Oct 24, 2019 (7 p.m. – 9 p.m.) MIDTERM EXAMINATION

PAPER A PAGE NO.: Page 1 of 5 plus formulas

COURSE NO.: PHYS 1020 General Physics EXAMINERS: W. Ens, C. O'Dea

All questions are of equal value. No marks are subtracted for wrong answers.

Record all answers on the computer score sheet provided. USE PENCIL ONLY! Black pen will look good but may not be read reliably by the scoring machine. Mark only one answer for each question! Select the answer which is closest to yours.

A formula sheet is provided for your use; you may not use your own formula sheet. Calculators should have limited memory capacity and should not be capable of remote communication. No phones or handheld computers (PDAs) or notes are permitted.

Unless the question specifically asks about significant figures, an answer should NOT be considered to be incorrect if the number of significant figures does not match the significant figures supplied in the question.

Be sure your name and 7-digit student number are printed on the score sheet and your student number is correctly coded in the box at the top right-hand side of the sheet.

This is paper A. Questions are numbered 1 to 20. Mark the correct answers in the first column of the accompanying IBM sheet in pencil. Also write "Paper A" next to your name on the IBM sheet.

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1. The surface of a lake has an area of 15.5 km^2. What is the area of the lake in m^2?

(a) $1.55 \times 10^4\ m^2$ (b) $1.55 \times 10^5\ m^2$ (c) $1.55 \times 10^6\ m^2$
(d) $1.55 \times 10^7\ m^2$ (e) $1.55 \times 10^8\ m^2$

2. A particle travels along a curved path between two points P and Q as shown. The displacement of the particle does *not* depend on

(a) the location of P.
(b) the location of Q.
(c) the distance traveled from P to Q.
(d) the shortest distance between P and Q.
(e) the direction of Q from P.

3. A train with a constant velocity of +28.6 m/s approaches a small town. The operator applies the brake, reducing the train's velocity to +11.4 m/s. If the average acceleration of the train during braking is -1.35 m/s^2, for what elapsed time does the operator apply the brake?

(a) 8.44 s (b) 12.7 s (c) 3.38 s (d) 5.92 s (e) 10.4 s

4. Ball A is dropped from rest from a window. At the same instant, ball B is thrown downward; and ball C is thrown upward from the same window. Which statement concerning the balls after their release is necessarily true if air resistance is neglected?

(a) At some instant after it is thrown, the acceleration of ball C is zero.
(b) All three balls strike the ground at the same time.
(c) All three balls have the same velocity at any instant.
(d) All three balls have the same acceleration at any instant.
(e) All three balls reach the ground with the same velocity

5. Car A accelerates from rest at 2.00 m/s^2 until it reaches a speed of 10.0 m/s, and then continues at constant velocity. Car B starting at the same position and the same time, accelerates at 1.00 m/s^2 until it reaches 12.0 m/s, and then continues at constant velocity, passing car A while at constant velocity. At what time does car B pass car A?

(a) 10.5 s (b) 23.5 s (c) 31.0 s (d) 47.0 s (e) 91.3 s

6. At time t = 0 s, a puck is sliding on a horizontal table with a velocity 3.60 m/s, 35.0º above the +x axis. As the puck slides, a constant acceleration acts on it that has the following components: a_x = -0.360 m/s^2 and a_y = -0.980 m/s^2. What is the velocity of the puck at time t = 1.50 s?

(a) 1.83 m/s, 12.0º above the +x axis
(b) 2.04 m/s, 21.2º above the +x axis
(c) 1.06 m/s, 11.7º above the +x axis
(d) 2.48 m/s, 13.9º above the +x axis
(e) 1.38 m/s, 15.2º above the +x axis

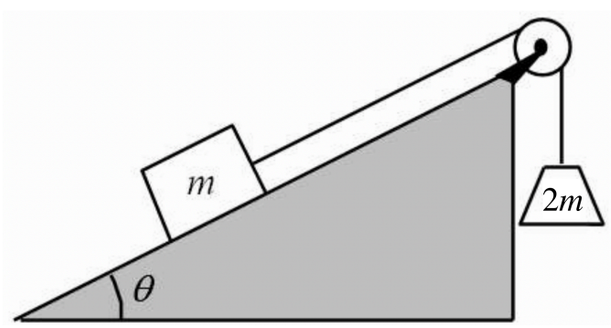
7. A projectile is fired horizontally with an initial speed of 57 m/s. What are the horizontal and vertical components of its displacement 3.0 s after it is fired?

horizontal	*vertical*
(a) 44 m	-29 m
(b) 170 m	zero m
(c) 170 m	-44 m
(d) 210 m	-44 m
(e) 210 m	zero m

8. A tennis ball is thrown vertically up with an initial speed of 20.0 m/s at time t = 0 s. Approximately, what is the *initial* speed of the ball relative to an observer in a car that moves *horizontally* past the launch location with a constant speed of 30 m/s?

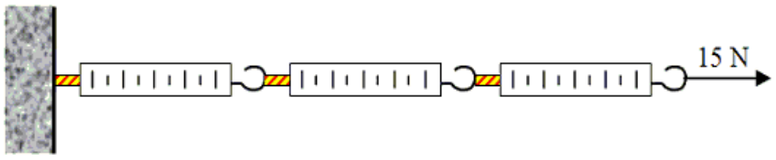
(a) 10 m/s (b) 20 m/s (c) 30 m/s (d) 36 m/s (e) 50 m/s

9. A block on a rough inclined plane is connected to a weight with twice its mass over a pulley as shown. As a result, the block accelerates up the incline. Taking the rope as massless, the pulley as massless and frictionless, and the coefficient of kinetic friction between the block and the incline is μ_k, what is the magnitude of the acceleration?



a) $g(2 - \mu_k \sin\theta)$
b) $\frac{2}{3}g(\mu_k \sin\theta - \cos\theta)$
c) $g(2\tan\theta - \mu_k \sin\theta)$
d) $\frac{1}{3}g(2 - \sin\theta - \mu_k \cos\theta)$
e) $3g(2\cos\theta - \mu_k \sin\theta)$

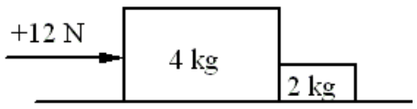
10. Three spring scales are attached along a straight line as shown. The scale on the left is attached to a wall. A force of 15 N is applied to the scale at the right.



What is the reading on the middle scale?

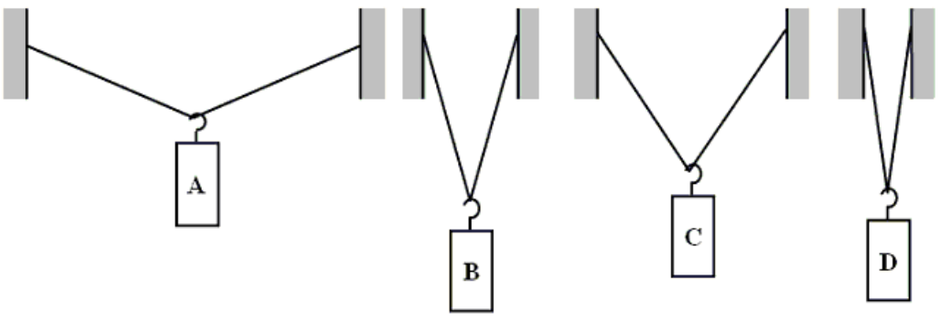
(a) 0 N (b) 45 N (c) 10 N (d) 5 N (e) 15 N

11. A 4-kg block and a 2-kg block can move on the horizontal frictionless surface. The blocks are accelerated by a +12-N force that pushes the larger block against the smaller one. Determine the force that the 2-kg block exerts on the 4-kg block.



(a) -4 N (b) -12 N (c) 0 N (d) +4 N (e) +8 N

12. A block of weight *W* is suspended by a string of fixed length. The ends of the string are held at various positions as shown in the figures below. In which case, if any, is the magnitude of the tension along the string the largest?



(a) case A (b) case B (c) case C (d) case D
(e) The magnitude of the tension will be the same in all four cases, since the string must support the entire weight of the block.

13. What is the magnitude of the gravitational force acting on a 79.5-kg student due to a 58.0-kg student sitting 2.40 m away in the classroom?

(a) 3.14×10^{-9} N (b) 5.34×10^{-8} N (c) 7.91×10^{-10} N
(d) 1.41×10^{-7} N (e) 6.29×10^{-8} N

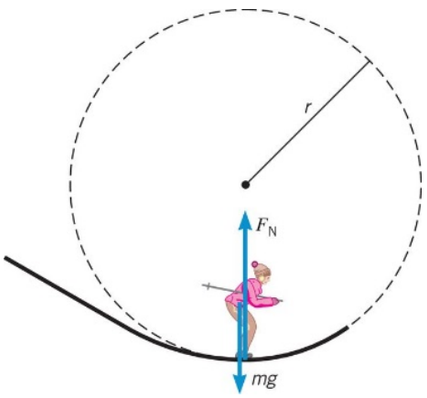
14. A 500-kg car is traveling on a horizontal (unbanked) curve with velocity 15 m/s. The radius of the curve is 100 m. What is the minimum value of the coefficient of static friction required to allow the car to travel safely around the curve?

(a) 0.09 (b) 0.23 (c) 0.34 (d) 0.56 (e) 0.75

15. The Enterprise is in a circular orbit around a newly discovered planet. The orbital velocity of the enterprise is 31 km/s at a distance of 1.4 x10^5 km from the center of the planet. What is the mass of the planet?

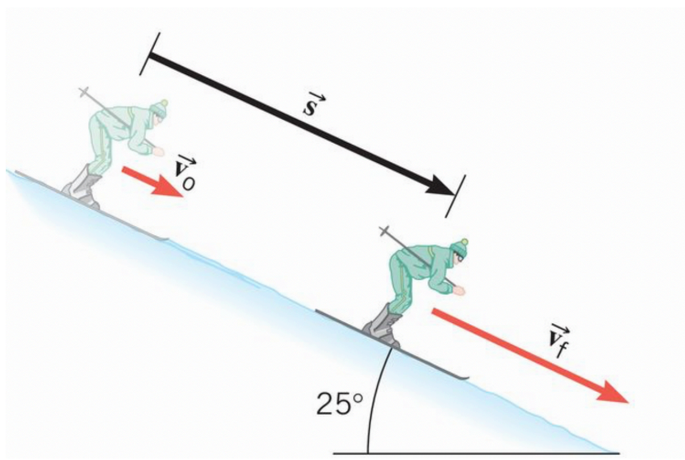
(a) 2×10^{27} kg (b) 2×10^{24} kg (c) 2×10^{30} kg
(d) 2×10^{28} kg (e) 5×10^{28} kg

16. A 70-kg skier is on piece of track with a circular radius of 10 m. If her velocity is 10 m/s what is the normal force on the skier?



(a) 532 N (b) 874 N (c) 1092 N (d) 1386 N (e) 2569 N

17. A 70-kg skier slides a distance s = 12 m down a hill at an angle of 25º. What is the work done by gravity?



(a) –3479 J (b) 3479 J (c) -5368 J (d) 5368 J (e) -256 J

18. A 1000-kg car starts from rest. The net force on the car is 5000 N while the car travels a distance of 100 m. What is the final velocity of the car?

(a) 2 .6 m/s (b) 10.2 m/s (c) 15.7 m/s (d) 31.6 m/s (e) 53.5 m/s

19. A small rock, attached to a 0.5-m rope is whirled in a circle that lies in the vertical plane. The rock is whirled at a constant speed of 2 revolutions per second and is released on the upward part of the vertical motion when it is 1.5 m above the ground. The rock travels straight upward. To what maximum height above the ground does the rock rise? (Ignore non-conservative forces.)

(a) 1.0 m (b) 1.5 m (c) 2.0 m (d) 2.5 m (e) 3.5 m

20. The 900-kg Mars rover Curiosity is traveling on the Martian surface at its average speed of 30 m/hr. Mission control puts on the brakes to avoid a collision with a boulder. If it takes Curiosity 5 s to come to rest once the brakes are applied, how much power is expended by kinetic friction?

(a) 1.0×10^{-4} W (b) 6.2×10^{-3} W (c) 1.4×10^{-2} W (d) 0.13 W (e) 1.5 W

THE END

Answers

1 d
2 c
3 b
4 d
5 b
6 d
7 c
8 d
9 d
10 e

11 a
12 a
13 b
14 b
15 a
16 d
17 b
18 d
19 e
20 b