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Grade	**14.00** out of 35.00 (**40**%)

Question 1

Incorrect

Mark 0.00 out of 1.00

Consider a rigid body whose moments of inertia about the 3 principal axes are I_1, I_2, I_3 and $I_1 > I_2 > I_3$. The body is rotating about one of its principal axes and total external torque on it is 0. In which of the following cases the rotation is unstable?

Select one:

- a. Body rotating about principal axis 1 ✗
- b. The rotation is unstable in all of these cases, since the torque is 0
- c. Body rotating about principal axis 2
- d. Body rotating about principal axis 3

Your answer is incorrect.

The correct answer is: Body rotating about principal axis 2

Question 2

Correct

Mark 1.00 out of 1.00

Apparent weight of an object is slightly lower at the equator than that at the poles. Which of the following is the main cause?

Select one:

- a. Coriolis force due to earth's rotation
- b. Centrifugal force due to earth's rotation ✓
- c. This is an error, since mass of the object is constant, its weight (*mg*) must also be constant
- d. Centrifugal force due to earth's revolution

Your answer is correct.

The correct answer is: Centrifugal force due to earth's rotation

Question 3

Incorrect

Mark 0.00 out of 1.00

If the angular velocity of a particle of mass m is defined as $\omega\hat{j}$ and linear velocity in the non-inertial frame is $\vec{v}_{rot} = v\hat{k}$ then determine the coriolis force.

Select one:

- a. $-2m\omega v\hat{k}$ ✗
- b. $2m\omega v\hat{k}$
- c. $2m\omega v\hat{i}$
- d. $-2m\omega v\hat{i}$

Your answer is incorrect.

The correct answer is: $-2m\omega v\hat{i}$

Question 4

Incorrect

Mark 0.00 out of 1.00

Which of the following is true about rotations?

Select one:

- a. Finite rotations about a given axis can be considered as a vector
- b. All rotations are vectors ✗
- c. Addition of rotations about different axes is commutative
- d. Infinitesimal rotations about a given axis can be considered as a vector

Your answer is incorrect.

The correct answer is: Infinitesimal rotations about a given axis can be considered as a vector

Question 5

Incorrect

Mark 0.00 out of 1.00

If the motion of a particle is along the arc of a circle then what will be the velocity of the particle?

Select one:

- a. 0
- b. $r\dot{\theta}\hat{\theta}$
- c. $\dot{r}\hat{r} + r\dot{\theta}\hat{\theta}$ ✗
- d. $\dot{r}\hat{r}$

Your answer is incorrect.

The correct answer is: $r\dot{\theta}\hat{\theta}$

Question 6

Correct

Mark 1.00 out of 1.00

Which of the following is a postulate of special theory of relativity?

Select one:

- a. Laws of physics do not change as one goes from one inertial frame to another ✓
- b. Laws of physics are invariant across all frames of references.
- c. Light can travel through vacuum at very high speeds
- d. Laws of physics remain invariant across all frames if we add a pseudo force in non-inertial frames

Your answer is correct.

The correct answer is: Laws of physics do not change as one goes from one inertial frame to another

Question 7

Correct

Mark 1.00 out of 1.00

With respect to principle axes the inertia tensor of a body is

Select one:

- a. off-diagonal
- b. symmetric
- c. anti symmetric
- d. diagonal ✓

Your answer is correct.

The correct answer is: diagonal

Question 8

Correct

Mark 1.00 out of 1.00

Which of the following is not true about plane polar coordinate system (r, θ)?

Select one:

- a. Coordinate θ is the angle made with x axis
- b. The unit vectors, $\hat{r}, \hat{\theta}$, have a constant direction ✓
- c. The unit vectors, $\hat{r}, \hat{\theta}$, have a constant magnitude
- d. The unit vectors, $\hat{r}, \hat{\theta}$, are always perpendicular to each other

Your answer is correct.

The correct answer is: The unit vectors, $\hat{r}, \hat{\theta}$, have a constant direction

Question 9

Correct

Mark 2.00 out of 2.00

A particle of mass 5.2gm moving along the positive x-axis with velocity 5.1cm/s. Determine the magnitude of the angular momentum of the particle with respect to a point P which is on the positive y-axis and 7.7cm away from the origin.

Answer: 204.204 ✓

The correct answer is: 204.20

Question 10

Correct

Mark 2.00 out of 2.00

A particle moves along the curve $r = 2\theta$, with $\theta = 4.9t^2$. What is the tangential component of the velocity of this particle in plane polar coordinates at t = 2s? Assume everything is in the same unit system.

Answer: 768.32 ✓

The correct answer is: 768.32

Question 11

Not answered

Marked out of 2.00

According to observer O, two events occur separated by a time interval $\Delta t = 0.6\mu s$ and at locations separated by Δx =79.6m. According to observer O', who is in motion relative to *O* at a speed of $4.7\times10^{-1}c$ in the positive *x* direction, what is the time interval between the two events? Your answer will be in μs.

Answer:

The correct answer is: 0.54

Question 12

Incorrect

Mark 0.00 out of 2.00

A particle is moving along a straight line parallel to the x axis with a constant velocity $\vec{v} = 10.0\hat{i}$. What is the radial component (in plane polar coordinate system) of the velocity when the particle is located at (*x*, *y*) = (4, 3)?

Answer: 6.82

The correct answer is: 8.00

Question 13

Correct

Mark 2.00 out of 2.00

If the spring constant, k, of an oscillating system is $7.6 dyn/cm$, amplitude of oscillation is 4.4 cm and damping coefficient is $1.1 s^{-1}$. Determine the energy of the spring system at $t = 0$. Your answer will be in CGS unit.

Answer: 73.568

The correct answer is: 73.57

Question 14

Incorrect

Mark 0.00 out of 2.00

Consider a system of two bodies moving under the influence of gravitational attraction of each other. The reduced mass μ of the system is 4.9. The relative coordinate *r* traces a circular orbit of radius 5.5. The constant *C* is 16.2. What is the magnitude of angular momentum *L* of the system? Assume all quantities are in the same unit system

Answer: 50

The correct answer is: 20.89

Question 15

Not answered

Marked out of 2.00

Consider a particle moving in the field of a central force in a circular path around the centre of the force. Radius of the circle is continuously shrinking, such that the particle effectively traces a circular spiral. At t = 0 s, the particle is at a radial distance of 20.5 and moving with speed 4.3. What is its velocity when it is at a radial distance of 1.2? Assume all quantities are in same unit system.

Answer:

The correct answer is: 73.46

Question 16

Correct

Mark 2.00 out of 2.00

A circular planck is rotating with constant angular velocity $\vec{\omega} = 2\hat{k}$. A particle of mass m = 1.6 is moving on it. Its velocity w.r.t. planck is $\vec{v} = 3\hat{r}$. At a given instant the particle is located at the polar coordinates (4.8, π/2). What is the magnitude of centrifugal force acting on it. Assume origin is at the centre of the plank, plank is in xy plane and all quantities are in the same unit system.

Answer: 30.72

The correct answer is: 30.72

Question 17

Correct

Mark 2.00 out of 2.00

Moment of inertia tensor of a rigid body for a chosen coordinate system is

$$I = \begin{bmatrix} 1 & 6 & 1 \\ 2 & 5 & 1 \\ 1 & 8 & 2 \end{bmatrix}$$

The body is rotating with angular velocity ω = 19.4 rad/s about the x axis. Find the y component of angular momentum. Assume all quantities are in SI unit system.

Answer: 38.8

The correct answer is: 38.80

Question 18

Incorrect

Mark 0.00 out of 3.00

A particle is moving under the influence of a central force. Potential energy V due the force is given by $V = -\frac{45.2}{2r^2}$. Reduced mass μ of the system is 6.4. For what value of angular momentum L the particle will move in a circular orbit? Hint: Energy is minimum in circular orbit. Assume all quantities are in SI system.

Answer: 20 ✗

The correct answer is: 17.01

Question 19

Incorrect

Mark 0.00 out of 3.00

ISRO wants to launch a satellite of mass $1000kg$, in an elliptical orbit around earth, so that the altitude of the satellite above earth at perigee is $1.6\times10^3 km$, and at apogee it is $3.9\times10^4 km$. Find out the energy of the satellite in the elliptic orbit. The radius of earth is $6400km$, accelaration due to gravity is $9.8ms^{-2}$. Your answer should be in units of GJ (Giga Joule).

Answer: 40 ✗

The correct answer is: 7.52

Question 20

Incorrect

Mark 0.00 out of 3.00

A particle is moving at high relativistic speeds, such that $\frac{v^2}{c^2} = \frac{3}{4}$. Kinetic energy of the particle is 35.4. If someone uses classical or Newtonian mechanics to predict the kinetic energy, what value would he get? Assume all quantities are in SI units.

Answer: 20 ✗

The correct answer is: 13.27