FIRST-YEAR PHYSICS EXAM

JANUARY, 1996

DIRECTIONS: Each question is worth 4 points for a total of 100 points. For each statement or question choose the answer which best completes the statement or answers the question and fill in the appropriate blank on the answer form. Make sure you fill the space completely.

CONSTANTS: g (earth) = 10 m/s^2 | sin 30° = 0.50 | cos 30° = 0.87 | tan 30° = 0.58
sin 37° = 0.60 | cos 37° = 0.80 | tan 37° = 0.75
tan 5.7° = 0.1 | cot 5.7° = 10

1. Which of the following is an example of a scalar quantity?

   1) position 2) acceleration 3) mass 4) weight

   A) both 2 and 4 B) 2 only C) 3 only D) both 1 and 2

2. Mass is a measure of:

   A) weight B) force C) inertia D) gravity

3. Block A has twice the weight and twice the volume of Block B. Block B has one-half the weight but double the volume of Block C. Which block has the greatest mass density?

   A) block A only B) block B only C) block C only D) all three blocks have the same density

4. A stone of mass 10^{-2} kg is tossed up from ground level with an initial vertical speed of 30 m/s. Ignoring air friction, how many seconds will it take the stone to reach its maximum height?

   A) 1 sec B) 2 sec C) 3 sec D) 6 sec

5. In the previous problem, (#4) what will be the magnitude of the stone's acceleration (m/sec^2) at its maximum height?

   A) 5 B) 10 C) 15 D) zero

6. Also in #4, what is the maximum height (m)?

   A) 15 B) 20 C) 35 D) 45

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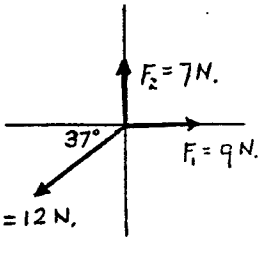
7. A 1 kg block of wood slides at constant velocity down a plane inclined at an angle of 30° to the horizontal. What must be the coefficient of kinetic friction between the block and the plane?

   A) 0.87 B) 0.67 C) 0.58 D) 0.50

8. If the block in the preceding problem (#7) drops 1 m in vertical height in sliding down the plane, how many joules of energy are dissipated by the frictional force?

   A) 5 B) 10 C) 15 D) 20

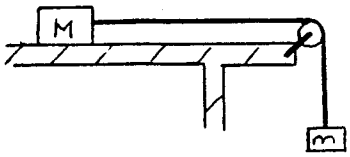


9. Given the X-Y diagram to the left with 3 forces acting as shown. In which quadrant will the resultant force vector be found?

   A) first B) second C) third D) fourth

10. Referring to the preceding problem #9, what will be the magnitude of the resultant force?

    A) 0.63 N B) 0.22 N C) 0.58 N D) 0.60 N



11. A firmly held block of mass M = 0.15 kg is attached to a suspended mass m = 0.05 kg by a weightless cord. The system is frictionless. When M is released, the acceleration of mass M will be, in magnitude:

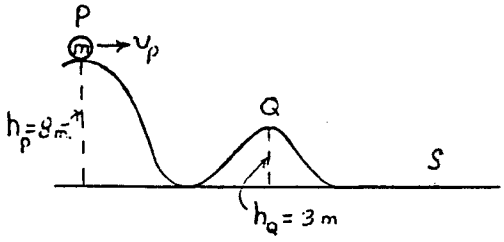
A) greater than the acceleration of mass m

B) the same as the acceleration of mass m

C) less than the acceleration of mass m D) zero

12. In the preceding problem, #11, the acceleration, in m/sec^2, of mass m is:

A) 1.0 B) 1.5 C) 2.0 D) 2.5



13. A small ball (m = 1 kg) at height hp = 8 m at point P, is given an initial horizontal speed U_p = 10 m/s. It slides over an uneven frictionless surface. What is speed V_Q (m/s) of the ball at height h_Q = 3 m at point Q?

A) 14 B) zero C) 10 D) 12

14. In the preceding problem, #13, what is the total energy, in joules, of the block at the point S?

A) zero B) 100 C) 130 D) 60

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15. A car (M = 3000 kg) traveling at a speed of 18 km/hr (5 m/s) on a straight road, enters a curve at a radius 25 m. The curve is icy (frictionless). At what angle must the road be banked so that the car can negotiate the curve safely (without sliding)?

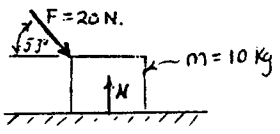
A) 2.9° B) 5.7° C) 8.5° D) 11°

16. Approximately how far can a soccer ball (m = 0.2 kg) be kicked if it is kicked with an initial speed of 20 m/s at an angle of 45° to the horizontal? Ignore air friction.

A) 40 m B) 60 m C) 20 m D) 50 m

17. In the preceding problem, #16, how long will the soccer ball be in the air?

A) 1.4 sec B) 2.8 sec C) 4.2 sec D) 5.6 sec



18. A force F = 20 N, acts at an angle of 53° to the horizontal, as shown, on a 10 kg block at rest. What is the magnitude of the normal force N, exerted by the table top on the block?

A) 120 N B) 30 N C) 38 N D) 116 N

19. In the preceding problem, #18, what is the horizontal acceleration of the block, in m/sec ^{2}, if frictional forces are absent?

A) 1.2 B) 0.8 C) 0.6 D) 0.4

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20. A 1 kg block is held off the edge of a high cliff (100 m), and then released. Ignoring frictional forces, what is the power, in watts, of the earth's gravitational force acting on the block over the first second of freefall?

A) 100 B) 75 C) 50 D) 25

21. What must be the acceleration of a car if the car uniformly accelerates from rest to a speed of 30 m/s in a distance of 100 m?

A) 1.5 m/s^2 B) 3.0 m/s^2 C) 4.5 $m/^2$ D) 6.0 m/s^2

22. A 10 kg mass is transported to a planet X, whose size (radius) is twice that of earth's, but has the same mass as earth. The weight of the 10 kg mass, on planet X, is:

A) 15 N B) 10 N C) 25 N D) 10 kg

23. How much work is required to push a 100 N boulder 100 m up a smooth hill inclined at 30° to the horizontal?

A) 2500 J B) 3500 J C) 4000 J D) 5000 J

24. A 2 kg ball, at the end of a 1 m cord is whirled in empty space in a perfect circle with a speed of 10 m/s. (No gravity or friction is present.) What must be the tension in the cord?

A) 200 N B) 400 N C) 100 N D) 300 N

25. If you exert a force F on an object, the force which the object exerts on you will:

A) depend on whether or not the object is moving

B) depend on whether or not you are moving

C) depend on the relative masses of you and the object

D) be F in all cases

SCIENCE LEAGUE

PHYSICS I

ANSWER KEY

MONTH OF JANUARY, 1996

EACH QUESTION IS WORTH 4 POINTS

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