

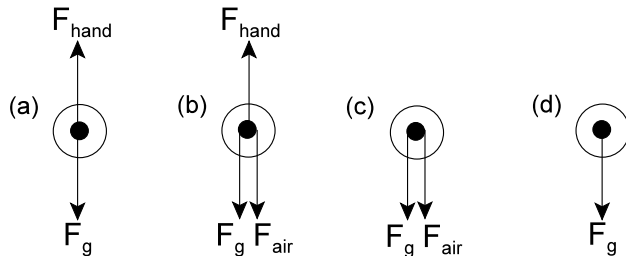
## PART A: MULTIPLE CHOICE (10 MARKS)

Choose the best response in each case and place your answer in the appropriate space on your answer sheet.

1. A force of 1.0 N is equivalent to:

- (a) 1.0 kg/s (b) 1.0 kg·m/s  
(c) 1.0 kg·m<sup>2</sup>/s (d) 1.0 kg·m/s<sup>2</sup>

2. You throw a tennis ball vertically upward. While the ball is in your hand, the correct FBD showing all the force(s) acting on the ball is:



3. A child stomps their feet to remove snow from their boots. This fact illustrates Newton's:

- (a) first law (b) second law  
(c) third law (d) law of gravitation

4. An object, moving at constant velocity, must:

- (a) have a net force acting on it.  
(b) eventually stop due to the force of gravity.  
(c) have all forces acting on it balance each other.  
(d) not have a force of gravity acting on it.

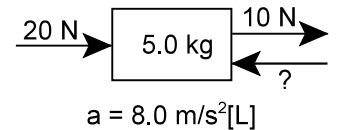
5. Acceleration is always in the direction of the:

- (a) net force (b) initial velocity  
(c) final velocity (d) displacement

6. The following forces act on an object: 13.5 N[W], 21.2 N[E], 33.0 N[E], and 25.3 N[W]. Calculate the net force acting on the object.

- (a) 15.4 N[W] (b) 15.4 N[E]  
(c) 23.6 N[W] (d) 23.6 N[E]

7. What is the missing force in the following diagram?



- (a) 10 N  
(b) 30 N  
(c) 50 N  
(d) 70 N

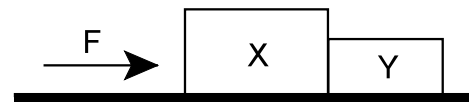
8. A net force of 58.0 N[W] is applied to a ball of mass  $4.50 \times 10^2$  g. Calculate the ball's acceleration.

- (a) 0.129 m/s<sup>2</sup>[W] (b) 0.13 m/s<sup>2</sup>[W]  
(c) 129 m/s<sup>2</sup>[W] (d) 130 m/s<sup>2</sup>[W]

9. A child is standing on the floor. If the action force is the force of Earth pulling down on the child, then the reaction force is:

- (a) the force of the floor pushing up on the child.  
(b) the force of the child pulling up on the Earth.  
(c) the force of the child pushing down on the floor.  
(d) a net force causing the child to accelerate.

10. A constant force of 36 N is applied to a 20 kg mass (X) that is in contact with a 4.0 kg mass (Y) on a frictionless surface.



What is the magnitude of the force exerted by mass X on mass Y?

- (a) 6.0 N (b) 29 N  
(c) 30 N (d) 36 N

## PART B: MATCH (5 MARKS)

Match the definition from the 1<sup>st</sup> column to the best term in the 2<sup>nd</sup> column and place the matching letter in the appropriate space on your answer sheet.

- Quantity of matter in an object.
- Force that opposes the motion between two objects in contact.
- Ratio of the magnitude of friction to the magnitude of the normal force.
- Force exerted by string, ropes, fibres, and cables.
- Vector sum of all the forces acting on an object.

- coefficient of friction
- force of gravity
- free-body diagram
- friction force
- inertia
- mass
- net force
- normal force
- tension force
- weight

## PART A: MULTIPLE CHOICE (10 MARKS)

|   |   |   |   |   |   |   |   |   |    |
|---|---|---|---|---|---|---|---|---|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
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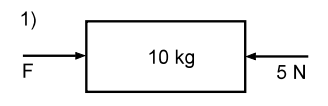
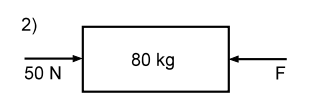
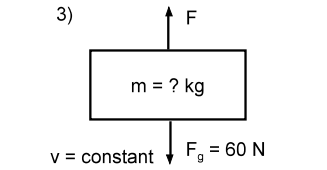
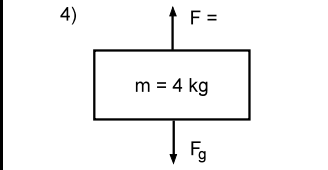
## PART B: MATCH (5 MARKS)

|   |   |   |   |   |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

## PART C: SHORT ANSWER (15 MARKS)

Answer the following questions in the space provided.

- {15} 1. Each of the following free body diagrams represents a different problem. Solve for the missing quantities and then place your answers in the space provided. Don't forget units, directions & sig.dig. **{Use  $g = 10 \text{ m/s}^2$ }**

|  |  |   |   |
|--|--|---|---|
| <p>1)</p>  <p><math>a = 2.0 \text{ m/s}^2[\text{W}]</math></p> <p><math>F_{\text{net}} = \underline{\hspace{2cm}}</math></p> <p><math>F = \underline{\hspace{2cm}}</math></p> | <p>2)</p>  <p><math>v_1 = 4.0 \text{ m/s} [\text{E}]</math><br/> <math>v_2 = 4.0 \text{ m/s} [\text{W}]</math><br/> <math>\Delta t = 2.0 \text{ s}</math></p> <p><math>a = \underline{\hspace{2cm}}</math></p> <p><math>F_{\text{net}} = \underline{\hspace{2cm}}</math></p> <p><math>F = \underline{\hspace{2cm}}</math></p> | <p>3)</p>  <p><math>v = \text{constant}</math></p> <p><math>a = \underline{\hspace{2cm}}</math></p> <p><math>F_{\text{net}} = \underline{\hspace{2cm}}</math></p> <p><math>F = \underline{\hspace{2cm}}</math></p> <p><math>m = \underline{\hspace{2cm}}</math></p> | <p>4)</p>  <p><math>a = 2.0 \text{ m/s}^2[\text{d}]</math></p> <p><math>F_{\text{net}} = \underline{\hspace{2cm}}</math></p> <p><math>F_g = \underline{\hspace{2cm}}</math></p> <p><math>F = \underline{\hspace{2cm}}</math></p> |
|--|--|---|---|

## PART D: PROBLEMS (30 MARKS)

Answer the following questions on a separate sheet of paper. You may use the back of this sheet if you wish.

- {5} 1. Assume that for each pulse, a human heart accelerates  $2.1 \times 10^{-2} \text{ kg}$  of blood from  $0.18 \text{ m/s}$  to  $0.28 \text{ m/s}$  during a time interval of  $0.10 \text{ s}$ . Calculate the magnitude of (a) the acceleration of the blood and (b) the net force needed to cause that acceleration.
2. A child's wagon experiences a frictional force of  $63 \text{ N}$  whenever it is in motion, regardless of the load it is carrying. An applied horizontal force of  $128 \text{ N}$  causes the wagon to accelerate at  $5.0 \text{ m/s}^2$ . The same applied force, with a child on the wagon, causes it to accelerate at  $1.0 \text{ m/s}^2$ .
- {4} (a) What is the mass of the sled? Don't forget to include a FBD.
- {4} (b) What is the mass of the child? Don't forget include a FBD.
3. A store clerk pushes a parcel along a counter with a force of  $17.7 \text{ N}[\text{W}]$ . The parcel has a mass of  $2.5 \text{ kg}$ . The kinetic friction acting on the parcel is  $6.5 \text{ N}[\text{E}]$ .
- {4} (a) Draw a FBD of the parcel as it is being pushed. Be sure to label your forces appropriately and to include values.
- {2} (b) Calculate the net force acting on the parcel.
- {2} (c) Calculate the acceleration of the parcel.
- {2} (d) Determine the coefficient of kinetic friction between the parcel and the counter.
4. Two crates, of mass  $12.0 \text{ kg}$  and  $20.0 \text{ kg}$ , respectively, are pushed across a smooth (ie no friction) floor together, the  $12 \text{ kg}$  crate in front of the  $20 \text{ kg}$  crate. Their acceleration is  $3.50 \text{ m/s}^2$ .
- {3} (a) Calculate the force applied to push the crates. Don't forget to include a FBD.
- {4} (b) Calculate the action-reaction force between the two crates. Don't forget to include FBD(s).