Introductory Physics

Test 2

Total 100

13 MC Questions	***5x13/65***
Problem #14	***/20***
Problem #15	***/15***

Answers without supporting /reasoning derivations will receive no full credit.

Useful Information:

Drag force $F_d = 1/2(C\rho A\upsilon^2)$

C is the drag coefficient; A is the area of the object moving in the fluid; ρ is the density of the fluid.

Work Done by a Constant Force

If the force is at an angle to the displacement:

$$\boldsymbol{W=(F\ cos\theta)\,d=F\ d\ cos\theta}$$

Kinetic energy: $\boldsymbol{K=\ 1/2\ m\ v^2}$

Work-Energy Theorem: The total work done on an object is equal to its change in kinetic energy.

$$\boldsymbol{W_{total} = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2}$$

$$\text{Power: } P = W/t = (\vec{F} \cdot \vec{d})/t = \Delta E/t$$

Gravitational Potential Energy PEg:

W = F d = mgh

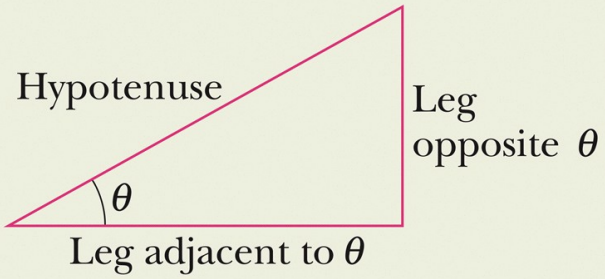
Vectors & Their Components

Know the three basic trigonometric functions

$$\sin\theta = \frac{\text{leg opposite } \theta}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{leg adjacent to } \theta}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{leg opposite } \theta}{\text{leg adjacent to } \theta}$$



Question #1

Which statement is not correct: (explain)

Drag Force F_D

a) Is acting on an moving object in a fluid (a gas or a liquid);

b) Like the friction force never opposes the motion of an object;

c) Is depending on the size and shape of the moving object;

d) Like the friction force depends on the speed of the moving object;

e) Can be written in a generalized form:
$F_D = \beta\upsilon^2$ where $b = 0.5\ C\rho A$

f) For the large objects, which are moving fast, is proportional to the square of the speed of the object υ^2

Question # 2

Which of the following statements are not correct:

In uniform Circular motion

a) The centripetal acceleration is directed toward the center of the circle;

b) The magnitude of the centripetal acceleration is given: $\alpha_{c\,p} = v^2 / r$

c) The centripetal acceleration is always parallel to the velocity;

d) The centripetal force $F_{c\,p}$ is directed toward the center of the circle;

e) The magnitude of the centripetal force is given: $F_{cp} = m\,\alpha_{cp}$

Question # 3

Which statement is correct: (explain)

a) The sign of the work depends on the direction of the force relative to the displacement;

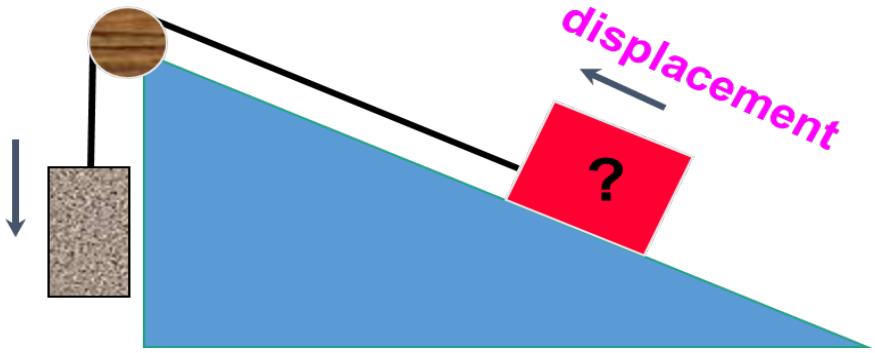
b) Work is negative when the force is in the same direction as the displacement;

c) Work is positive when the force is in the opposite direction of the displacement;

d) A box is being pulled across a rough floor at constant speed. The work done by friction is positive.

Question #4

A box is being pulled up a rough incline by a rope connected to a pulley. How many forces are doing work on the red box? (explain)



a) one force

b) two forces

c) three forces

d) four forces

Question # 5

The work done $W=\vec{F}\cdot\vec{d}=F\ d\cos\theta$ may be positive, zero, or negative, depending on the angle between the force & the displacement.

Which statement is not correct : (explain)

a) If $\theta = 90^0 \Rightarrow W = F\ d$
b) If $\theta > 90^0 \Rightarrow W < 0$
c) If $\theta < 90^0 \Rightarrow W > 0$
d) If $\theta = 0^0 \Rightarrow W = -F\ d$
e) If $\theta = 180^0 \Rightarrow W = 0$

Question # 6

Which of the following statements are correct:

1) Kinetic energy is a scalar quantity;

2) Kinetic energy depends on the direction of motion;

3) Kinetic energy increases linearly with the speed of the object ;

4) Kinetic energy increases with the square of the mass of the object;

5) Kinetic energy is always negative.

Question #7

A child does 320 J of work while pulling a box from the ground up to his tree house at a steady speed with a light rope. The tree house is 3.5m above the ground. The mass of the box is: (Show the calculations)

a) 7.2 kg

b) 7.8 kg

c) 8.3 kg

d) 9.3 kg

Question #8

Which statement is correct:

a) A conservative force is a force with the property that the total work done in moving a particle between two points is dependent of the taken path;

b) An example of a conservative force is gravity;

c) Work done by gravity on a closed path is zero;

d) An example of a conservative force is Friction;

e) A non conservative force is a force with the property that the total work done in moving a particle between two points is independent of the taken path;

f) Work done by friction on a closed path is zero;

g) Work done by conservative force can be stored in the form of energy that can be released at a later time.

Question # 9

Jack performed 8 J of work in 14 sec. David performed 10 J of work in 12 sec. and Michael did 7 J work in 10 sec. Who produced the greater power? (show the calculations).

A) Lack
B) David
C) Michael
D) They all produced the same amount of power

Question # 10

Two paths lead to the top of a big hill. One is steep & direct, while the other is twice as long but less steep. How much more potential energy would you gain if you take the longer path? (explain).

a) the same
b) two times as much
c) four times as much
d) half as much

Question # 11

You see a leaf falling to the ground with *constant speed*. When you first notice it, the leaf has initial total energy PEi + KEi. You watch the leaf until just before it hits the ground, at which point it has final total energy $PE_f + KE_f$. How do these total energies compare**?** (explain).

a) $PE_i + KE_i < PE_f + KE_f$

b) $PE_i + KE_i = PE_f + KE_f$

c) $PE_i + KE_i > PE_f + KE_f$

Question # 12

Which statement is not correct:

a) Work-Energy Theorem: the total work done on object is

equal to its change in kinetic energy;

b) Energy is the capacity of a physical system to perform work. Energy cannot be created nor destroyed;

c) Work done by non conservative force can be stored in the form of energy;

d) Potential Energy is defined as stored energy due to position, shape, or state;

e) Mecanical Energy $E=U+1/2\ mv^2=U+K$

f) For the non conservative forces mechanical Energy is conserved;

g) In the presence of conservative forces, the total mechanical energy is not conserved .

Question # 13

The maximum height a typical human can jump from a crouched start is about 60.0 cm≈2ft. By how much does the gravitational potential energy increase for a 75.0 kg person in such a jump, by: (show calculations)

a) 345 J

b) 441 J

c) 421 J

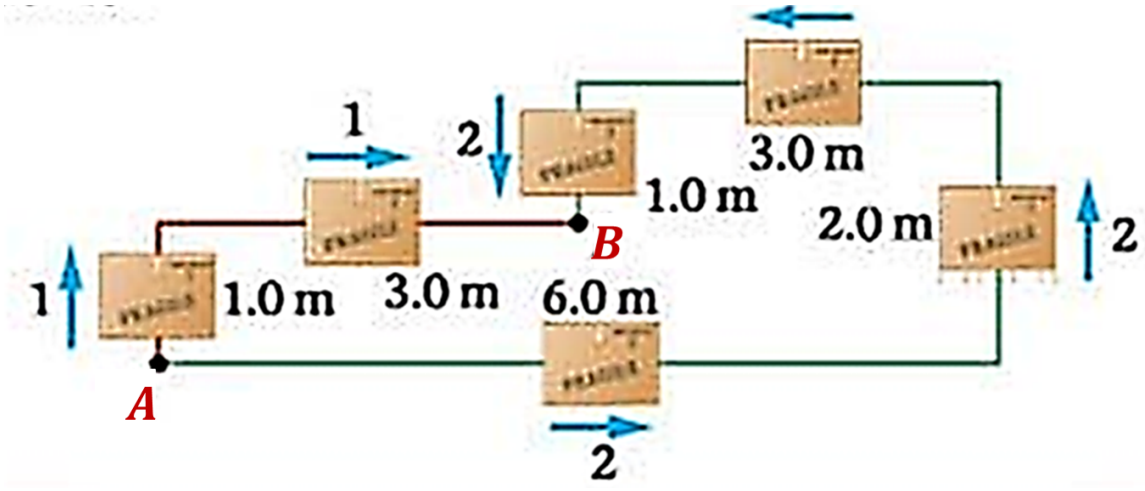
d) 237 J

Question # 14

A 5.72 kg box is moved with constant speed from A to B along two paths of sketch. Calculate the work done by

a) gravity on each of these paths

b) friction on each of there paths. Kinetic friction is $\mu_k = 0.63$



c) Based on your answers, explain which one is conservative and non conservative forces.

Show all calculations.

Question # 15

An 79.0 kg mountain climber is in the final stage to climb 4300 m high Peak. What is the change in gravitational potential energy as the climber gains the last 120.0 m of altitude? Let U=0 be (a) at sea level or (b) at the top of the peak. Show all calculations.