for 2.00s.

11. A. Find the work that friction does in bringing a 1500kg car to rest from 72.0km/h on level ground.

B. If the car stops over 35.0m, determine the minimum coefficient of static friction.

12.

d

43o

A. In order to use the formula Wg= Fgdcosθ to find the work done by gravity as the block slides down the ramp, what is the appropriate value for θ?

B. In order to use the formula Wf= Ffdcosθ to find the work done by friction as the block slides down the ramp, what is the appropriate value for θ?

C. In order to use the formula WN= FNdcosθ to find the work done by the normal force as the block slides down the ramp, what is the appropriate value for θ?

13. A 290g cart and a 620g cart are moving together to the left at 2.00m/s. They have a compressed spring between them, and a string tying them together. The string breaks. The 620g cart is propelled leftward at 2.75m/s. How much energy was stored in the spring?

14. A satellite is 1250km above a planet. The potential energy of the system is -5.0x1011J. What is the kinetic energy of the satellite, assuming a stable circular orbit?

15. A 12300kg meteor falls toward Earth! The meteor has a speed of 2.85km/s at a height of 1234km above the surface of the Earth. As it falls 1.60x1010J of heat are lost in the Earth’s atmosphere. What is the impact velocity of the meteor? Assume mass is constant. ME=5.98x1024kg rE=6.38x106m

16. An object which looks, feels, smells and tastes exactly like a piece of double cream brie cheese, but is in fact not a piece of double cream brie, but rather a small, sentient being from an alien planet, sent to Earth on a noble, but misguided mission to liberate all of Earth’s double cream brie cheeses from the evil human overlords who keep eating them, has 6.4J of K, 1.9J of Ug and 3.3J of Us. Then some things happen. After the things happen, the small, sentient being has 7.7J of K, 0.11J of Ug and 2.0J of Us.

Find the net work.

Find the work done by gravity.

Find the work done by the spring.

Find the work done by non-conservative forces.

17. Find the work done by the force shown over the following intervals. (Assume 3 sig figs for 17 and 18)

120N

100N

80N

60N

40N

20N

0N

2m 4m 6m 8m 10m 12m 14m 16m

a. 0m to 4m

b. 2m to 6m

c. 8m to 16m

d. 0m to 16m

18.

30N

25N

20N

15N

10N

5N

0N

2m 4m 6m 8m 10m 12m 14m 16m

The force shown acts on a 4.0kg object initially at rest.

a. IF there is no friction present find the final velocity of the object, assuming level ground.

b. IF there is no friction present find the final velocity of the object, assuming the ground is angled at 120 above horizontal.

c. IF there is no friction present find the final velocity of the object, assuming the ground is angled at 320 below horizontal.

19. How much work does must you do to push a 25.0kg cart, at constant speed, a distance of 14.0m (in a straight line) up a ramp inclined at 11.0o, assuming negligible friction?

20. How much work does must you do to push a 25.0kg cart, at constant speed, a distance of 14.0m (in a straight line) up a ramp inclined at 11.0o, assuming a constant frictional force of 35.0N?

21. How much work does must you do to accelerate a 25.0kg cart, from rest to 3.00m/s, over a distance of 14.0m (in a straight line) up a ramp inclined at 11.0o, assuming negligible friction?

22. How much work does must you do to accelerate a 25.0kg cart, from rest to 3.00m/s, over a distance of 14.0m (in a straight line) up a ramp inclined at 11.0o, if μ between the cart and the ramp is 0.400?

23. A 5.00kg mass is being pushed up an inclined plane. The plane is inclined at 21.0o. The coefficient of friction between the cart and the ramp is 0.225687. The speed of the mass increases from 1.255m/s to 2.36m/s as the mass is pushed 4.25889m up the ramp. Find the net work performed on the mass.

24. A 4.0kg mass has some stuff done to it. Some of the stuff is quite nasty. But no matter, the result is that: ΔK=-220J, ΔUg=-445J and ΔUs=332J. What is the net work done to the object? How much energy has been liberated to the surroundings as heat and sound?

25. The potential energy of a system of two masses is -880J when their centres are separated by D. What is the potential energy of the same two masses when separated by ½D?

26. What is the total mechanical energy of a planet (r=7.10x106m, M=2.29x1025kg) and a satellite (m=9999kg) which is in stable circular orbit with a period of 62.0h. Assume the planet is stationary.

27. A 28.0kg frictionless cart, initially at rest, rolls down the hill shown below. The cart then collides, perfectly inelastically, with a stationary 12.0kg cart. Find the speed after the collision (v).

4.00m

*v*

28. A 28.0kg frictionless cart, initially at rest, rolls down the hill shown below. The cart then collides, perfectly inelastically, with a stationary 12.0kg box. The coefficient of friction between the box and the ground is 0.6500. How far (d) from the point of impact will the two slide before coming to rest?

4.00m

d

29. The two carts below are each released from rest such that they strike the spring (fixed in place) simultaneously. Assuming negligible friction,

a. What is the compression of the spring if both carts come to rest at the same time?

b. What is the speed of the 25.0kg cart if the 14.0kg cart comes to rest when the spring is compressed by 20.0cm?

25.0kg

14.0kg

90.0cm

k=6500N/m 70.0cm

30. An object has 220J of K, 380J of Ug and 40J of Us. Then some stuff happens. After the stuff happens the object has 180J of K, 620J of Ug and 440J of Us.

A. What is the net work done?

B. What is the work done by non-conservative forces?

C. What is the work done by the spring force?

D. What is the work done by gravity?

31. 30. An object has 520J of K, 180J of U. Then some stuff happens. The stuff results in 180J of net work, and -260 of Wnc.

A. What is the final K of the object?

B. What is the final U of the object?

C. How much work was done by conservative forces?

32. Two carts are at rest on a surface with negligible friction. The carts have a compressed spring between them, but are also tied together with a string. The spring has a k-value of 999N/m and a rest length of 24.0cm.

11cm

2

1

The string is cart and the spring unfurls! The carts travel off in opposite directions. Cart 1 travels left at 0.88m/s, cart 2 travels right at 3.52m/s.

Find the mass of each cart.

33. A 25kg mass has an initial momentum of 216kgm/s east. A net impulse acts on the object resulting in a final momentum of 826kgm/s north. Which best shows the direction of the impulse?