Lab 4 – free-body diagrams

Draw the free-body diagram for each object in each situation. Identify the forces on the object,

draw X & Y axes, show force vectors as labeled arrows on the axes. All surfaces are frictionless except for number 11 where friction is significant. I have done number 1 as an example of what your answers should look like. All pulleys and washers are massless and frictionless. The lines labeled A, B, etc. are ropes. A dotted line is just a reference line. If I ask for a FBD for two objects, identify the forces on each object. ex. In number 2 you should identify the forces on the hanging object and the forces on the washer. Number 2 will also have two axes and two different FBD’s.

pulley washer

R

+X

+Y

1. Draw the FBD for the hanging object.

**forces: gravity W**

●

**rope tension R**

W

Θ

A

B

C

2. Draw the FBD for the hanging object

and the FBD for the washer.

**forces:**

3. Draw the FBD for the hanging object

Θ

Θ

A

B

C

and the FBD for the washer.

**forces:**

4. Draw the FBD for each hanging object.

A

B

The objects are connected by a rope

passing over a pulley.

**forces:**

5. Draw the FBD for the hanging object

A

C

C

Θ

Θ

and the FBD for the washer.

**forces:**

B

6. Draw the FBD for the object on

the surface.

**forces:**

7. Draw the FBD for the hanging

object and for the object on the

surface.

**forces:**

8. Draw the FBD for object A and

B

A

the FBD for object B.

**forces:**

spring

9 Draw the free-body diagram

for the object on the surface

and for the hanging object.

**forces:**

10. Draw the free-body diagram

Θ

spring

for the object on the surface

and for the hanging object.

**forces:**

11. Draw the FBD for the

Θ

object on the ramp.

**forces:**

12. Draw the FBD for the object

Θ

on the ramp and the FBD

for the hanging object.

**forces:**

13. Draw the FBD for the upper

object and the FBD for the

lower object.

**forces:**

Setup 1: one FBD for hanging object

Setup 2; two FBD’s

(a) hanging object (b) washer

Setup 3; two FBD’s

(a) hanging object (b) washer

Setup 4; two FBD’s

(a) left hanging object (b) right hanging object

Setup 5; two FBD’s

(a) hanging object (b) washer

Setup 6: two FBD’s

(a) object A – upper object (b) object B – lower object

Setup 7: one FBD for object on table

Setup 8; two FBD’s

(a) hanging object (b) object on surface

Setup 9; two FBD’s

(a) book A (book on top) (b) book B (book on table)

Setup 10: two FBD’s

(a) hanging object (b) cart on track

Setup 11: two FBD’s

(a) hanging object (b) cart on track

Setup 12: one FBD for the object on the ramp

Setup 13: two FBD’s

(a) hanging object (b) cart on ramp