

### Exam 1-021

**Q1** The standard kilogram is a platinum-iridium cylinder 39 mm in height and 19.5 mm in radius. What is the density of the material?

- A1: 21 g/cm<sup>3</sup>
- A2: 1.0 g/cm<sup>3</sup>
- A3: 13 g/cm<sup>3</sup>
- A4: 11 g/cm<sup>3</sup>
- A5: 19 g/cm<sup>3</sup>

**Q2** Fig (1) shows the velocity ( $V_x$ ) of a particle moving along x axis as a function of time ( $t$ ). What is the acceleration of the particle at  $t = 2.0$  s?

- A1: -4 m/s<sup>2</sup>
- A2: +4 m/s<sup>2</sup>
- A3: -1 m/s<sup>2</sup>
- A4: +1 m/s<sup>2</sup>
- A5: 0 m/s<sup>2</sup>

**Q3** The speed of sound in air is about 350 m/s. Express this speed in miles per hour (mi/h). (1 mile = 1.61 km)

- A1: 783 mi/h
- A2: 350 mi/h
- A3: 564 mi/h
- A4: 980 mi/h
- A5: 0 mi/h

**Q4** A particle moving along the x axis has a position given by  $x = (24t - 2t^3)$  meters, where  $t$  is measured in seconds. How far is the particle from the origin ( $x=0$ ) when the particle stops momentarily?

- A1: 32 m
- A2: 23 m
- A3: 40 m
- A4: 17 m
- A5: 98 m

**Q5** In 2.0 seconds, a particle moving with constant acceleration along the x axis goes from  $x=10$  m to  $x=50$  m. The velocity at the end of this time interval is 10 m/s. What is the acceleration of the particle?

- A1: -10 m/s<sup>2</sup>
- A2: +15 m/s<sup>2</sup>
- A3: -15 m/s<sup>2</sup>
- A4: +20 m/s<sup>2</sup>
- A5: -20 m/s<sup>2</sup>

**Q6** A stone is thrown downward from height ( $h$ ) above the ground with an initial speed of 10 m/s. It strikes the ground 3.0 seconds later. Determine  $h$ .

- A1: 74 m
- A2: 44 m
- A3: 14 m
- A4: 90 m
- A5: 60 m

**Q7** Fig (2) shows four vectors A, B, C, D. Which of the following statements is correct:

- A1:  $C = D + B - A$
- A2:  $C = A + B + D$
- A3:  $C = -D - B + A$
- A4:  $C = A - B + D$
- A5:  $C = -A - B - D$

**Q8** Unit vectors  $i, j, k$  have magnitudes of unity and are directed in the positive directions of the  $x, y, z$  axes. The value of  $k \cdot (k \times i)$  is:

- A1: 0
- A2: -1
- A3: +1
- A4:  $i$
- A5:  $j$

**Q9** If we have two vectors  $A = (a \mathbf{i} - 2 \mathbf{j})$  and  $B = (2 \mathbf{i} + 3 \mathbf{j})$  such that  $A \cdot B = 4$ , find the value of  $a$ .

- A1: 5
- A2: 4
- A3: 0
- A4: -5
- A5: -4

**Q10** A particle starts from the origin at  $t=0$  with a velocity of  $(8\mathbf{j})$  m/s and moves in the  $xy$  plane with constant acceleration of  $(4\mathbf{i} - 2\mathbf{j})$  m/s<sup>2</sup>. At the instant the  $x$  coordinate of the particle is 32 m, what is the value of its  $y$  coordinate?

- A1: 16 m
- A2: 35 m
- A3: 45 m
- A4: 32 m
- A5: 12 m

**Q11** A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m horizontally away from the base of the building (Fig 3). What is the speed of the ball just before it strikes the ground?

- A1: 47 m/s
- A2: 40 m/s
- A3: 37 m/s
- A4: 14 m/s
- A5: 50 m/s

**Q12** A particle moves at a constant speed in a circular path with a radius of 2.0 cm. If the particle makes 4 revolutions each second, what is the magnitude of its acceleration?

- A1: 13 m/s<sup>2</sup>
- A2: 20 m/s<sup>2</sup>
- A3: 15 m/s<sup>2</sup>
- A4: 18 m/s<sup>2</sup>
- A5: 24 m/s<sup>2</sup>

**Q13** The pilot of an airplane flies due north relative to the ground with a speed of 80 km/h. A wind is blowing towards the east with a speed of 40 km/h. What is the speed of the airplane relative to the wind?

- A1 89 km/h
- A2 85 km/h
- A3 81 km/h
- A4 76 km/h
- A5 72 km/h

**Q14** A student is standing on a scale in an elevator. The apparent weight of the student is greatest when the elevator:

- A1: accelerates upward.
- A2: moves upward at a constant velocity.
- A3: moves downward at a constant velocity.
- A4: accelerates downward.
- A5: is not moving.

**Q15** A roller-coaster car has a mass of 500 kg when fully loaded with passengers. The car passes over a hill of radius 15 m (Fig 4). At the top of the hill, the car has a speed of 8 m/s. What is the force of the track on the car at the top of the hill?

- A1: 2800 N up
- A2: 7000 N down
- A3: 7000 N up
- A4: 2800 N down
- A5: 0 N

**Q16** A 1.8 kg block is released from rest at the top of a rough 30 degrees inclined plane. As the block slides down the incline, its acceleration is  $3.0 \text{ m/s}^2$  down the incline. Determine the magnitude of the force of friction acting on the block.

- A1: 3.4 N
- A2: 4.2 N
- A3: 3.0 N
- A4: 3.8 N
- A5: 2.3 N

**Q17** A 3.0 kg block is pushed across a horizontal surface by a force  $F=20 \text{ N}$  making an angle of 30 degrees with the horizontal (Fig 5). If the coefficient of kinetic friction between the block and the surface is 0.3, what is the magnitude of the acceleration of the block?

- A1:  $1.8 \text{ m/s}^2$
- A2:  $2.8 \text{ m/s}^2$
- A3:  $3.3 \text{ m/s}^2$
- A4:  $5.4 \text{ m/s}^2$
- A5:  $2.5 \text{ m/s}^2$

**Q18** In Fig (6),  $F=40 \text{ N}$  and  $M=2 \text{ kg}$ . What is the magnitude of the acceleration of the suspended object M ? (All surfaces are frictionless)

- A1:  $2.5 \text{ m/s}^2$
- A2:  $2.8 \text{ m/s}^2$
- A3:  $3.3 \text{ m/s}^2$
- A4:  $5.4 \text{ m/s}^2$
- A5:  $1.8 \text{ m/s}^2$

**Q19** The horizontal surface on which the objects (Fig 7) slide is frictionless. If the magnitude of the force of the small block on the large block is 5.2 N, determine F.

- A1: 7.8 N
- A2: 9.0 N
- A3: 4.8 N
- A4: 4.1 N
- A5: 6.0 N

**Q20** Three blocks are placed on a table as shown in Fig (8). The table exerts a normal force:

- A1: only on block C.
- A2: only on block A.
- A3: upward on block B and downward on block C.
- A4: upward on block A and downward on block C.
- A5: only on block B.

**PHYS101 - FIRST MAJOR EXAM – FIGURES**  
Term-021

