King Abdulaziz University …..… Faculty of Science …..… Department of Physics

PHYSICS 110 | Final Exam | A. Z ALZAHRANI

1. The volume of a sphere of radius r is given by $V=4/3\pi r^a$. The value of the power a is:

(a) 1 (b) 2 (c) 3 (d) 4

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2. A dimensionless quantities A is described as $A = k v l$, where v and l are velocity and length, respectively. The SI unit of k is:

(a) s/m^2 (b) m/s^2 (c) m/s (d) s

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3. Given a formula of force as $F = \alpha\beta + \lambda$. The unit of λ is:

(a) Dimensionless (b) N.s (c) $kg.m/s^2$ (d) N

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4. The velocity of a particle in terms of its acceleration is given by $v = ka$, the unit of k is:

(a) m/s (b) m (c) m.s (d) s

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5. The acceleration of a car, starting its motion with a speed of 5 m/s, is given by the equation $a(t)=2t$ (m/s^2). The average acceleration of the car in the interval t=1s and t= 2s is:

(a) 3 m/s^2 (b) 2 m/s^2 (c) 6 m/s^2 (d) 4 m/s^2

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6. The position of a particle is given by the equation $x = 1.5t^2-t^4$ (m), the speed of the ball when its acceleration vanishes is:

(a) 0.5 m/s (b) 1.0 m/s (c) 1.5 m/s (d) 2.0 m/s

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7. A car moves with a constant speed of 12 m/s. If the driver uniformly increases the speed in which it covers 240 m in 12 s, the acceleration of the car is:

(a) 5.3 m/s^2 (b) 3.3 m/s^2 (c) 1.3 m/s^2 (d) 13 m/s^2

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8. A particle moves along the x-axis with constant acceleration of 3 m/s^2. If its initial position is 1.2 m and initial speed is 2.1 m/s, its position at t=2 s is:

(a) 9.4 m (4) 10.4 m (c) 11.4 m (d) 12.4 m

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9. A stone is thrown vertically upwards from the top of a tall building with a speed of 19.6 m/s. The height of the building if the stone took 12 s to hit the ground is:

(a) 490 m (b) 470.4 m (c) 380 m (d) 19.6 m

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10. A ball is thrown vertically upwards. If the ball takes 2 s to pass a window of height 1.2 m located at 10 m above the ground, the maximum height of the ball is:

(a) 10.4 m (b) 11.2 m (c) 13.5 m (d) 15.5 m

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11. A rock is thrown down at 2 m/s from a height of 25.8 m above the ground. The rock will take:

(a) 1.2 s (b) 2.1 s (c) 4.2 s (d) 5 s

12. For vectors $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - \hat{k}$, the length of the vector $\vec{A} - \vec{B}$ is:

(a) 2 (b) 3 (c) 4 (d) 5

13. The angle that the vector $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ makes with the positive x-axis is:

(a) 42^0 (b) 58^0 (c) 98^0 (d) 109^0

14. The vector that is normal to both vectors $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - \hat{k}$ is:

(a) $-5\hat{i} + 5\hat{j} + 5\hat{k}$ (b) $5\hat{i} - 5\hat{j} + 5\hat{k}$ (c) $5\hat{i} + 5\hat{j}$ (d) $-5\hat{i}$

15. If vector $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ is perpendicular to vector $\vec{D} = x\hat{i} + 2\hat{j}$, the value of x will be:

(a) 1 (b) 2 (c) 3 (d) 4

16. The result of $(\hat{i} \times \hat{k}) \times \hat{j}$ is:

(a) -1 (b) $-\hat{j}$ (c) 0 (d) $\hat{j}$

17. For non-zero vectors $\vec{A}$ and $\vec{B}$, $\vec{A} \cdot \vec{B} = \frac{4}{5}|\vec{A} \times \vec{B}|$ when the angle between them is:

(a) 0^0 (b) 36.7^0 (c) 51.3^0 (d) 90^0

18. Vector $\vec{a}$ is added to vector $\vec{b}$, the result is $2\hat{i} + 2\hat{j}$. If $\vec{b}$ is subtracted from $\vec{a}$, the result is $-8\hat{i} + 6\hat{j}$. The magnitude of $\vec{a}$ is:

(a) 5.4 (b) 5 (c) 4 (d) 3.2

19. A particle starts from origin with initial speed of 5 m/s along the positive x-axis. If its acceleration is $\vec{a} = 2\hat{i} - 4\hat{j}\ (m/s^2)$, the position vector of the particle at t=1 s is:

(a) $6\hat{i} - 2\hat{j}$ (b) $2\hat{i} + 6\hat{j}$ (c) $\hat{i} - 2\hat{j}$ (d) $6\hat{i}$

20. A ball is kicked at an angle of 50^0 above the horizontal with an initial speed of 24 m/s. The maximum height of the ball is:

(a) 57.9 m (b) 34.5 m (c) 28.9 m (d) 17.3 m

21. A projectile is fired to achieve a maximum range of 140 m, the speed of the projectile must be:

(a) 17 m/s (b) 27 m/s (c) 37 m/s (d) 45 m/s

22. A projectile is fired at an angle θ above the horizontal. It takes 15 s to reach its range of 140 m. Its speed at the highest point is:

(a) 9.3 m/s (b) 15.2 m/s (c) 19.6 m/s (d) 22 m/s

23. A projectile is fired in such a way that its horizontal range equals three times its maximum height, the launch angle is:

(a) 82.1^0 (b) 60.9^0 (c) 53.1^0 (d) 65.8^0

24. An object having a speed of 1.256 m/s rotates in a circular path. If it completes two revolutions in 5 s, the centripetal acceleration is:
(a) 2.51 m/s^2 (b) 3.16 m/s^2 (c) 4.4 m/s^2 (d) 6 m/s^2

25. A force of 20 N is applied to move a stationary body of mass 5 kg. The speed of the body after 4 s will be:
(a) 1.25 m/s (b) 12.5 m/s (c) 16 m/s (d) 18 m/s

26. A force of 10 N is applied to move a stationary body. If the speed of the body after 2 s is 4 m/s, the mass of the body is:
(a) 2 kg (b) 5 kg (c) 8 kg (d) 10 kg

27. A box, has mass of 4 kg, is pulled over a frictionless floor with a force of magnitude 40 N making an angle of 30^0 above the horizontal. The normal force is:
(a) 39.2 N (b) 59.2 N (c) 19.2 N (d) 40 N

28. A box, has weigh of 98 N, is pulled over a rough, flat surface with a horizontal force of magnitude 50 N. If the box moves with constant speed of 2 m/s, the coefficient of kinetic friction is:
(a) 0.51 (b) 0.31 (c) 0.22 (d) 0.15

29. A car rotates a circular path of radius 200 m with constant speed of 25 m/s. The car's mass if it has a centripetal force of 2500 N is:
(a) 600 kg (b) 700 kg (c) 800 kg (d) 1000 kg

30. A block of mass 4.2 kg is pulled up a frictionless inclined plane of angle 30^0 by a horizontal force. If the block moves with constant speed of 2.6 m/s, the magnitude of the force is:
(a) 23.8 N (b) 71.3 N (c) 42.2 N (d) 13.9 N

31. A 5 kg body is horizontally moving with constant speed of 6 m/s. The work done to increase the speed of the body to 10 m/s is:
(a) 64 J (b) 128 J (c) 160 J (d) 192 J

32. An 40 N crate slides with constant speed a distance of 4 m downward along a rough slope that makes an angle of 30^0 with the horizontal. The work done by the gravity is:
(a) 80 J (b) 0 J (c) 160 J (d) 200 J

33. An 40 N crate slides with constant speed a distance of 4 m downward along a rough slope that makes an angle of 30^0 with the horizontal. The work done by the normal force is:
(a) 80 J (b) 0 J (c) 160 J (d) 200 J

34. A person lifts a 100 N weight 2 m above the ground during 2 s. The power required is:
(a) 40 W (b) 60 W (c) 80 W (d) 100 W

35. A 2 kg block is released from rest 8 m above the ground. Its kinetic energy when it has fallen 6 m is:

(a) 80 J (b) 117.6 J (c) 176.2 J (d) 185.3 J

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36. A block attached to a spring with a spring constant of 80 N/m oscillates on a horizontal frictionless floor. If the total mechanical energy is 0.1 J, the greatest extension of the spring from its equilibrium length is:

(a) 0.02 m (b) 0.03 m (c) 0.025 m (d) 0.05 m

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37. Three particles of masses m_1=3 kg, m_2=5 kg, and m_3=2 kg are located in *xy* plane as (0,0), (1,2), and (2,0), respectively. The coordinates of the center of mass are

(a) 0.9, 0.9 (b) 0.9, 1.0 (c) 1.0, 0.9 (d) 1.0, 1.0

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38. A car has a kinetic energy of 72000 J and a momentum of 12000 kg.m/s. The car's speed is:

(a) 12 m/s (b) 15 m/s (c) 16 m/s (d) 18 m/s

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39. In a perfectly inelastic collision, a car of mass 800 kg moving with a speed of 20 m/s collides with another stationary car of mass 1200 kg. If they move together after the collision, their speed is:

(a) 12 m/s (b) 10 m/s (c) 8 m/s (d) 6 m/s

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40. A 0.075 kg bullet moving at 250 m/s strikes a wooden block that is initially at rest. If the bullet embeds the block and move together with a speed of 17 m/s, the mass of the block is:

(a) 1.03 kg (b) 1.25 kg (c) 1.4 kg (d) 1.9 kg