IIT-JEE-2013-P2-Model

Time:2:00 PM to 5:00 PM **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 9 – 16)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 17 – 20)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 –28)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 29 – 36)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 37 – 40)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 48)	Questions with Multiple Correct Choice	3	-1	8	24
Sec – II(Q.N : 49 – 56)	Questions with Comprehension Type (4 Comprehensions – 2 +2+2+2 = 8Q)	3	-1	8	24
Sec – III(Q.N : 57 – 60)	Matrix Matching Type	3	-1	4	12
Total				**20**	**60**

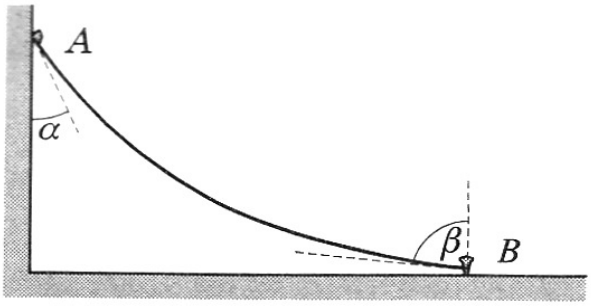
PHYSICS: **Max. Marks : 60**

SECTION – I

(MULTIPLE CORRECT CHOICE TYPE)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE is/ are correct**

1. A uniform cable is tied between two nails A and B, first on a wall and the second on the ground. The rope assumes a curved shape, which is known as "catenary". The rope nowhere touches the ground. The tangents to the catenary of the rope make angles α *and* β with the vertical at the nails A and B.



Which of the following conclusions can you make for tension force developed in the rope?

A) Horizontal component of the tension force in the rope is uniform

B) Vertical component of the tension force increases with increase in height.

C) Angle α can be greater than angle β.

D) Angle α cannot assume a value of 0º.

2. A 3 kg block of wood is on a level surface where $\mu_s = 0.25 \& \mu_k = 0.2$. A force of 7 N is being applied horizontally to the block. Mark the correct statement(s) regarding this situation.

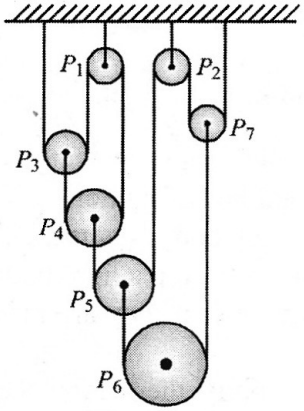
A) If the bock is initially at rest, it will remain at rest and friction force will be about 7 N.

B) If the block is initially moving, then it will continue its motion forever if force applied is in the direction of motion of the block.

C) If the block is initially moving and the direction of applied force is same as that of motion of block, then block moves with an acceleration of $\frac{1}{3} ms^{-2}$ along its initial direction of motion.

D) If the block is initially moving and direction of applied force is opposite to that of initial motion of block, then block decelerates, comes to a stop, and starts moving in the opposite direction.

3. Seven pulleys are connected with the help of three light strings as shown in the figure below. Consider P_3, P_4, P_5 as light pulleys and pulleys P_6 & P_7 have masses m each. For this arrangement, mark the correct statement(s).



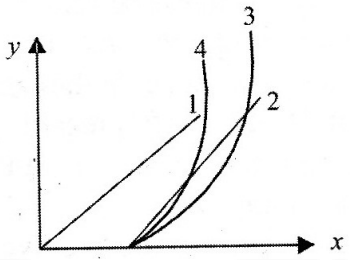
A) Tension in the string connecting P_1, P_3 & P_4 is zero

B) Tension in the string connecting P_1, P_3 & P_4 is mg/3.

C) Tensions in all the three strings are same and equal to zero.

D) Acceleration of P_6 is g downwards and that of P_7 is g upwards.

4. A block is resting over a rough horizontal floor. At t =0, a time –varying horizontal force starts acting on it, the force is described by equation $F = kt$, where k is constant and t is in seconds. Mark the correct statement(s) for this situation.



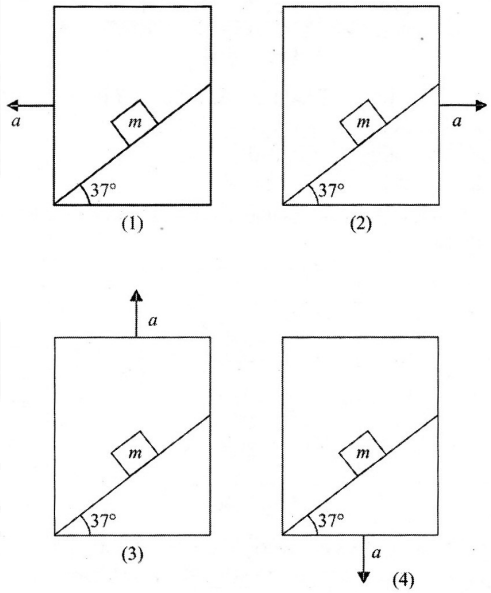
A) Curve 1 shows acceleration –time graph

B) Curve 2 shows acceleration-time graph

C) Curve 3 shows velocity-time graph

D) Curve 4 shows displacement-time graph

5. A block of mass m is placed on a smooth wedge. The wedge can be accelerated in four manners marked as (1), (2), (3), and (4) as shown. If the normal reactions is situations $(1),(2),(3)\,\&\,(4)$ are $N_1,N_2,N_3\,\&\,N_4$, respectively and acceleration with which the block slides on the wedge in the situations are $b_1,b_2,b_3\,\&\,b_4$ respectively, then



A) $N_3 > N_1 > N_2 > N_4$ B) $N_4 > N_3 > N_1 > N_2$

C) $b_2 > b_3 > b_4 > b_1$ D) $b_2 > b_3 > b_1 > b_4$

6. The acceleration of a particle as observed from two different frames $S_1\,\&\,S_2$ have equal magnitudes of $2ms^{-2}$

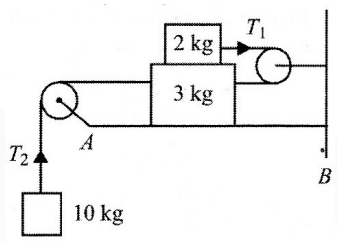
A) The relative acceleration of the frame may either be zero or $4ms^{-2}$ only.

B) Their relative acceleration may have any value between 1 and $4ms^{-2}$

C) Both the frames may be stationary with respect to earth.

D) The frames may be moving with same acceleration in same direction.

7. Coefficient of friction between the two blocks is 0.3. Whereas the surface AB is smooth.



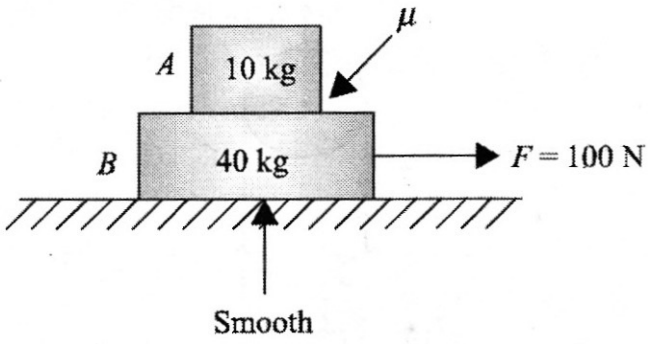
A) Acceleration of the masses is $88/15\, ms^{-2}$

B) Net force acting on 3 kg mass is greater than that on 2 kg mass.

C) Tension $T_2 > T_1$

D) Since 10 kg mass is accelerating downwards, so net force acting on it should be greater than any of the two blocks shown in the figure.

8. A 10 kg block is placed on top of 40 kg block as shown. A horizontal force F acting on B causes an acceleration of $2ms^{-2}$ to B. For this situation mark out the correct statement(s).



A) The acceleration of A may be $2ms^{-2}$ or less than $2ms^{-2}$

B) The acceleration of A must also be $2ms^{-2}$

C) The coefficient of friction between the blocks may be 0.2.

D) The coefficient of friction between the blocks must be 0.2 only

SECTION - II
(COMPREHENSION TYPE)

This section contains **4 groups of questions.** Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONLY ONE** is **correct.**

Paragraph for Questions 9 and 10

In an experimental demonstration, a small block is placed on a wooden plank, which can move on a straight horizontal track. The plank begins from rest at the instant t = 0, and accelerates till the instant $t = t_2$ with a velocity v given by the equation $v = kt^2$, where k is a positive constant. There after the plank is maintained to move with a constant velocity acquired until the instant when acceleration ends. The block begins to slide at $t = t_1$ and stops sliding at $t = t_3$. You observe that $0 < t_1 < t_2 < t_3$ and are informed to assume acceleration due to gravity equal to be g.

9. The coefficient of static friction between the block and the plank is

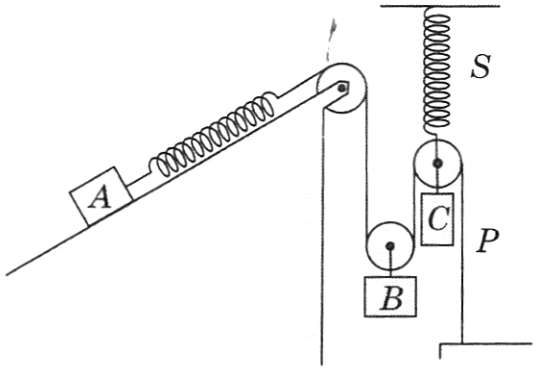
A) $\frac{2kt_1}{g}$ B) $\frac{2kt_2}{g}$ C) $\frac{2kt_2^2}{gt_1}$ D) $\frac{2k(t_2 - t_1)}{g}$

10. Coefficient of kinetic friction between the block and the plank is

A) $\frac{kt_3^2}{gt_1}$ B) $\frac{kt_1t_3}{gt_2}$ C) $\frac{k(t_2 - t_1)^2}{g(t_3 - t_1)}$ D) $\frac{k(t_2^2 - t_1^2)}{g(t_3 - t_1)}$

Paragraph for Questions 11 and 12

The system shown in the figure is in equilibrium. The blocks A, B and C all are of same mass m and the pulleys are ideal. There is no friction anywhere. The thread is inextensible and very light.



11. Find the accelerations of the blocks A,B and C, immediately after the thread is cut at point P

A) $g/2(\swarrow), g(\downarrow), g(\uparrow)$ B) $g/2(\swarrow), g(\uparrow), g(\uparrow)$

C) $g/2(\nearrow), g(\downarrow), g(\uparrow)$ D) $0, 0, g(\downarrow)$

12. Find the accelerations of the blocks A,B and C, immediately after the spring is cut at point S.

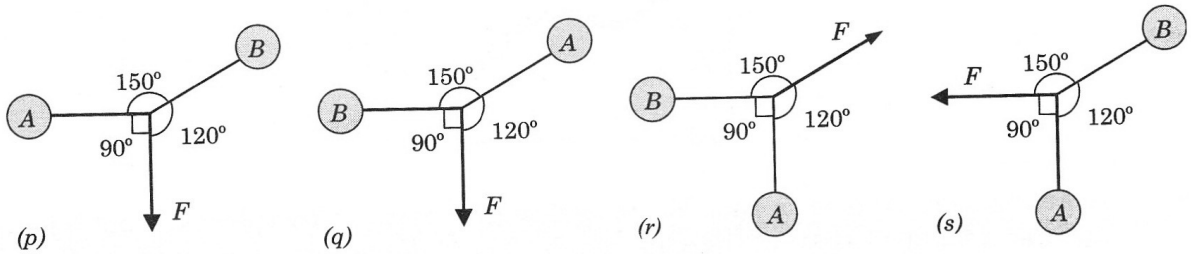
A) $g/2(\swarrow), g(\downarrow), g(\uparrow)$ B) $g/2(\swarrow), g(\uparrow), g(\uparrow)$

C) $g/2(\nearrow), g(\downarrow), g(\uparrow)$ D) $0, 0, g(\downarrow)$

Paragraph for Questions 13 and 14

Two small disks A and B of masses 1kg and 2kg respectively connected by a light thread are placed on a frictionless table. At the middle of the thread is tied another light

thread. The two segments of the former thread and this new thread are straight and arranged horizontally making angles of 90º, 120º and 150º with each other. Resembling the description, following four arrangements are shown



When the free end of the new thread is pulled with a force F = 10N, both the disks begin to move with equal magnitude of acceleration.

13. Which of the above arrangements satisfies the given condition?

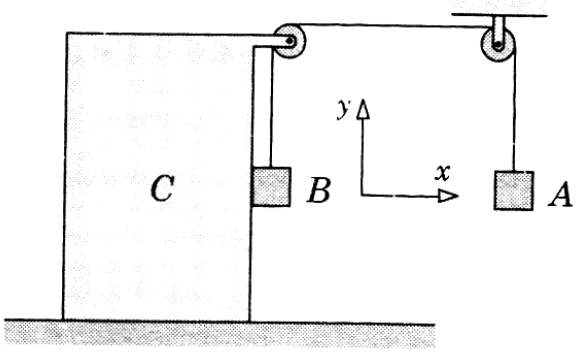
A) p B) q C) r D) s

14. What is the magnitude of the acceleration? (in m/s^2)

A) $5\sqrt{3}$ B) $\frac{10}{\sqrt{3}}$ C) $10\sqrt{3}$ D) None of these

Paragraph for Questions 15 and 16

In the given arrangement blocks A, B and C each are of equal mass, pulleys are light and their axles are frictionless, cords are light and inextensible. There is no friction between the blocks B and C as well as between the horizontal floor and the block C. If the system is set free, we have to find acceleration vectors of all the blocks. Acceleration of free fall is $g = 10 m/s^2$



15. Acceleration of block B is

A) $\overrightarrow{a_B} = \left(6\hat{i} - 3\hat{j}\right) m/s^2$ B) $\overrightarrow{a_B} = \left(8\hat{i} - 4\hat{j}\right) m/s^2$

C) $\overrightarrow{a_B} = \left(2\hat{i} - 2\hat{j}\right) m/s^2$ D) $\overrightarrow{a_B} = \left(4\hat{i} - 2\hat{j}\right) m/s^2$

16. Acceleration of C is

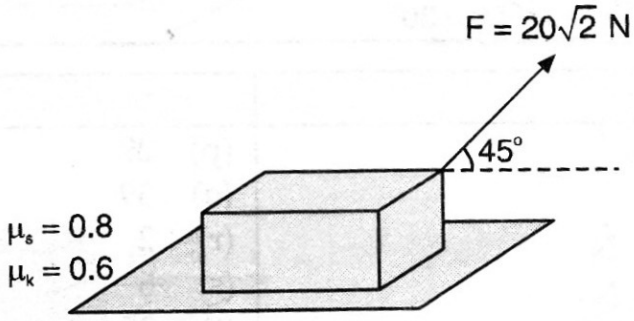
A) $2\hat{i}\, m/s^2$ B) $4\hat{i}\, m/s^2$ C) $5\hat{i}\, m/s^2$ D) $3\hat{i}\, m/s^2$

SECTION – III

(MATRIX MATCH TYPE)

This section contains **4 multiple choice questions.** Each question has matching lists. The codes for the lists have choices (A), (B), (C), and (D) out of which **ONLY ONE** is correct.

17. In the diagram shown in figure a light string is attached to the mass and is pulled by a constant force $F = 20\sqrt{2}$ N which makes an angle of 45^o with the horizontal. Taking $g = 10ms^{-2}$, match the quantities in Column – I with their respective match(es) in Column-II

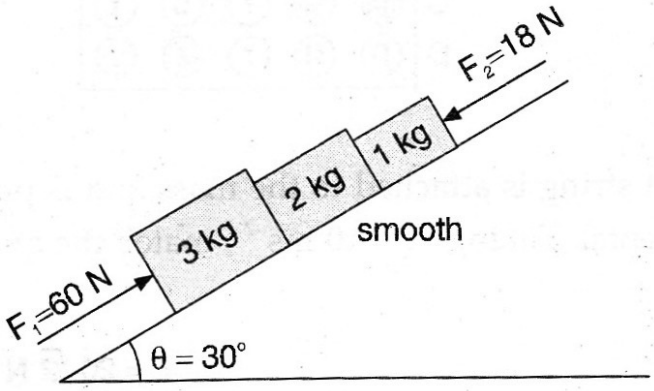


Column-I		Column-II	
A)	Normal reaction, in Newton	p)	$20\sqrt{2}$
B)	Force of friction, in Newton	q)	20
C)	Acceleration of block, in cms^{-2}	r)	12
D)	Tension in the string, in Newton	s)	200

A) A – q; B – r; C – s; D – p B) A – q; B – p; C – s; D – r

C) A – q; B – r; C – p; D – s D) A – s; B – r; C – p; D – q

18. In the diagram shown in figure, match the following $\left(g = 10 ms^{-2}\right)$



List-I	List-II
A) Acceleration of 1 kg block, in ms^{-2}	p) 29
B) Net force on 3 kg block, in N	q) 39
C) Force exerted on 2 kg by 1 kg, in N	r) 2
D) Force exerted on 3 kg by 2kg , in N	s) 6
	t) 25

A) A – r; B – s; C – t; D – q

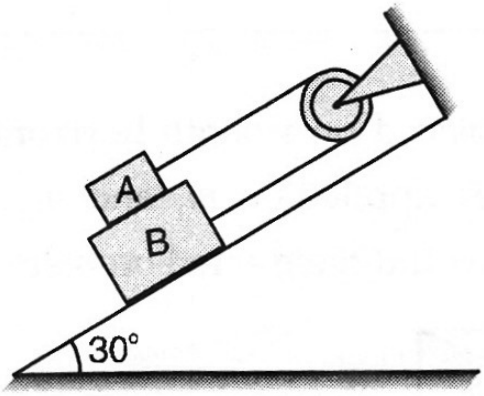
B) A – r; B – s; C – q; D – t

C) A – r; B – q; C – s; D – t

D) A – s; B – q; C – p; D – t

19. In the arrangement shown, a block A of mass $m_A = 1kg$ is sliding on a block B of mass $m_B = 4kg$. Friction is absent between all surface in contact. Based on this information and $g = 10ms^{-2}$, match the items of COLUMN-I with their respective values in COLUMN-II

COLUMN-I	**COLUMN-II**
A) Acceleration of A, in ms^{-2}	p) $5\sqrt{3}$
B) Thrust on the pulley, in N	q) $25\sqrt{3}$
C) Force exerted by A on B, in N	r) 3
D) Force exerted by B on incline, in N	s) 8
	t) 16



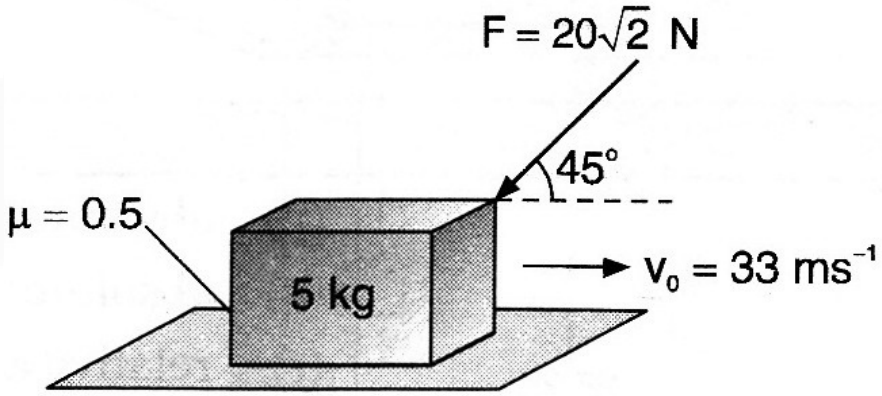
A) A – s; B – r; C – q; D – t

B) A – r; B – s; C – q; D – t

C) A – r; B – t; C – p; D – q

D) A – s; B – p; C – q; D – t

20. A block of mass $m = 5kg$ is moving right with velocity $\upsilon_0 = 33ms^{-1}$ on a rough surface. A force $F = 20\sqrt{2}$ is applied as shown $\left(g = 10ms^{-2}\right)$



List-I	List-II
A) At t = 2.5 s, friction force is	p) zero
B) At t = 4.5 s, friction force is	q) 55 N
C) At t = 2.5 s net retardation force is	r) 35 N
D) At t = 4.5 s, net force on block is	s) 15 N
	t) 20 N

A) A – r; B – t; C – p; D – q

B) A – r; B – p; C – q; D – s

C) A – p; B – q; C – s; D – r

D) A – s; B – r; C – p; D – q