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| Bon Secours College for Women Nationally Accredited with “A” Grade by NAAC (Affiliated to Bharathidasan University, Trichy-24) Recognized by UGC Under Section 2(f) & 12 (B)    Vilar Bypass, Thanjavur-613 006. |

**DEPARTMENT OF PHYSICS**

**MECHANICS AND RELATIVITY**

**2 Marks**

1. A body is thrown with a velocity 10 m/s at an inclination 30 degree from Earth’s surface. Find the greatest height attained by the body.

2. Define co-efficient of restitution for the impact of a sphere on a fixed horizontal plane.

3. When will be the time period of a compound pendulum minimum?

4. What is centre of mass?

5. Find the gravitational potential on the surface of a spherical shell of

Radius 1m and mass 20kg.

6. Where does the centre of gravity of a solid tetrahedron lie in it?

7. Define centre of pressure?

8. Distinguish between stream lines and turbulent motion.

9. What is a central force field? Give one example.

10. What are the constraints? How are they classified?

11. A body is projected at an angle 30 degree to the horizontal. The horizontal range is R. When projected at the same speed, find the other angle of projection for which the horizontal range is R again.

12. Define: Co-efficient of Restitution.

13. A body of moment of inertia 2kgm2 has an angular velocity 5 rad/sec. Find its rotational kinetic energy.

14. Define: Centre of mass.

15. Define: Gravitational potential at a point.

16. In Boy's method for finding "G", two smaller spheres and two larger spheres are used. Name the materials of those spheres.

17. Define: Centre of pressure.

18. State any two applications of Bernoulli's theorem.

19. State what are "Constraints".

20. State the two conditions necessary for Hamiltonian H to be equal to the total energy E.

21. Write the equation for the motion of a particle projected horizontally from a point above the earth.

22. Define impulse of a force.

23. Obtain the expression for the kinetic energy of rotation of a body about its axis through its centre of mass.

24. State the law of conservation of linear momentum.

25. Define the intensity of gravitational field.

26. Find the centre of gravity of a hollow hemisphere of radius 2m and mass 2kg.

27. Where does the centre of pressure of a triangular lamina lie when the vertex just touches the liquid surface and base horizontal?

28. What is called equation of continuity of fluid flow?

29. What are generalized co-ordinates?

30. Write the principle of virtual work.

31. What is an impulsive force?

32. What is meant by direct impact?

33. Give the principle of conservation of angular momentum.

34. Define centre of mass.

35. Define Newton's law of gravitation.

36. What is meant by gravitational potential?

37. Write the Euler's equation.

38. Define Bernoulli's theorem.

39. What is Newtonian relativity?

40. What is time dilation?

41. Define reduced mass.

42. What is meant by oblique impact?

43. Define acceleration due to gravity 'g'.

44. What is centre of mass?

45. Define centre of gravity?

46. What is gravitational energy?

47. What is Torricelli's theorem.

48. Why atmospheric pressure varies with altitude?

49. What is Galilean-Newtonian relativity?

50. Write the postulate's of special theory of relativity.

51. Define 'Impulsive force'.

52. What is angle of projection?

53. Give the principle of Rocket.

54. What is linear of momentum?

55. Write any three advantages of Boys method.

56. Write two conditions for more stable.

57. Why the atmospheric pressure decreases with increase of altitude?

58. Write the uses of venturimeter.

59. Discuss about calculated and observed result in Michelson-Morley experiment.

60. Write the two postulates of special relativity.

61. What do you mean by inertial frame?

62. What are the postulates of special theory of relativity?

63. What is work function of a metal?

64. What are the characteristics of De Broglie waves?

65. Define Zero point energy.

66. Give the time dependent Schrödinger equation.

67. Find the radius of the nucleus with mass number 27.

Radius of hydrogen nucleus is 1.3x10-15m.

68. What is (a) Isotope (b) Isobar?

69. Write a short note on mesons.

70. What is chain nuclear reaction?

**5 Marks**

1. Show that the velocity at any point in the path of a projectile is equal in magnitude to that acquired by it in falling freely from the direction to that point.

2. Explain the impact of a smooth sphere on smooth fixed horizontal plane.

3. Derive an expression for the time period of oscillation of a bifilar

pendulum without parallel threads.

4. State and explain the law of conservation of angular momentum.

5. State Newton's law of gravitation and define gravitation constant.

6. Obtain an expression for the centre of gravity of a hollow hemisphere.

7. How does the atmospheric pressure change with altitude?

8. State the theorems due to Bernoulli and Torricelli. Derive the second theorem

from the first.

9. Obtain Lagrange's equation from D'Alembert's principle.

10. Starting from the Hamiltonian, arrive at the equation of motion

of a simple pendulum.

11. A body is projected with a velocity "u", making an angle (alpha) to

the horizontal. Find expressions for its,

(i) Horizontal range

(ii) Time dilation

(iii) Maximum height attained.

12. State and explain all the three laws of impact.

13. Show that the centre of suspension and centre of oscillation are

interchangeable for a compound pendulum.

14. Explain the following for a system of particles,

(i) Centre of mass.

(ii) Velocity of centre of mass and

(iii) Acceleration of centre of mass.

15. Obtain an expression for the centre of gravity of a solid tetrahedron.

16. Find an expression for the gravitational potential due to a spherical

shell at a point outside the shell.

17. A rectangular lamina is immersed vertically in a liquid with one side

at the surface. Find its centre of pressure.

18. A triangular lamina is immersed vertically in a liquid with its

vertex at the surface and its base remaining horizontal. Find its centre of pressure.

19. What are generalised co-ordinates? With the help of generalise

co-ordinates, explain "configuration space".

20. Write short notes on:

(i) Virtual displacement.

(ii) Virtual work.

21. Obtain an expression for loss of energy due to oblique impact.

22. A ball of mass m1 moving with velocity u1 strikes another ball of mass m2

which is stationary. If the collision is inelstic, calculate the fraction of the

kinetic energy transferred to the second ball.

23. Derive an expression for time period of compound pendulum.

24. Write a note on reversibility of centre of oscillation.

25. Obtain the centre of gravity of a solid tetrahedron.

26. Explain the gravitational field due to spherial shell.

27. Derive the continuity equation of flow.

28. What is centre of pressure? Explain.

29. A rod of 1m long is moving along its length with a velocity 0.6C.

Calculate its length as it appears to an observer.

30. Explain the relativistic addition of velocities.

31. State the laws of impact and explain.

32. Derive an expression for the direct impact of a smooth sphere on a

horizontal smooth plane.

33. Write the equation for a Rocket and explain.

Explain why rocket has multistages.

34. Give an account on the reversibility of centre of oscillation.

35. Obtain the centre of gravity of a hollow tetrahedron.

36. Derive an expression for the gravitational field due to a spherical shell.

37. State and explain Bernoulli's theorem.

38. Explain about the centre of pressure due to a vertical rectangular lamina.

39. Explain the variation of mass with velocity under relativity.

40. If a bar of rest length 100m moves with a velocity of 0.75C,

determine its moving length.

41. Find the maximum range of a ball throwing with velocity 98m/s as a projectile.

42. Find the velocity of a two smooth spheres after direct impact.

43. Derive the period of oscillation of a bifilar pendulum with parallel threads.

44. Explain centre of mass.

45. Find the centre of gravity of solid tetrahedron.

46. Find the centre of gravity of solid hemisphere.

47. Find the centre of pressure for a rectangular lamina one side is

on the surface of the liquid.

48. Find the centre of pressure for a circular lamina immersed vertically.

49. Explain Mass energy equivalence.

50. Explain the relativistic addition of velocities.

51. Describe an equation for the motion of a projectile projected in any direction.

52. Discuss the direct impact between two smooth spheres.

53. How are the values of acceleration due to gravity and radius of gyration

of a bar pendulum determined experimentally?

54. Establish the relation for the velocity of a rocket when its weigth is ignored.

55. Obtain an expression for the gravitational potential at a point outside a

hollow spherical shell.

56. Obtain an expression for the centre of gravity of a solid tetrahedron.

57. Derive a relation for the centre of pressure on a circular lamina.

58. Establish Bernoulli's theorem.

59. Obtain Hamilton's equation of motion.

60. Derive the equation of motion of a simple pendulum starting

from the Lagrangian.

61. Explain time dilation in special theory of relativity.

62. A particle has rest mass 1x10-24. Find its mass when it moves

with a velocity 1.8x10-8 m/sec.Velocity of light is 3x10+8 m/sec.

63. State and explain Heisenberg's uncertainty principle.

64. Explain Einstein's photo electric equation.

65. Derive Schrodinger's steady state equation.

66. State the postulate of wave mechanics.

67. Explain Q-value in a nuclear reaction with example.

68. Define mass defect, packing fraction and binding energy.

69. Write short note on (a) nuclear isomerism (b) Nuclear spin.

70. With suitable example show that energy will be release in nuclear fission.

**10 Marks**

1. Discuss the oblique impact between two smooth spheres. Also find the loss in kinetic energy.
2. Establish the relation for the velocity of a rocket both when its weight is ignored and when it is taken into account.
3. Describe the Boy's method of determination of gravitational constant.

4. Determine theoritically the centre of pressure of a vertical triangular lamina.

5. Apply Lagrange's equation to Atwood's machine for determining the value of g'.

6. A particle is projected with a velocity u at an angle (alpha) to the horizontal. Find an expression for the range of the particle on a plane inclined at (Beta) to the horizontal. Find also the time of flight.

7. Derive an expression for the loss of kinetic energy due to direct impact of two smooth spheres.

8. Explain with necessary theory, the experiment to determine the acceleration due to gravity at a place using compound pendulum.

9. A rigid body is suspended by two equal non-parallel threads. Using such a bifilar pendulum, how will you determine the moment of inertia of the body? Describe the experiment and derive the formula you use.

10. Describe in detail,Boy's method of determining the universal constant of gravitation G.

11. Derive expressions for the centre of gravity,

(a) a hollow hemisphere

(b) a solid hemisphere.

12. A vertical circular lamina is immersed in a liquid at a depth. Find its centre of pressure.

13. Write short notes on:

(a) Torricelli's theorem

(b) Stability equilibrium

14. Using Lagrange's equations, derive an expression for the period of oscillation of a simple pendulum.

15. Two masses are suspended over a frictionless pulley by a flexible string. For this Atwood's machine, use Lagrange's equations and study its motion. Derive expressions for the accelerations of the masses suspended.

16. Describe in detail the motion of two interacting bodies for a planet moving around the sun.

17. Describe bifilar pendulum and find an expression for its period of oscillation.

18. Describe the Boy's method of determination of gravitational constant.

19. How does the atmospheric pressure change with altitude? Explain the reasons for variation.

20. Starting from D'Alembert's principle, obtain the Lagrangian equation.

21. Write a note on:

(a) A Projectile

(b) Reduced mass.

22. Explain the Bifilar pendulum and derive an expression for its period of oscillation.

23. Describe the Boy's method for measuring the gravitational constant.

24. Explain in detail about Torricelli's theorem.

25. What is meant by mass-energy equivalence? Obtain Einstein's mass-energy relation.

26. Explain the theory of projectile thrown on a horizontal plane.

27. Explain the determination of 'g' using compound pendulum.

28. Explain with a diagram the Boy's method of determine of 'G'.

29. Write short notes on the determine of, (a) Velocity (b) Quanity of flow in stream lined motion of a liquid.

30. Write short notes on:

(a) Lorentz transformation equations.

(b) Time dilation.

31. Write a note on:

(a) Laws of impact

(b) Direct and oblique impacts

(c) Reduced mass.

32. Discuss conservation of angular momentum.

33. Derive the gravitational potential due to spherical shell.

34. Find the centre of pressure for a triangular lamina immersed vertically in a liquid,

(a) The vertex at the surface.

(b) The base at the surface.

35. Write a note on:

(a) Length contraction.

(b) Time dilation.

36. Derive Einstein's mass-energy equation.

37. Explainb Darvision-Germer experiment with diagram.

38. How will you calculate the energy eigen value of a particle in one dimensuional box?

39. Draw the diagram of a Betetron and explain its operation Obtain Betatron conditions.

40. Discuss nuclear shell model in detail.