Class – VII

DIWALI ASSIGNMENT

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Maths

Exponent & Power

1. If $a = c^z, b = a^x$ and $c = b^y$, prove that $xyz = 1$.
2. If $a = xy^{p-1}, b = xy^{q-1}$ and $c = xy^{r-1}$, prove that $a^{q-r}.b^{r-p}.c^{p-q} = 1$.
3. If $2^x = 3^y = 6^{-z}$ prove that $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0$.
4. If $2^x = 3^y = 12^z$, prove that $x = \frac{2yz}{y-z}$.
5. Simplify and express with positive exponents :
   $(3x^2)^0, (xy)^{-2}, (27a^9)^{2/3}$
6. If $a = 3$ and $b = -2$, find the values of : (i) $a^a + b^b$ (ii) $a^b + b^a$
7. If $x = 10^3 \times 0.0099, y = 10^{-2} \times 110$, find the value of $\sqrt{\frac{x}{y}}$.
8. Evaluate $x^{1/2}.y^{-1}.z^{2/3}$ when $x = 9, y = 2$ and $z = 8$.
9. If $x^4y^2z^3 = 49392$, find the values of x, y and z, where x, y and z are different positive primes.
10. If $\sqrt[3]{a^6b^{-4}} = a^x.b^{2y}$, find x and y, where a, b are different positive primes.
11. If $(p+q)^{-1}(p^{-1}+q^{-1}) = p^aq^b$, prove that $a + b + 2 = 0$, where p and q are different positive primes.
12. If $\left(\frac{p^{-1}q^2}{p^2q^{-4}}\right)^7 \div \left(\frac{p^3q^{-5}}{p^{-2}q^3}\right)^{-5} = p^xq^y$, find $x + y$, where p and q are different positive primes.
13. Solve the following equations for x:
    (i) $5^{2x+3} = 1$ (ii) $(13)^{\sqrt{x}} = 4^4 - 3^4 - 6$
    (iii) $\left(\sqrt{\frac{3}{5}}\right)^{x+1} = \frac{125}{27}$ (iv) $\left(\sqrt[3]{4}\right)^{2x+\frac{1}{2}} = \frac{1}{32}$
14. Solve the following equation for x:
    (i) $\sqrt{\frac{p}{q}} = \left(\frac{q}{p}\right)^{1-2x}$ (ii) $4^{x-1} \times (0.5)^{3-2x} = \left(\frac{1}{8}\right)^x$
15. If $5^{3x} = 125$ and $(10)^y = 0.001$, find x and y.
16. If $\frac{9^n3^23^n - (27)^n}{3^{3m}2^3} = \frac{1}{27}$, prove that $m = 1 + n$.
17. If $3^{4x} = (81)^{-1}$ and $(10)^{1/y} = 0.0001$, find the value of $2^{-x}.(16)^y$.
18. If $3^{x+1} = 9^{x-2}$, find the value of 2^{1+x}.
19. Solve the following equation :
    (i) $2(2^x + 1) - 2^{x+2} + 5 = 0$ (ii) $3^x = 9.3^y, 8.2^y = 4^x$.
20. Evaluate : $\left(\frac{8}{125}\right)^{-\frac{1}{3}}$

Evaluate

21. $(0.027)^{-\frac{1}{3}}$

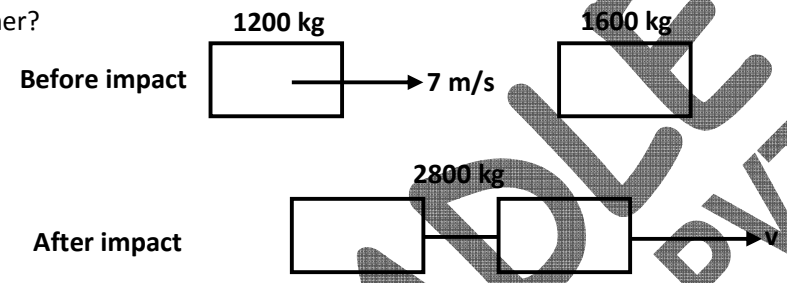
22. $\left(-\frac{1}{27}\right)^{-\frac{2}{3}}$
23. $(64)^{-\frac{2}{3}} \div 9^{-\frac{3}{2}}$
24. $\frac{(27)^{\frac{2n}{3}} \times (8)^{-\frac{n}{6}}}{(18)^{-\frac{n}{2}}}$
25. $\frac{5.(25)^{n+1} - 25.(5)^{2n}}{5.(5)^{2n+3} - (25)^{n+1}}$
26. $\left[8^{-\frac{4}{3}} \div 2^{-2}\right]^{1/2}$
27. $\left(\frac{27}{8}\right)^{2/3} - \left(\frac{1}{4}\right)^{-2} + 5^0$
28. $(3x^2)^{-3} \times (x^9)^{2/3}$
29. $(8x^4)^{1/3} \div x^{1/3}$
30. $(3^2)^0 + 3^{-4} \times 3^6 + \left(\frac{1}{3}\right)^{-2}$
31. $9^{5/2} - 3.(5)^0 - \left(\frac{1}{81}\right)^{-1/2}$
32. $16^{3/4} + 2\left(\frac{1}{2}\right)^{-2}(3)^0$
33. $(81)^{3/4} - \left(\frac{1}{32}\right)^{-2/5} + (8)^{1/3}\left(\frac{1}{2}\right)^{-1}(2)^0$
34. $\left(\frac{64}{125}\right)^{-\frac{2}{3}} \div \frac{1}{\left(\frac{256}{625}\right)^{\frac{1}{4}}} + \left(\frac{\sqrt{25}}{\sqrt[3]{64}}\right)^0$
35. $\frac{5^{n+3} - 6 \times 5^{n+1}}{9 \times 5^n - 2^2 \times 5^n}$
36. $\left[(64)^{\frac{2}{3}}2^{-2} \div 8^0\right]^{-1/2}$
37. $3^n \times 9^{n+1} \div (3^{n-1} \times 9^{n-1})$
38. $\frac{\sqrt{2^2} \times \sqrt[4]{256}}{\sqrt[3]{64}} - \left(\frac{1}{2}\right)^{-2}$
39. $\frac{3^{-\frac{6}{7}} \times 4^{-\frac{3}{7}} \times 9^{\frac{3}{7}} \times 2^{\frac{6}{7}}}{2^2 + 2^0 + 2^{-2}}$
40. $\frac{(32)^{\frac{2}{5}} \times (4)^{-\frac{1}{2}} \times (8)^{\frac{1}{3}}}{2^{-2} \div (64)^{-1/3}}$

Physics
Force and Laws of Motion

1. A force acts for 0.1s on a body of mass 1.2 kg initially at rest. The force then ceases to act and the body moves through 2m in the next one second. Find the magnitude of force.
2. A motorcar is moving with a velocity of 108 km/hr. and it takes 4s to stop after the brakes are applied. Calculate the force exerted by the brakes on the motorcar if its mass along with the passengers is 1000 kg.
3. A force of 20N acts on a body of mass 5 kg for 5 sec. Find
   (i) The acceleration of the body
   (ii) Velocity at the end of 5 sec, and
   (iii) displacement at the end of 5 sec.
4. A ball of mass 10g is initially moving with a velocity of 50 ms^{-1}. On applying a constant force on ball for 2.0 s, it acquires a velocity of 70 ms^{-1}. Calculate:

(i) the initial momentum of ball
(ii) the final momentum of ball
(iii) the rate of charge of momentum
(iv) the acceleration of ball, and
(v) the magnitude of force applied

5. A force of 20N acting on a mass m_1, produces an acceleration of 4 m/sec^2. The same force is applied on mass m_2 then the acceleration produced is 0.5 m/sec^2. What acceleration would the same force produce, when both masses are tied together.
6. Two particles of mass 200g and 500g are released from rest at some mutual separation. If the velocity of the smaller mass be 2.5 ms^{-1}, at any instant, then what is the velocity of the larger mass.
7. A truck of mass 1200 kg is moving with a speed of 7 m/s when it collides with a second truck of mass 1600 kg which is stationary. If the two trucks are automatically coupled together at impact, with what speed do they move on together?



8. A cricket ball of mass 100g moving with a speed of 30 ms^{-1} is brought to rest by a player in 0.03 s. Find:
(i) the change in momentum of ball,
(ii) the average force applied by the player.
9. A boy of mass 58 kg jump with a horizontal velocity of 3 ms^{-1} onto stationary skateboard of mass 2kg. What is his velocity as he moves of on the skateboard?
10. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 ms^{-1}. If the mass of the ball is 0.15 kg, determine the impulse imparted to the ball. (Assume linear motion of the ball).

Fill in the Blanks

1. Application of a force changes the ……. of an object.
2. An object moving at constant speed is in a state of …… .
3. When a running car stops suddenly, the passengers are jerked …… .
4. ……. is a measure of the inertia of a body.
5. To every action, there is an …… and …….. reaction.
6. The force acting on the body which changes the momentum of the body at the rate of 1 kg ms^{-2} is …….. .
7. The change in the momentum of an object is equal to the …….. applied to it.
8. The change in the velocity of an object is proportional to the …… Applied to it.
9. The ratio of net force applied to an object to the acceleration it produces is the …….. of the object.
10. If there are several forces on an object, its acceleration depends on its mass and the …… force.

True / False

11. It is easier to start motion in a lighter body than a heavier body.
12. A rocket can propel itself in a vacuum.
13. Particle of different masses falls with different acceleration on earth.

14. Particle is at rest, it force is zero.
15. Particle moves in the direction of force.
16. If particle is initially at rest then it moves in direction of net force.
17. Momentum is never created nor destroyed.
18. The product of the mass of a body and its velocity is called inertia.
19. Action and reaction act on the same body.
20. Volume is a measure of the inertia of a body.

Match the Column

Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **column I** have to be matched with statements (p, q, r, s) in **column II.**

21. Match the column

Column I	Column II
(A) Newton first law	(p) Quantitative definition of force
(B) Newton second law	(q) Qualitative definition of force
(C) Newton third law	(r) Oppose relative linear motion
(D) Friction force	(s) define nature of force

22. Match the column

Column I	Column II
(A) Force	(p) $kg\ ms^{-1}$
(B) Momentum	(q) newton
(C) Impulse	(r) kg
(D) Mass	(s) ms^{-2}
(E) Acceleration	(t) Force $\times$ time

Multiple Choice Questions

23. By applying a force of one Newton, one can hold a body of mass
    (a) 102 grams (b) 102 kg (c) 102 mg (d) None of these
24. The speed of a falling body increases continuously, this is because
    (a) No force acts on it (b) It is very light
    (c) The air exert the frictional force (d) The earth attract it
25. If an object is in a state of equilibrium
    (a) it is at rest (b) it is in motion at constant velocity
    (c) it is in free fall (d) may be more than one of the above
26. If a boat is moving along at constant speed, it may be assumed that
    (a) a net force is pushing it forward (b) the sum of only vertical forces is zero
    (c) the buoyant force is greater than gravity (d) the sum of all forces is zero
27. If A and B are two objects with masses 6 kg and 34 kg respectively, then
    (a) A has more inertia than B (b) B has more inertia than A
    (c) A and B have same inertia (d) None of the two has inertia
28. When a bus suddenly starts, the standing passengers lean backwards in the bus. It is an example of
    (a) Newton's first law (b) Newton's second law
    (c) Newton's third law (d) None of Newton's law
29. Momentum has the same units as that of

(a) couple (b) torque (c) impulse (d) force

30. When a force of newton acts on a mass of 1 kg that is free to move, the object moves with a
    (a) speed of 1 m/s (b) speed of 1 km/s (c) acceleration of 10 m/s^2 (d) acceleration of 1 m/s^2
31. If an object experience a net zero unbalanced force, then the body
    (a) can be accelerated (b) moves with constant velocity
    (c) cannot remain at rest (d) none of these
32. A hockey player pushes the ball on the ground. It comes to rest after travelling certain distance because
    (a) the player stops pushing the ball (b) no unbalanced force action on the wall
    (c) the ball moves only when pushes (d) the opposing force acts on the body
33. The physical quantity which is the product of mass and velocity of a body is known as
    (a) inertia (b) momentum (c) force (d) change in momentum
34. A book of weight 10 N is placed on a table. The force exerted by the surface of the table on the book will be
    (a) zero (b) 10 N (c) 20 N (d) None of these
35. A moving object can come to rest only if it
    (a) has a frictional force acting on it (b) has no net force acting on it
    (c) is completely isolated (d) applies an impulse to something else
36. When a body is stationary –
    (a) There is no force acting on it (b) The force acting on it not in contact with it
    (c) The combination of forces acting on it balances each other
    (d) The body is in vacuum
37. A rider on horse falls back when horse starts running, all of a sudden because
    (a) rider is taken back (b) rider is suddenly afraid of falling
    (c) inertia of rest keeps the upper part of body at rest while lower part of the body moves forward with the horse
    (d) none of the above
38. A man getting down a running bus, falls forward because
    (a) due to inertia of rest, road is left behind and man reaches forward
    (b) due to inertia of motion upper part of body continues to be in motion in forward direction while feet come to rest as soon as they touch the road
    (c) he leans forward as a matter of habit
    (d) of the combined effect of all the three factors stated in (a), (b) and (c)
39. A force 10 N acts on a body of mass 20 kg for 10 sec. Change in its momentum is
    (a) 5 kg m/s (b) 100 kg m/s (c) 200 kg m/s (d) 1000 kg m/s
40. Swimming is possible on account of
    (a) First law of motion (b) Second law of motion
    (c) Third law of motion (d) Newton's law of gravitation
41. A man is at rest in the middle of a pond on perfectly smooth ice. He can get himself to the shore by making use of Newton's
    (a) first law (b) second law (c) third law (d) all the laws
42. A parrot is sitting on the floor of a closed glass cage which is in a boy's hand. If the parrot starts flying with a constant speed, the boy will feel the weight of the cage as
    (a) unchanged (b) reduced (c) increased (d) Nothing can be said
43. A cannot after firing recoils due to –
    (a) Conservation of energy (b) Backward thrust of gases produced
    (c) Newton's third law of motion (d) Newton's first law of motion

44. Newton's third law of motion leads to the law of conservation of –
    (a) Angular momentum (b) Energy (c) Mass (D) Momentum

Subjective Questions

VERY SHORT QUESTIONS:

45. Name the property of bodies to resist a change in their state of rest or of motion.
46. On what factors does the momentum of a body depend?
47. Why do action and reaction not cancel each other?
48. Which scientist proved first that objects move with constant speed when no forces act on them.
49. Which scientist gave the famous three laws of motion?
50. Can a body in linear motion be in equilibrium.
51. Write the SI unit of momentum.
52. A body is acted upon by a number of external forces. Can it remain at rest?
53. What is the magnitude of the force which produces an acceleration of 1 m/s^2 in a body of mass 1 kg?
54. What is the relationship between force and mass.
55. What is the total momentum of the cannon and shell.
    (i) Before firing
    (ii) After firing

SHORT QUESTIONS:

56. What happens when you shake a wet piece of cloth? Explain your observation.
57. A javelin throw is marked foul if the athlete crosses over the line marked for the throw.
58. Chinawares are wrapped in straw paper before packing.
59. Why is it necessary to bend knees while jumping from greater height?
60. A boxer moves his head backward to protect himself from the attack of his rival. Why?
61. When a balloon filled with air and with its untied mouth directing downwards is released, it moves upwards. Why?
62. Why it is difficult to climb up a greasy pole?
63. State Newton's third law of motion. Give two examples for the law.
64. People often shake a tree for getting down the fruits. Give reason.
65. Describe an experiment to illustrate the Inertia of Rest.

LONG QUESTIONS:

66. Indicate the forces of action and reaction in the following cases:
    (i) a man standing on the ground
    (ii) a stone suspended by a thread from the celing.
67. Discuss the conservation of momentum in each of the following cases
    (i) a bullet fired from a gun
    (ii) a rocket taking off from ground
    (iii) flying of a jet-aeroplane
    (iv) a car hitting a stone wall
    (v) a falling stone stopped by the ground
68. Explain the following
    (i) Why does a gun recoil backward when fired?

(ii) Why does an inflated balloon rise up vertically for some distance when punctured from below?
(iii) Why do the pieces of a cracker in all directions, when it is burst?
(iv) Why a boat man pushes the bank of the river with a pole to take his boat into the river?
(v) Why do the tiny rockets used on festivals rise up when ignited?

Numerical Problems:

69. A girl of mass 40 kg jumps with a horizontal velocity of 5 m/s onto a stationary cart with frictionless wheels. The mass of the cart is 3 kg. What is her velocity as the cart starts moving? Assume that there is no external unbalanced force working in the horizontal direction.
70. A motor car of mass 1200 kg is moving along a straight line with a uniform velocity of 90 km/h. Its velocity is slowed down to 18 km/h 4s by an unbalanced external force. Calculate the acceleration and change in momentum. Also calculate the magnitude of the force required.
71. By how much does the momentum of a body of mass 5 kg change when its speed
    (i) decreases from 20 m/s to 0.20 m/s; and
    (ii) increases from 30 m/s to 40 m/s
72. Calculate the mass of the body, when a force of 525 N, produces an acceleration of 3.5 m/s^2.
73. Which would require a greater force accelerating a 2 kg mass at 5 ms^{-2} or a 4 kg mass at 2 ms^{-2}.
74. A man pushes a box of mass 50 kg with a force of 80 N. What will be the acceleration of the box due to this force? What would be the acceleration if the mass were halved?
75. For how long should a force of 100 N act on a body of mass 20 kg so that it acquires a velocity of 100 m/s?
76. A car of mass 800 kg travelling at a speed of 10 ms^{-1} is brought to rest in 20 seconds by applying brakes. Calculate the average braking force acting on the wheels.
77. A bullet of mass 10 g is fired at a speed of 400 ms^{-1} from the gun of mass 4 kg. What is the recoil of the gun?
78. A 40 kg shell is lying at a speed of 72 km/h. It explodes into two pieces, one piece of mass 15 kg stops. Calculate the velocity of the other piece.
79. A bullet of mass 10g is fired with a rifle. The bullet takes 0.003 s to move through its barrel and leaves it with a velocity of 300 m/s. What is the force exerted on the bullet by the rifle?