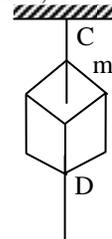


# LEVEL # 1

Questions based on

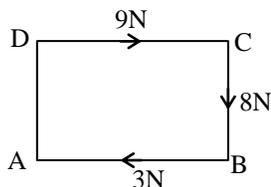
## General concept

- Q.1** The Newton's laws of motion are valid in-  
(A) inertial frames  
(B) non-inertial frames  
(C) rotating frames  
(D) accelerated frames
- Q.2** The incorrect statement about Newton's second law of motion is-  
(A) it provides a measure of inertia  
(B) it provides a measure of force  
(C) it relates force and acceleration  
(D) it relates momentum and force
- Q.3** Newton's third law is equivalent to the-  
(A) law of conservation of linear momentum  
(B) law of conservation of angular momentum  
(C) law of conservation of energy  
(D) law of conservation of energy and mass
- Q.4** We can derive Newton's-  
(A) second and third laws from the first law  
(B) first and second laws from the third law  
(C) third and first laws from the second law  
(D) All the three laws are independent of each others
- Q.5** Ratio of inertial mass to gravitational mass is-  
(A) 1 : 2  
(B) 1 : 1  
(C) 2 : 1  
(D) No fixed number
- Q.6** A rider on horse back falls 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 where as lower part of the body moves forward with the horse  
(D) None of the above
- Q.7** 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)
- Q.8** When we jump out a boat standing in water it moves-  
(A) forward  
(B) backward  
(C) side ways  
(D) none of these
- Q.9** 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
- Q.10** You are on a friction less horizontal plane. How can you get off if no horizontal force is exerted by pushing against the surface ?  
(A) by jumping  
(B) by spitting or sneezing  
(C) by rolling your body on the surface  
(D) by running on the plane
- Q.11** 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
- Q.12** The incorrect relation is-  
(A)  $F = ma$   
(B)  $F = m \frac{dv}{dt}$   
(C)  $F = \frac{dp}{dt}$   
(D)  $F = mv$
- Q.13** A heavy block of mass  $m$  is supported by a cord C from the ceiling, and another cord D is attached to the bottom of the block. If a sudden jerk is given to D, then-



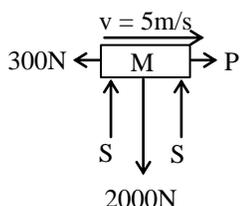
- (A) cord C breaks  
(B) cord D breaks  
(C) cord C and D both break  
(D) none of the cords breaks

- Q.14** ABCD is a rectangle forces of 9N, 8N, 3N act along the lines DC, CB and BA, respectively, in the directions indicated by the order of the letters. Then the resultant force is



- (A) 8 N (B) 5 N (C) 20 N (D) 10 N

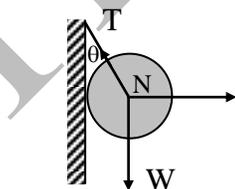
- Q.15** The forces acting on an object are shown in the fig. If the body moves horizontally at a constant speed of 5 m/s, then the values of the forces P and S are, respectively –



- (A) 0 N, 0 N (B) 300 N, 200 N  
(C) 300 N, 1000 N (D) 2000 N, 300 N

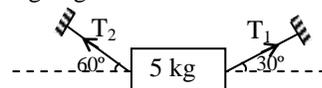
- Q.16** A person says that he measured the acceleration of a particle to be non-zero while no force was acting on the particle-
- (A) He is a liar  
(B) His clock might have run slow  
(C) His meter scale might have been longer than the standard  
(D) He might have non-inertial frame

- Q.17** A metal sphere is hung by a string fixed to a wall. The forces acting on the sphere are shown in fig. Which of the following statements is/are correct ?



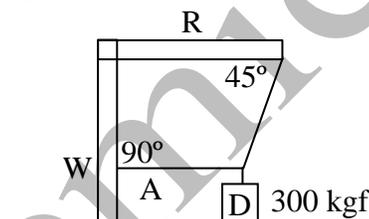
- (a)  $\vec{N} + \vec{T} + \vec{W} = 0$   
(b)  $T^2 = N^2 + W^2$   
(c)  $T = N + W$   
(d)  $N = W \tan \theta$
- (A) a, b, c (B) b, c, d  
(C) a, b, d (D) a, b, c, d

- Q.18** A body of mass 5 kg is suspended by the strings making angles  $60^\circ$  and  $30^\circ$  with the horizontal -



- (a)  $T_1 = 25$  N (b)  $T_2 = 25$  N  
(c)  $T_1 = 25\sqrt{3}$  N (d)  $T_2 = 25\sqrt{3}$  N  
(A) a, b (B) a, d (C) c, d (D) b, c

- Q.19** A block D weighing 300 kg is suspended by means of two cords A and B as shown in the figure. W is a vertical wall and R a horizontal rigid beam. The tension in the string A in kg is-



- (A) zero (B) 150 (C) 300 (D) 400

Questions based on **Motion of the lift**

- Q.20** A lift moves downwards with an acceleration  $a$ . A passenger in the lift drops a book. The acceleration of the book with respect to the floor of lift is- (assume acceleration due to gravity =  $g$ )  
(A)  $g$  (B)  $a$  (C)  $g - a$  (D)  $g + a$
- Q.21** The ratio of the weight of a man in a stationary lift and in a lift accelerating downwards with a uniform acceleration ' $a$ ' is 3:2. The acceleration of the lift is -  
(A)  $g/3$  (B)  $g/2$  (C)  $g$  (D)  $2g$
- Q.22** A lift is moving up with an acceleration of  $3.675 \text{ m/sec}^2$ . The weight of a man-  
(A) increases by 37.5%  
(B) decreases by 37.5%  
(C) increases by 137.5%  
(D) remains the same
- Q.23** If the tension in the cable supporting an elevator is equal to the weight of the elevator, the elevator may be -  
(a) going up with increasing speed  
(b) going down with increasing speed  
(c) going up with uniform speed  
(d) going down with uniform speed  
(A) a, d (B) a, b, c (C) c, d (D) a, b

- Q.24** The mass of a lift is 600 kg and it is moving upwards with a uniform acceleration of  $2 \text{ m/s}^2$ . Then the tension in the cable of the lift is-
- (A) 7080 N (B) 5880 N  
(C) 4680 N (D) zero N

Questions based on

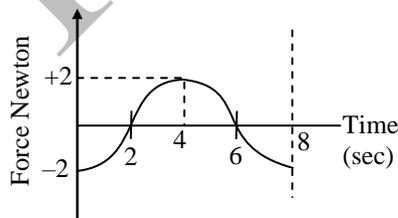
### Second law & third law

- Q.25** When a 1 Newton force acts on a 1 kg body that is able to move freely, the body receives-
- (A) A speed of  $1 \text{ m/sec}$   
(B) An acceleration of  $1 \text{ m/sec}^2$   
(C) An acceleration of  $980 \text{ cm/sec}^2$   
(D) An acceleration of  $1 \text{ cm/sec}^2$
- Q.26** A force of 10 Newton acts on a body of mass 20 kg for 10 seconds. The change produced in momentum is given by-
- (A)  $5 \text{ kg m/sec}$  (B)  $100 \text{ kg m/sec}$   
(C)  $200 \text{ kg m/sec}$  (D)  $2000 \text{ kg m/sec}$

- Q.27** A car travelling at a speed of 30 kilometer per hour is brought to a half in 8 metres by applying brakes. If the same car is travelling at 60 km per hour, it can be brought to a half with same braking power in-
- (A) 8 metres (B) 16 metres  
(C) 24 metres (D) 32 metres

- Q.28** A bullet of 5 g, travelling at a speed of 100 m/s penetrates a wooden block up to 6.0 cm. Then the average force applied by the bullet on the block is-
- (A) 417 N (B) 8333 N  
(C) 83.3 N (D) zero

- Q.29** A force-time graph for a linear motion is shown in figure where the segments are circular. The linear momentum gained between zero and 8 seconds in -



- (A)  $-2\pi \text{ N.s}$  (B)  $0 \text{ N.s}$   
(C)  $4\pi \text{ N.s}$  (D)  $-6\pi \text{ N.s}$

- Q.30** A particle moves in the xy plane under the action of a force  $\mathbf{F}$  such that the value of its linear momentum ( $\mathbf{P}$ ) at any time  $t$  is,  $P_x = 2 \cos t$ ,  $P_y = 2 \sin t$ . The angle  $\theta$  between  $\mathbf{P}$  and  $\mathbf{F}$  at that time  $t$  will be -
- (A)  $0^\circ$  (B)  $30^\circ$  (C)  $90^\circ$  (D)  $180^\circ$

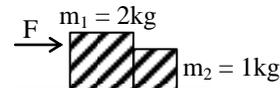
- Q.31** The linear momentum  $P$  of a body moving in one dimension varies with time according to the equation  $P = at^3 + bt$  where  $a$  and  $b$  are positive constants. The net force acting on the body is
- (A) proportional to  $t^2$   
(B) a constant  
(C) proportional to  $t$   
(D) inversely proportional to  $t$

- Q.32** A player catches a ball of 200 g moving with a speed of 20 m/s. If the time taken to complete the catch is 0.5 sec, the force exerted on the players hand is -
- (A) 8 N (B) 4 N (C) 2 N (D) 0 N

Questions based on

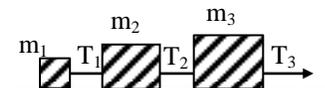
### Motion of the blocks

- Q.33** Blocks are in contact on a frictionless table. A horizontal force  $F = 3\text{N}$  is applied to one block as shown. The force exerted by the smaller block  $m_2$  on block  $m_1$  is-



- (A) 1 N (B) 2 N  
(C) 3 N (D) 6 N

- Q.34** Three blocks are connected as shown, on a horizontal frictionless table and pulled to the right with a force  $T_3 = 60 \text{ N}$ . If  $m_1 = 10 \text{ kg}$ ,  $m_2 = 20 \text{ kg}$  and  $m_3 = 30 \text{ kg}$ , the tension  $T_2$  is-

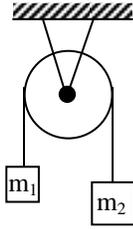


- (A) 10 N (B) 20 N  
(C) 30 N (D) 60 N

- Q.35** A block of mass  $M$  is pulled along a horizontal frictionless surface by a rope of mass  $m$ . A force  $P$  is being applied to one end of the rope, the force that the rope exerts on the block  $M$  is-

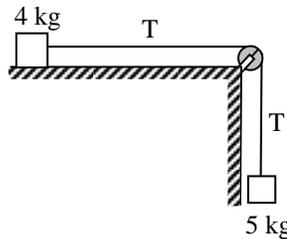
- (A)  $\left(\frac{M}{M+m}\right)P$  (B)  $\left(\frac{m}{M+m}\right)P$   
(C)  $\left(\frac{M+m}{m}\right)P$  (D)  $\left(\frac{M+m}{M}\right)P$

- Q.36** Two masses are hanging vertically over frictionless pulley. The acceleration of the two masses is-



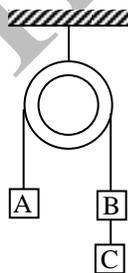
- (A)  $\frac{m_1}{m_2}g$                       (B)  $\frac{m_2}{m_1}g$   
 (C)  $\left(\frac{m_2 - m_1}{m_1 + m_2}\right)g$                       (D)  $\left(\frac{m_1 + m_2}{m_2 - m_1}\right)g$

- Q.37** Two bodies of 5 kg and 4 kg are tied to a string as shown in the figure. If the table and pulley both are smooth, acceleration of 5 kg body will be equal to-



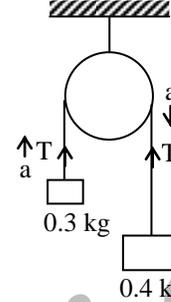
- (A)  $g$                       (B)  $g/9$                       (C)  $4g/9$                       (D)  $5g/9$

- Q.38** Three equal weights A, B, C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in the fig. The tension in the string connecting weights B and C is-



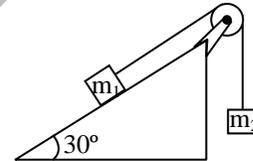
- (A) zero                      (B) 13 Newton  
 (C) 3.3 Newton                      (D) 19.6 Newton

- Q.39** Two bodies of mass 0.3 kg and 0.4 kg are tied to the ends of a weightless string which passes over a smooth pulley as shown in the figure. The tension in the string is-



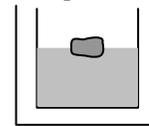
- (A) 3.06 Newton                      (B) 3.36 Newton  
 (C) 4.05 Newton                      (D) 3.0 Newton

- Q.40** A block of mass  $m_1 = 2$  kg on a smooth inclined plane at angle  $30^\circ$  is connected to a second block of mass  $m_2 = 3$  kg by a cord passing over a frictionless pulley as shown in figure. The acceleration of each block is- (Assume  $g = 10$  m/sec<sup>2</sup>)



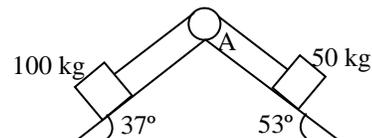
- (A) 2 m/sec<sup>2</sup>                      (B) 4 m/sec<sup>2</sup>  
 (C) 6 m/sec<sup>2</sup>                      (D) 8 m/sec<sup>2</sup>

- Q.41** A body floats in liquid contained in a beaker. If the whole system as shown in figure falls under gravity then the upthrust on the body is-



- (A) 2 mg                      (B) zero  
 (C) mg                      (D) less than mg

- Q.42** Two blocks are connected by a cord passing over a small frictionless pulley and resting on frictionless planes as shown in the figure. The acceleration of the blocks is-



- (A) 0.33 m/s<sup>2</sup>                      (B) 0.66 m/s<sup>2</sup>  
 (C) 1 m/s<sup>2</sup>                      (D) 1.32 m/s<sup>2</sup>

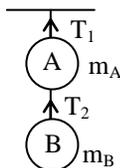
**Q.43** A thief stole a box full of valuable articles of weight  $W$  and while carrying it on his back, he jumped down a wall of height  $h$  from the ground. Before he reached the ground, he experienced a load of

- (A)  $2W$  (B)  $W$  (C)  $W/2$  (D) zero

**Q.44** A block of mass  $m$  is placed on a smooth wedge of inclination  $\theta$ . The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block has magnitude -

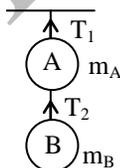
- (A)  $mg$  (B)  $mg/\cos\theta$   
(C)  $mg \cos\theta$  (D)  $mg \tan\theta$

**Q.45** Two objects A and B of masses  $m_A$  and  $m_B$  are attached by strings as shown in fig. If they are given upward acceleration, then the ratio of tension  $T_1 : T_2$  is -



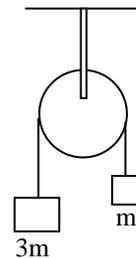
- (A)  $(m_A + m_B)/m_B$  (B)  $(m_A + m_B)/m_A$   
(C)  $\frac{m_A + m_B}{m_A - m_B}$  (D)  $\frac{m_A - m_B}{m_A + m_B}$

**Q.46** If the arrangement in fig is given a downward acceleration  $(a)$  then the ratio of tensions  $T_1$  and  $T_2$  in strings, is -



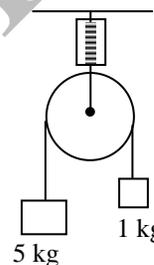
- (A)  $(m_A + m_B)/m_B$  (B)  $(m_A + m_B)/m_A$   
(C)  $\frac{m_A - m_B}{m_A + m_B}$  (D) None of these

**Q.47** In given figure find out the acceleration of any of the particle-



- (A)  $(1/2)g$  (B)  $g$   
(C)  $(1/3)g$  (D)  $(1/4)g$

**Q.48** In the figure a smooth pulley of negligible weight is suspended by a spring balance. Weights of 1kg and 5 kg are attached to the opposite ends of a string passing over the pulley and move with acceleration because of gravity. During the motion, the spring balance reads a weight of -



- (A) 6 kg  
(B) less than 6 kg  
(C) more than 6 kg  
(D) may be more or less than 6 kg

**Questions based on Friction Force**

**Q.49** A block is placed on a rough floor and a horizontal force  $F$  is applied on it. The force of friction  $f$  by the floor on the block is measured for different values of  $F$  and a graph is plotted between them -

- (a) The graph is a straight line of slope  $45^\circ$   
(b) The graph is straight line parallel to the  $F$  axis  
(c) The graph is a straight line of slope  $45^\circ$  for small  $F$  and a straight line parallel to the  $F$ -axis for large  $F$ .  
(d) There is small kink on the graph  
(A) c, d (B) a, d (C) a, b (D) a, c

**Q.50** Mark the correct statements about the friction between two bodies -

- (a) static friction is always greater than the kinetic friction
- (b) coefficient of static friction is always greater than the coefficient of kinetic friction
- (c) limiting friction is always greater than the kinetic friction
- (d) limiting friction is never less than static friction

- (A) b, c, d                      (B) a, b, c  
(C) a, c, d                      (D) a, b, d

**Q.51** A block of mass 2kg rests on a rough inclined plane making an angle of  $30^\circ$  with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is-

- (A)  $0.7 \times 9.8$  Newton
- (B) 9.8 Newton
- (C)  $0.7 \times 9.8 \sqrt{3}$  Newton
- (D)  $9.8 \times \sqrt{3}$  Newton

**Q.52** A body of mass M is kept on a rough horizontal surface (friction coefficient =  $\mu$ ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on A is F, where -

- (A)  $F = Mg$
- (B)  $F = \mu Mg$
- (C)  $Mg \leq F \leq Mg \sqrt{1 + \mu^2}$
- (D)  $Mg \geq F \geq Mg \sqrt{1 - \mu^2}$

**Q.53** In a situation the contact force by a rough horizontal surface on a body placed on it has constant magnitude if the angle between this force and the vertical is decreased the frictional force between the surface and the body will -

- (A) increase
- (B) decrease
- (C) remain the same
- (D) may increase or decrease

**Q.54** It is easier to pull a body than to push, because -

- (A) the coefficient of friction is more in pushing than that in pulling
- (B) the friction force is more in pushing than that in pulling
- (C) the body does not move forward when pushed
- (D) None of these

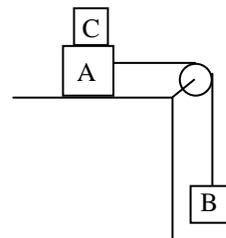
**Q.55** A block of metal is lying on the floor of a bus. The maximum acceleration which can be given to the bus so that the block may remain at rest, will be -

- (A)  $\mu g$     (B)  $\mu/g$     (C)  $\mu^2 g$     (D)  $\mu g^2$

**Q.56** A chain is lying on a rough table with a fraction  $1/n$  of its length hanging down from the edge of the table. if it is just on the point of sliding down from the table, then the coefficient of friction between the table and the chain is -

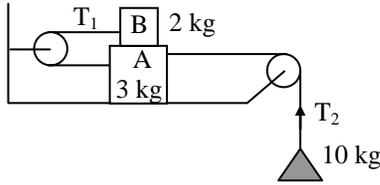
- (A)  $\frac{1}{n}$                                       (B)  $\frac{1}{(n-1)}$   
(C)  $\frac{1}{(n+1)}$                                 (D)  $\frac{n-1}{(n+1)}$

**Q.57** Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley at a corner of a table as shown in the adjoining diagram. The coefficient of friction of A with the table is 0.2. The minimum mass of C that may be placed on A to prevent it from moving is equal to -



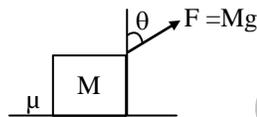
- (A) 0 kg                                      (B) 5 kg  
(C) 10 kg                                    (D) 15 kg

**Q.58** In the figure, the block A and B are of masses 3 kg and 2 kg. The coefficient of friction between the two blocks A and B is 0.3. The surface of the table is smooth. Then -



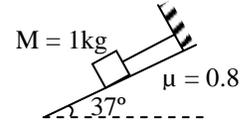
- (a) The acceleration of masses is  $5.75 \text{ ms}^{-2}$   
 (b) The tensions are  $T_1$  and  $T_2$  in the strings are 90.36 N and 17.55 N  
 (c) Acceleration of masses is  $8.15 \text{ ms}^{-2}$   
 (d) Tension  $T_1$  and  $T_2$  in the strings are 17.38 N and 40.50 N
- (A) a, c                      (B) c, d  
 (C) b, d                      (D) a, d

**Q.59** A block of mass  $M$  rests on a rough horizontal surface as shown. Coefficient of friction between the block and the surface is  $\mu$ . A force  $F = Mg$  acting at angle  $\theta$  with the vertical side of the block pulls it in which of the following cases the block can be pulled along the surface ?



- (A)  $\tan \theta \geq \mu$                       (B)  $\tan (\theta/2) \geq \mu$   
 (C)  $\cot \theta \geq \mu$                       (D)  $\cot (\theta/2) \geq \mu$

**Q.60** For the arrangement shown in fig., the tension in the string to prevent it from sliding down, is -



- (A) 6 N                                      (B) 6.4 N  
 (C) 0.4 N                                  (D) None of these

**Q.61** A block moves down a smooth inclined plane of inclination  $\theta$ . Its velocity on reaching the bottom is  $v$ . If it slides down a rough inclined plane of some inclination, its velocity on reaching the bottom is  $v/n$ , where  $n$  is a number greater than 0. The coefficient of friction is given by -

- (A)  $\mu = \tan \theta \left[ \frac{1}{n^2} \right]$   
 (B)  $\mu = \cot \theta \left[ \frac{1}{n^2} \right]$   
 (C)  $\mu = \tan \theta \left[ \frac{1}{n^2} \right]^{1/2}$   
 (D)  $\mu = \cot \theta \left[ \frac{1}{n^2} \right]^{1/2}$

# ANSWER KEY

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## LEVEL # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	A	A	A	C	B	C	B	B	C	B	C	D	B	D	C	D	C	B	C	C
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	A	A	C	A	B	B	D	A	B	C	A	A	A	C	A	C	D	B	B	B
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	B	D	D	B	A	A	A	B	A	A	B	C	B	B	A	B	D	D	D	D
Q.No.	61																			
Ans.	A																			