FIRST-YEAR PHYSICS EXAM

JANUARY, 2001

DIRECTIONS: For each statement or question fill in the appropriate space on the answer sheet. Use the letter preceding the word, phrase, or quantity which best completes or answers the question. Each of the 25 questions is worth 4 points.

CONSTANTS: ***g (Earth)*** = ***10*** m/s^2

1) A vacationing bather is floating lazily in a pure water mountain lake with only 10% of his body's volume above the water level. His body's density in ***g/cm^3*** is most nearly
   a) 0.1 b) 0.9 c) 1.0 d) 10

2) Which of the following is NOT a vector quantity?
   a) position b) displacement c) velocity d) acceleration

Use the following information for Questions #3 & 4.
A scout on a weekend camping maneuver leaves base camp and hikes ***3 km North in 1 hour*** then ***4 km East in another hour*** to pick up supplies at the nearest town.

3) What is the Scout's displacement?
   a) 7 km NE b) 5 km NE c) 7 km 53° East of North d) 5 km 53° East of North

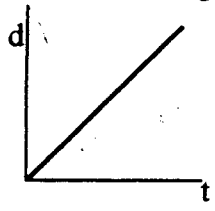
4) If the scout returns to camp by following the straight-line path from town to camp in another hour, what is his average velocity for the entire trip in $^{km}/_{hr}$? (Ignore any possible stops and rests.)
   a) $^{5}/_{3}$ b) $^{7}/_{3}$ c) 4 d) zero

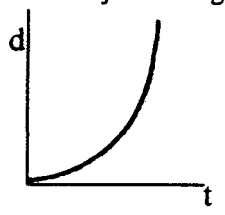
5) A motorist travels for ***3 hours*** at an average speed of ***60 km/hr*** and another ***2 hours*** at an average speed of ***100 km/hr***. What is her average speed for the entire trip?
   a) 70 km/hr b) 76 km/hr c) 80 km/hr d) 85 km/hr

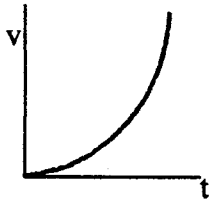
6) When is the average velocity of an object equal to the instantaneous velocity?
   a) This is always true
   b) This is never true
   c) This is true only when the velocity is constant
   d) This is true only when the velocity is increasing at a constant rate.

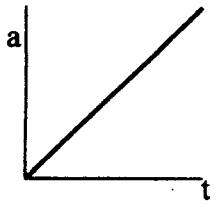
7) A ***20 kg*** object is dropped from rest on a mysterious planet and found to fall ***10 meters*** in one second. The acceleration due to gravity on this mysterious planet is most nearly
   a) 5 m/s^2 b) 10 m/s^2 c) 15 m/s^2 d) 20 m/s^2

8) Which of the following displacement-time graphs would represent an object undergoing uniform acceleration?

a)


b)


c)


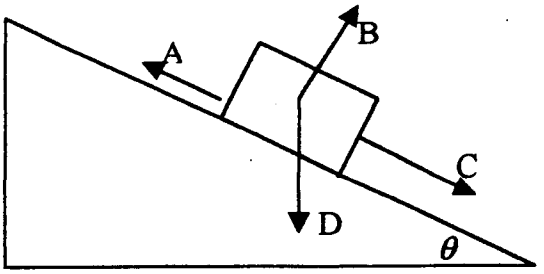
d)


NJSL Phy 1

9) A projectile is launched from the ground with an initial velocity, v, and angle, θ, such that the maximum height reached is equal to the total range of the projectile. The tangent of the launch angle, θ, is equal to.... (Assume no air resistance, level ground, and $g = 10\ m/s^2$)
   a) 1 b) 2 c) 4
   d) this cannot be solved without knowing the mass of the projectile.

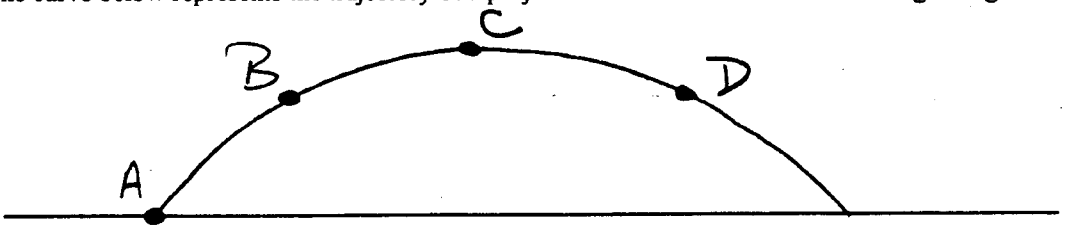
Use the following information for Questions #10 and 11.
In the accompanying diagram, a block of mass ***m*** is sliding down a rough inclined plane.
10) Which labeled force represents the Normal Force?

   a) A
   b) B
   c) C
   d) D



11) Given the following information, what is the coefficient of kinetic friction between the block and the surface ; m = 25 kg, θ = 10°, acceleration a of block down ramp = $0.8\ m/s^2$.
   a) 0.1 b) 0.2 c) 0.3 d) 0.4

Use the following diagram and information for Questions #12 – 14
The curve below represents the trajectory of a projectile near the surface of the earth ignoring air resistance.

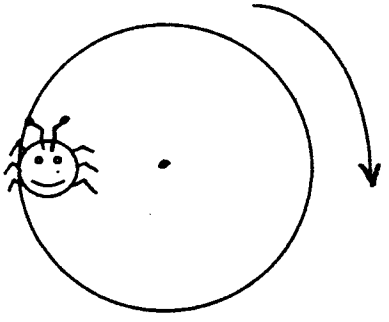


12) At which labeled point is the speed the smallest?
   a) A b) B c) C d) D

13) Which pair of labeled points represents equal kinetic energies?
   a) A & B b) B & C c) A & C d) B & D

14) In what direction is the acceleration of the projectile when at Point C?
   a) ↑ b) → c) ↓ d) No acceleration at Point C.

15) A bug is sitting firmly on to the top surface of a horizontally rotating CD, which is traveling at a constant speed. Relative to looking downward, in what direction is the frictional force acting on the bug?
   a) ↑ b) → c) ↓ d) ←



16) A car traveling ***20 m/s*** rounds a curve with radius of ***80 m*** with the tires just on the verge of slipping. What is the maximum speed at which this car, under identical conditions, could negotiate a curve of radius ***320 m***?
a) 30 m/s b) 40 m/s c) 80 m/s d) 100 m/s

17) A spherically symmetrical planet has twice the earth's mass and twice the earth's radius. An object that weighs 12 N on the surface of the earth would weigh how much on the surface of this planet?
a) 6 N b) 12 N c) 24 N d) 48 N

18) On a graph of Force, ***F***, vs Position, ***x***, what represents the work done by the force?
a) The slope of the curve.
b) The length of the curve.
c) The area under the curve.
d) The product of the average value of F and the average value of x

19) A truck has twice the mass and half the speed of a car. Which statement is true about the truck's kinetic energy, ***KE***, compared to that of the car?
a) It's the same.
b) The truck has half the KE.
c) The truck has 2 times the KE.
d) The truck has 4 times the KE.

20) Compared to your Lab partner, you did 3 times the work in 1/3 the time. To do so, your power output had to be
a) The same as your partner's power output.
b) 1/3 as much as your partner's power output.
c) 3 times your partner's power output.
d) 9 times your partner's power output.

21) A 30-N stone is dropped from a height of ten meters and strikes the ground with a speed of 7 m/s. What force of air resistance acted on the object as it fell?
a) 23 N b) 30 N c) 226 N d) 300 N

22) A spring-driven dart gun propels a 10-gram dart. It was cocked by exerting a force of 20 N over a distance of 5 cm. With what speed will the dart leave the gun, assuming the spring has negligible mass?
a) 4 m/s b) 10 m/s c) 14 m/s d) 50 m/s

Use the following information to answer Questions #23 – 25.
A 12 kg object is moving on a rough horizontal surface. At t=0, it has 24 Joules of kinetic energy. The frictional force is a constant 0.5 N.

23) How far will it slide before coming to rest?
a) 2 m b) 12 m c) 24 m d) 48 m

24) If it takes the object ten seconds to come to rest, with what rate was the frictional force dissipating energy?
a) 1.2 W b) 2.4 W c) 3.6 W d) 4.8 W

25) What is the coefficient of friction between the object and the surface?
a) 4×10^{-3} b) 0.5 c) 120 d) 240

NEW JERSEY SCIENCE LEAGUE
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1. B	14 C
2 A	15 B
3 D	16 B
4 D	17 A
5 B	18 C
6 C	19 B
7 D	20 D
8 B	21 A
9 C	22 C
10 B	23 D
11 A	24 B
12 C	25 A
13 D	

PHYSICS 1

JANUARY: scalars, vectors, kinematics, projectiles, mass, density, Newton's laws, forces(mechanical, gravitational, frictional, centripetal), work,
energy(potential, kinetic), and its conservation, power.

FEBRUARY: impulse, linear momentum and its conservation, elastic and inelastic collisions, angular measure and motion, the concept of
angular momentum and its conservation, equilibrium of forces and torques, simple machines, plus previous topics

MARCH: temperature, thermal equilibrium, linear expansion and contraction, specific heat, calorimetry, modes of energy transfer,
thermodynamic laws, simple harmonic motion, wave propagation, standing waves, sound, plus previous topics

APRIL: electrical charges and force, coulombs law, voltage sources and resistances, series/parallel networks, electricity and magnetism, light,
index of refraction, color, optics, lenses, mirrors, interference phenomena, plus previous topics.