PHYSICS

NCERT - FULL MARKS PHYSICS(TAMIL)

LAWS OF MOTION

Example

1. A book of mass m is at rest on the table.

What are the forces acting on the book?

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2. A book of mass m is at rest on the table.

What are the forces exerted by the book?

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3. A book of mass m is at rest on the table.
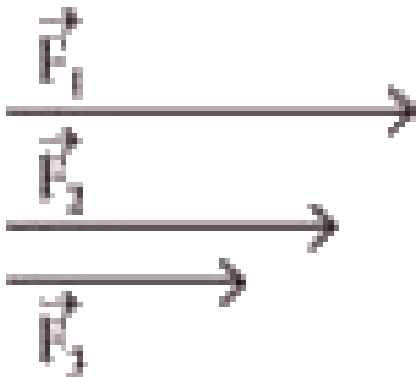
Draw the free body diagram for the book.

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4. If two objects of masses 2.5 kg and 100 kg experience the same force 5 N, what is the acceleration experienced by each of them?

5. Which is the greatest force among the three force $\vec{F}_1, \vec{F}_2, \vec{F}_3$ shown below

6. Apply Newton's second law to a mango hanging from a tree. (Mass of the mango is 400 gm)

7. A person rides a bike with a constant velocity $\vec{c}$ with respect to ground and another biker accelerates with acceleration $\vec{a}$

with respect to ground. Who can apply Newton's second law with respect to a stationary observer on the ground?

8. The position vector of a particle is given $\overrightarrow{r} = 3t\hat{i} + 5\hat{j} + 7\hat{k}$ Find the direction in which the particle experiences net force?

9. Consider a bob attached to a string, hanging from a stand. It oscillates as shown in the figure.

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10. Th e velocity of a particle moving in a plane is given by the following diagram. Find out the direction of force acting on the particle?

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11. Apply Newton's second law for an object at rest on Earth and analyse the result.

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12. A particle of mass 2 kg experiences two forces,

$$\overrightarrow{F}_1 = 8\hat{j} + 7\hat{k} \text{ and } \overrightarrow{F}_2 = 3\hat{i} - 4\hat{j} + 3\hat{k}$$

What is the acceleration of the particle?

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13. Identify the forces acting on blocks A, B and C shown in the figure.

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14. Consider a horse attached to the cart which is initially at rest. If the horse starts walking forward, the cart also accelerates in the forward direction. If the horse pulls the cart with force F_h in forward direction, then according to Newton's third law, the cart also pulls the horse by equivalent opposite force

$F_c = F_h$ in backward direction. Then total force on 'cart+horse' is zero. Why is it then the 'cart+horse' accelerates and moves forward?

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15. The position of the particle is represented by $y = ut - \dfrac{1}{2}gt^2$.
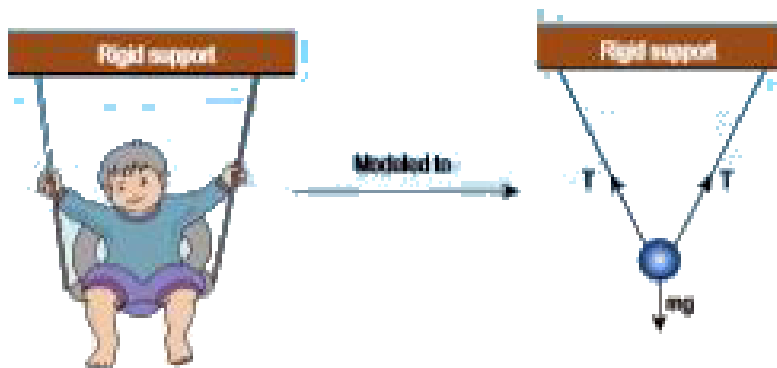
a) What is the force acting on the particle?

b) What is the momentum of the particle?

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16. A baby is playing in a swing which is hanging with the help of two identical chains is at rest. Identify the forces acting on the baby. Apply Lami's theorem and find out the tension acting on the chain.

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17. Identify the internal and external forces acting on the following systems.

Earth alone as a system

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18. Identify the internal and external forces acting on the following systems.

Earth and Sun as a system

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19. Identify the internal and external forces acting on the following systems.

Our body as a system while walking

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20. Identify the internal and external forces acting on the following systems.

Our body + Earth as a system

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21. An object of mass 10 kg moving with a speed of $15ms^{-1}$ hits the wall and comes to rest within

a) 0.03 second

b) 10 second

Calculate the impulse and average force acting on the object in both the cases.

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22. Consider an object of mass 2 kg resting on the floor. The coefficient of static friction

between the object and the floor is $us_s = 0.8$.

What force must be applied on the object to

move it?

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23. Consider an object of mass 50 kg at rest on

the floor. A Force of 5 N is applied on the

object but it does not move. What is the

frictional force that acts on the object?

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24. Two bodies of masses 7 kg and 5 kg are connected by a light string passing over a smooth pulley at the edge of the table as shown in the figure. The coefficient of static friction between the surfaces (body and table) is 0.9. Will the mass $m_1 = 7$ kg on the surface move? If not what value of m_2 should be used so that mass 7 kg begins to slide on the table?
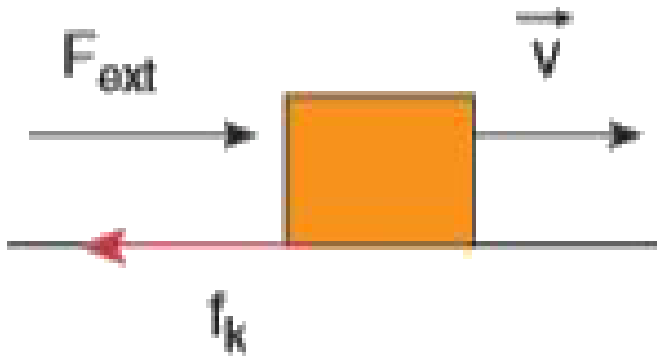
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25. A block of mass m slides down the plane inclined at an angle $60°$ with an acceleration $\dfrac{g}{2}$. Find the coefficient of kinetic friction?

26. Consider an object moving on a horizontal surface with a constant velocity. Some external force is applied on the object to keep the object moving with a constant velocity. What

is the net force acting on the object?

27. If a stone of mass 0.25 kg tied to a string executes uniform circular motion with a speed of $2ms^{-1}$ of radius 3 m, what is the magnitude of tensional force acting on the stone?

28. The Moon orbits the Earth once in 27.3 days in an almost circular orbit. Calculate the centripetal acceleration experienced by the Moon? (Radius of the Earth is $6.4 \times 10^6 m$)

29. Consider a circular leveled road of radius 10 m having coefficient of static friction 0.81.

Three cars (A, B and C) are travelling with speed $7ms^{-1}$, $8ms^{-1}$ and $10ms^{-1}$ respectively. Which car will skid when it moves in the circular level road? $(g = 10ms^{-2})$

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30. Consider a circular road of radius 20 meter banked at an angle of 15 degree. With what speed a car has to move on the turn so that it will have safe turn?

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31. Calculate the centrifugal force experienced by a man of 60 kg standing at Chennai? (Given: Latitude of Chennai is $13°$

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Exercise I Multiple Choice Questions

1. When a car takes a sudden left turn in the curved road, passengers are pushed towards the right due to

A. inertia of direction

B. inertia of motion

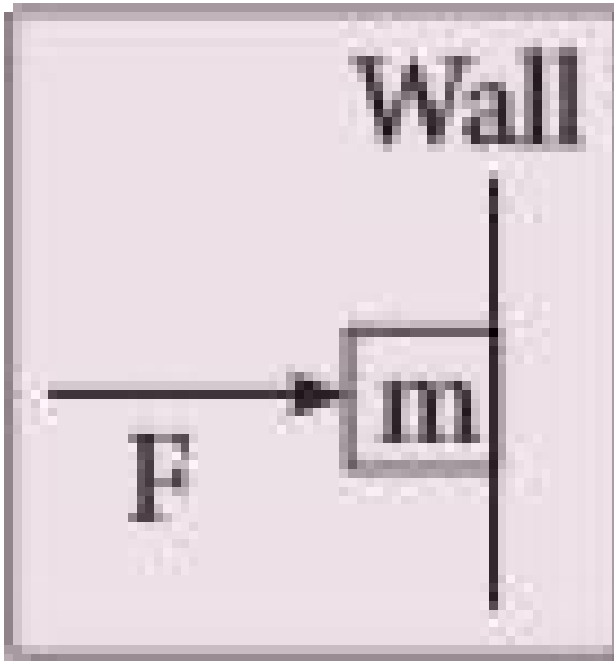C. inertia of rest

D. absence of inertia

Answer: A

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2. An object of mass m held against a vertical

wall by applying horizontal force F as shown in

the figure. Th e minimum value of the force F

is

A. Less than mg

B. Equal to mg

C. Greater than mg

D. Cannot determine

Answer: C

3. A vehicle is moving along the positive x direction, if sudden brake is applied, then

    A. Frictional force acting on the vehicle is along negative x direction

    B. frictional force acting on the vehicle is along positive x direction

C. no frictional force acts on the vehicle

D. frictional force acts in downward direction

Answer: A

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4. A book is at rest on the table which exerts a normal force on the book. If this force is considered as reaction force, what is the action force according to Newton's third law

A. Gravitational force exerted by Earth on the book

B. Gravitational force exerted by the book on Earth

C. Normal force exerted by the book on the table

D. None of the above

Answer: C

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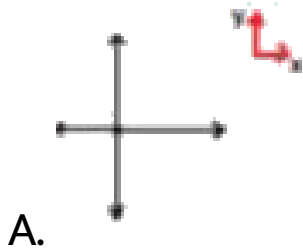**5.** Two masses m_1 and m_2 are experiencing the same force where $m_1 < m_2$. The ratio of their acceleration $\dfrac{a_1}{a_2}$ is
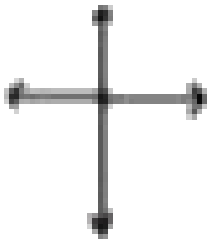
A. 1

B. less than 1

C. greater than 1

D. all the three cases

Answer: C

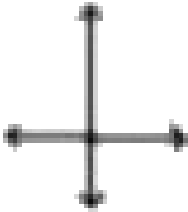**6.** Choose appropriate free body diagram for the particle experiencing net acceleration along negative y direction. (Each arrow mark represents the force acting on the system).
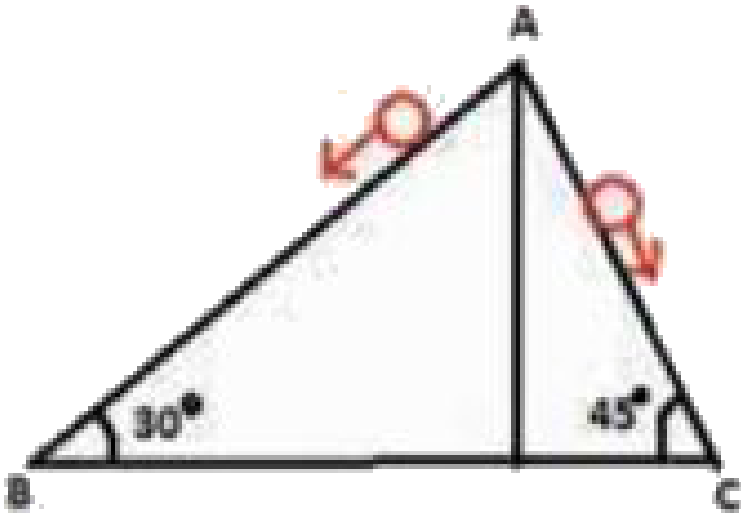
A.

B.
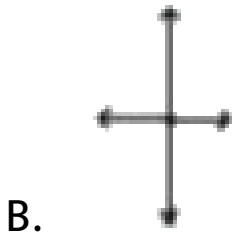
C.

D.

Answer: C

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7. A particle of mass m sliding on the smooth

double inclined plane (shown in fi gure) will

experience

A. greater acceleration along the path AB

B. greater acceleration along the path AC

C. same acceleration in both the paths

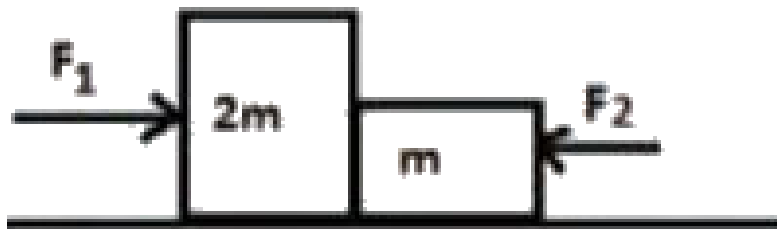D. no acceleration in both the paths.

Answer: B

8. Two blocks of masses m and 2m are placed on a smooth horizontal surface as shown. In the first case only a force F_1 is applied from the left. Later only a force F_2 is applied from the right. If the force acting at the interface of the two blocks in the two cases is same, then $F_1 : F_2$ is

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: C

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9. Force acting on the particle moving with constant speed is

A. always zero

B. need not be zero

C. always non zero

D. cannot be concluded

Answer: B

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10. An object of mass m begins to move on the plane inclined at an angle θ . The coefficient of static friction of inclined surface is μ_s . The

maximum static friction experienced by the mass is

A. mg

B. μ_s mg

C. $\mu mg \sin \theta$

D. $\mu_s mg \cos \theta$

Answer: D

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11. When the object is moving at constant velocity on the rough surface,

A. net force on the object is zero

B. no force acts on the object

C. only external force acts on the object

D. only kinetic friction acts on the object

Answer: A

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12. When an object is at rest on the inclined rough surface,

    A. static and kinetic frictions acting on the object is zero

    B. static friction is zero but kinetic friction is not zero

    C. static friction is not zero and kinetic friction is zero

    D. static and kinetic frictions are not zero

Answer: C

13. The centrifugal force appears to exist

    A. only in inertial frames

    B. only in rotating frames

    C. in any accelerated frame

    D. both in inertial and non-inertial frames

Answer: B

14. Choose the correct statement from the following

A. Centrifugal and centripetal forces are action reaction pairs

B. entripetal forces is a natural force

C. Centrifugal force arises from gravitational force

D. Centripetal force acts towards the center and centrifugal force appears to

act away from the center in a circular motion

Answer: D

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15. If a person moving from pole to equator, the centrifugal force acting on him

A. increases

B. decreases

C. remains the same

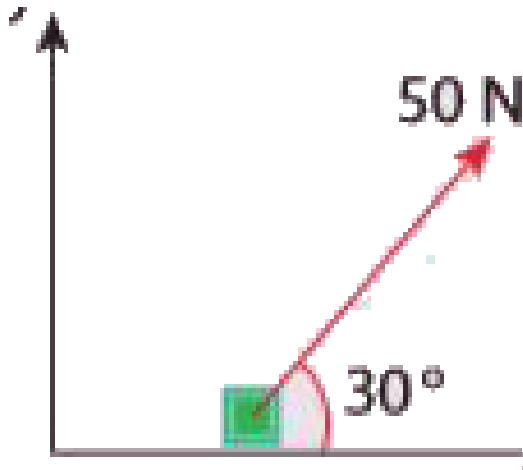D. increases and then decreases

Answer: A

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Exercise V Numerical Problems

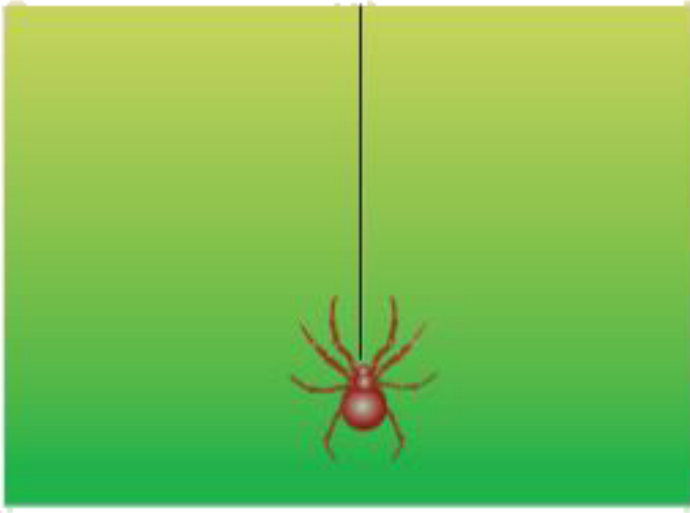**1.** A force of 50N act on the object of mass 20 kg. shown in the figure. Calculate the

acceleration of the object in x and y directions

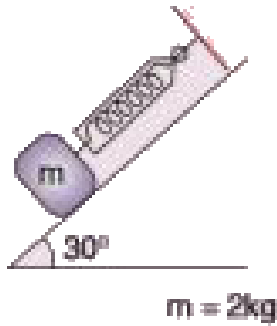**2.** A spider of mass 50 g is hanging on a string of a cob web as shown in the figure. What is

the tension in the string?

3. What is the reading shown in spring balance?

Spring balance

4 kg

4 kg

m

30°

m = 2kg

4. A bob attached to the string oscillates back and forth. Resolve the forces acting on the bob in to components. What is the
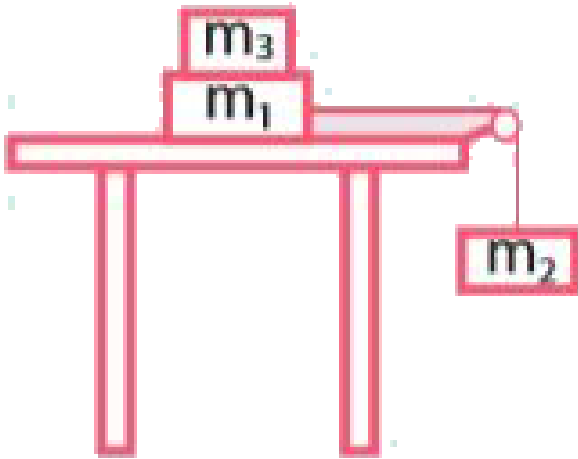
acceleration experience by the bob at an angle

θ

5. Two masses m1 and m2 are connected with a string passing over a frictionless pulley fixed at the corner of the table as shown in the figure. The coefficient of static friction of mass m1 with the table is μ_s Calculate the minimum mass m3 that may be placed on m1to prevent it from sliding. Check if m1=15 kg,

$m2 = 10kg, m3 = 25$ and $\mu_s = 0.2$

6. Two masses m1 and m2 are connected with a string passing over a frictionless pulley fixed at the corner of the table as shown in the figure. The coefficient of static friction of mass

m1 with the table is μ_s Calculate the minimum mass m3 that may be placed on m1to prevent it from sliding. Check if m1=15 kg, $m2 = 10kg$, $m3 = 25$ and $\mu_s = 0.2$

500 N

400 N

400 N

400 N

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7. Apply Lami's theorem on sling shot and calculate the tension in each string ?
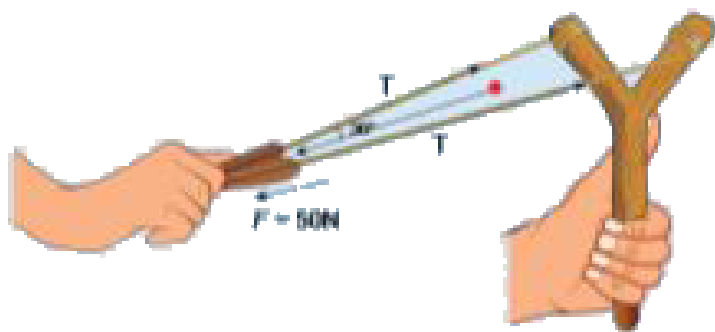
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8. A football player kicks a 0.8 kg ball and imparts it a velocity 12 ms 1. Th e contact between the foot and ball is only for one-

sixtieth of a second. Find the average kicking force

9. A stone of mass 2 kg is attached to a string of length 1 meter. Th e string can withstand maximum tension 200 N. What is the maximum speed that stone can have during the whirling motion?

10. Imagine that the gravitational force between Earth and Moon is provided by an invisible string that exists between the Moon and Earth. What is the tension that exists in this invisible string due to Earth's centripetal force? (Mass of the Moon = $7.34x \times 10^{22}$ kg, Distance between Moon and Earth

$$= 3.84 \times 10^8 m)$$

Moon

Invisible
string

o Earth
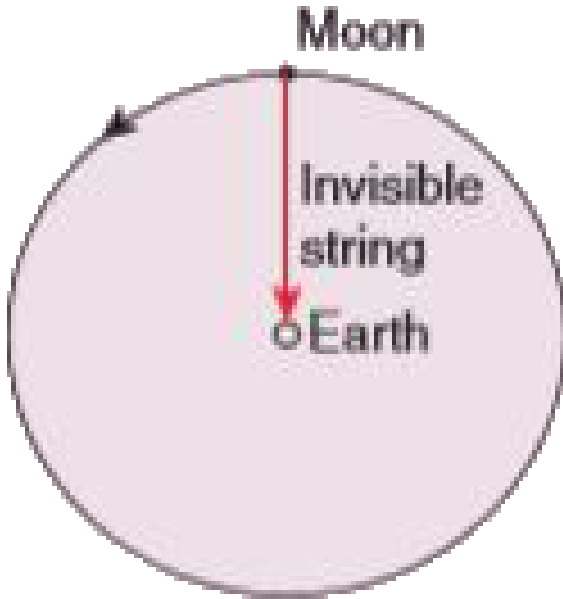
11. Two bodies of masses 15 kg and 10 kg are

connected with light string kept on a smooth

surface. A horizontal force F=500 N is applied

to a 15 kg as shown in the fi gure. Calculate the tension acting in the string.

15 kg   10 kg

500 N   T

12. People oft en say "For every action there is an equivalent opposite reaction". Here they meant 'action of a human'. Is it correct to apply Newton's third law to human actions? What is

mean by 'action' in Newton third law? Give

your arguments based on Newton's laws.

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13. A car takes a turn with velocity $50\ ms^{-1}$ on

the circular road of radius of curvature 10 m.

calculate the centrifugal force experienced by

a person of mass 60kg inside the car?

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14. A long stick rests on the surface. A person standing 10 m away from the stick. With what minimum speed an object of mass 0.5 kg should he thrown so that it hits the stick. (Assume the coeffi cient of kinetic friction is 0.7).

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