AP Physics - Unit 4 - Energy - KEY

Tipper #1 - Unit 4

#1 · A) iii - greater than zero

The force by the hand component is in the same direction
∴ positive work done

· B) i - zero

F_W is ⊥ to displacement, so product of force & the component of the displacement parrallel to the force is Ø

C) ii, less than zero

f_f is opposite the positive direction of work ∴ $-f_f$
or The angle Btwn f_f & displacement is 180°, so the product of the magnitude of the f_f & the component of displacement parallel to the f_f is negative

D) ii, less than zero

The angle Btwn F_W & the displacement is greater than 90°
so the product of the magnitude of F_W & the component parallel to the F_W is Negative

E) i, zero

The Block is moving at a constant speed ∴ No change in KE
From the work-Kinetic energy theorem, the Net work done equals the Δ in KE

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2. (A) $W = 50 \cdot F$ (B) $W = 100 \cdot F$ (C) $W = 50 \cdot F \cos 45$ (.70)

(D) $W = 10d(0)$ ⊥F (E) $W = 50(-F)$ (F) $W = 50(0)$ ⊥F

B > A > C > D = F > E

3. F > A = C > E > B > D

$PE_i + \cancel{KE_i}^{0} = \cancel{PE_f}^{0} + KE_f$

$mgh = KE_f$

(A) mgh 10g (B) 2g (C) 10g (D) .5g

(E) 2.5g (F) = (0.75)(15)g = 11.25g

Since the blocks all start from rest so they have zero initial kinetic energy, and they are sliding down frictionless surfaces, the initial gravitational potential energy, which depends on the height of the incline, is converted to the final kinetic energy. The initial gravitational potential energy is proportional to the product of the mass and the height above the horizontal surface, length of the incline is irrelevant.

4.

Answer: The student's answer is correct.
The initial kinetic energy of the object was 9 Joules, and the final kinetic energy was 49 Joules. The change in kinetic energy was 40 Joules. Since the change in kinetic energy is equal to the net work done on the object, the net work must also be 40 Joules.

$m = 2kg$ $3 m/s \rightarrow$ $\frac{1}{2}mv^2$

$= \frac{1}{2}(2kg)(3mk)^2$

$= 9J$

$+$ →

$\leftarrow 7mk$ 0

$= -\frac{1}{2}(2kg)(7m/s^2)$

$= -49J$

$49 + 9 = -40J$

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#5 *Answer: B > A = D > C.*

In this situation the work done on the box will change its kinetic energy, so to find how much work was done we need to subtract the initial kinetic energy from the final value for each 5 second interval. The external agent will do positive work in interval B, no work in intervals A and D since the kinetic energy doesn't change in those intervals, and negative work in interval C, i.e., the box is doing work on the external agent in C rather than the agent doing work on the box.

$W = \Delta KE$

$= \frac{1}{2}m(v_f^2 - v_i^2)$

(A) $W = \frac{1}{2}m(2^2 - 2^2)$

$= 0$

(B) $W = \frac{1}{2}(6^2 - 2^2)m$

$= 16m$

(C) $W = \frac{1}{2}m(0^2 - 6^2)$

$W = -18m$

(D) $W = \frac{1}{2}m(0-0)$

$W = 0$

$B > A = D > C$

#6

A) *Answer-(iii) Same for both. Both skateboarders lose the same amount of height as they travel down the hill, and their change in potential energy (strictly speaking, the change in potential energy of the skateboarder-earth system) is equal to their gains in kinetic energy. Both kinetic and potential energy terms are proportional to the mass, so it doesn't matter that the skateboarders have different masses.*

B)

Answer-(ii) Greater for Britney. Both start from rest, and Angel, who will have the greater acceleration, also has a shorter path.

C)

Answer-(i) Greater for Angel. If the two skateboarders had the same mass, then the work done by the gravitational force would be the same for both. (Work depends only on displacement in direction of force, and the vertical displacement is the same for the two skateboarders). But since the gravitational force is proportional to the mass, this force is greater on Angel, and more work will be done on her by the gravitational force.

D)

Answer-(iii) Same for both. The displacement for each skateboarder at all points on the hill is parallel to the surface of the hill, and the normal force at all points is perpendicular to the hill, so the angle between the normal force and the displacement is 90°. Since work depends on the dot product of the force and displacement vectors, the work done by the normal force is zero for both skater

e)

Answer: (i) Greater for Angel. They have the same speed, but Angel has a larger mass.

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#7

A) *Answr: (iii) equal*
The kinetic energy of the block is the same at A and B since the speed is constant.

B)

Answer: (i) greater
Using the work-kinetic energy theorem, since the change in kinetic energy of the block is zero, from point A to point B, the net work done on the block must be zero.

$W_{net} = \Delta KE = \frac{1}{2}m(v_f^2 - v_i^2)$ $\quad v_f = v_i$

$W_{net} = 0$

C)

Answer: (iii) less than
The work done on the block by the hand is less than the product of the magnitude of this force and the magnitude of the displacement (one meter) because the force and the displacement are not parallel to one another, and the work done is therefore equal to the magnitude of the force times the magnitude of the