

# STEMonstrations



**NEWTON'S 2ND LAW**

1  
00:00:00,767 --> 00:00:15,382

[ MUSIC ]

2  
00:00:15,382 --> 00:00:16,549

>> HELLO, EVERYONE.

3  
00:00:16,549 --> 00:00:17,817

I'M ASTRONAUT RANDY BRESNIK,

4  
00:00:17,817 --> 00:00:18,918

LIVING AND WORKING ABOARD

5  
00:00:18,918 --> 00:00:21,154

THE INTERNATIONAL SPACE STATION.

6  
00:00:21,154 --> 00:00:22,889

NOW, ON THE SPACE STATION,

7  
00:00:22,889 --> 00:00:23,857

WE LIVE IN A MICROGRAVITY

8  
00:00:23,857 --> 00:00:25,125

ENVIRONMENT.

9  
00:00:25,125 --> 00:00:25,725

DO YOU THINK THE LAWS

10  
00:00:25,725 --> 00:00:27,494

OF PHYSICS WILL HOLD UP?

11  
00:00:27,494 --> 00:00:29,229

COME ON-- LET'S GO FIND OUT.

12  
00:00:29,229 --> 00:00:32,599

[ MUSIC ]

13  
00:00:32,599 --> 00:00:33,466

>> THE ACCELERATION OF

14

00:00:33,466 --> 00:00:34,434

AN OBJECT DEPENDS ON

15

00:00:34,434 --> 00:00:35,602

THE NET FORCE ACTING ON

16

00:00:35,602 --> 00:00:36,836

THE OBJECT AND THE MASS

17

00:00:36,836 --> 00:00:39,372

OF THE OBJECT, OR  $F = MA$ .

18

00:00:39,372 --> 00:00:41,174

>> JOLLY GOOD SHOW, SIR ISAAC!

19

00:00:41,174 --> 00:00:41,908

>> HERE WE SEE THAT

20

00:00:41,908 --> 00:00:42,942

ONCE THE FORCE OF THE THRUST

21

00:00:42,942 --> 00:00:43,910

IS GREATER THAN THE WEIGHT

22

00:00:43,910 --> 00:00:45,245

OF THE VEHICLE, THE ROCKET

23

00:00:45,245 --> 00:00:47,680

BEGINS TO ACCELERATE.

24

00:00:47,680 --> 00:00:48,448

>> I'M GOING TO START WITH

25

00:00:48,448 --> 00:00:50,049

SOMETHING SMALL, SOMETHING

26

00:00:50,049 --> 00:00:51,918

YOU MIGHT HAVE AT HOME--

27

00:00:51,918 --> 00:00:54,988

A LITTLE STICK OF CHAPSTICK.

28

00:00:54,988 --> 00:00:55,755

WE'LL GO AHEAD AND USE

29

00:00:55,755 --> 00:00:56,990

OUR FORCE, BEING

30

00:00:56,990 --> 00:00:59,392

OUR BUNGEE CORD HERE.

31

00:00:59,392 --> 00:01:01,261

WE'LL PUT IT ON OUR BUNGEE

32

00:01:01,261 --> 00:01:02,862

AND WE'LL PULL IT BACK...

33

00:01:02,862 --> 00:01:04,531

AND LET IT GO.

34

00:01:04,531 --> 00:01:05,365

AND YOU CAN SEE HOW FAST

35

00:01:05,365 --> 00:01:06,699

IT ACCELERATES, BECAUSE

36

00:01:06,699 --> 00:01:09,102

THERE'S VERY LITTLE MASS.

37

00:01:09,102 --> 00:01:10,170

NEXT, WE'LL TRY

38

00:01:10,170 --> 00:01:12,372

A LITTLE SPACESHIP.

39

00:01:12,372 --> 00:01:13,873

A LITTLE MORE MASSIVE, AND

40

00:01:13,873 --> 00:01:15,108

YOU CAN FEEL THAT BECAUSE

41

00:01:15,108 --> 00:01:16,609

AS YOU MOVE IT, YOU CAN FEEL

42

00:01:16,609 --> 00:01:18,244

THE KIND OF EXTRA FORCE

43

00:01:18,244 --> 00:01:20,713

YOU HAVE TO PUSH WITH YOUR HAND.

44

00:01:20,713 --> 00:01:21,548

SO, WE'LL PUT OUR SPACESHIP

45

00:01:21,548 --> 00:01:24,017

ON OUR LAUNCHER HERE,

46

00:01:24,017 --> 00:01:28,421

SAME SPOT.

47

00:01:28,421 --> 00:01:29,122

NOTICE IT'S FLYING

48

00:01:29,122 --> 00:01:30,690

A LOT SLOWER THAN

49

00:01:30,690 --> 00:01:32,659

THAT CHAPSTICK DID.

50

00:01:32,659 --> 00:01:34,394

WHAT WE'VE SEEN IS THE SAME

51  
00:01:34,394 --> 00:01:36,062  
AMOUNT OF FORCE ON

52  
00:01:36,062 --> 00:01:38,565  
A SMALLER, LESS MASSIVE OBJECT

53  
00:01:38,565 --> 00:01:40,333  
MEANS IT ACCELERATES FASTER.

54  
00:01:40,333 --> 00:01:41,100  
WELL, THIS IS THE BIGGEST

55  
00:01:41,100 --> 00:01:41,901  
AND MOST MASSIVE THING

56  
00:01:41,901 --> 00:01:43,470  
WE HAVE, SO LET'S SEE HOW

57  
00:01:43,470 --> 00:01:48,308  
THE ACCELERATION IS AFFECTED.

58  
00:01:48,308 --> 00:01:49,642  
PULL BACK THE SAME AMOUNT

59  
00:01:49,642 --> 00:01:53,146  
ON THE FORCE, AND HERE WE GO.

60  
00:01:57,517 --> 00:01:58,585  
THERE YOU HAVE IT-- NEWTON'S

61  
00:01:58,585 --> 00:02:02,422  
2nd LAW OF MOTION IN ACTION.

62  
00:02:02,422 --> 00:02:03,223  
THANKS, EVERYBODY, FOR

63  
00:02:03,223 --> 00:02:03,990

## EXPLORING A LITTLE PHYSICS

64

00:02:03,990 --> 00:02:05,091

WITH ME TODAY.

65

00:02:05,091 --> 00:02:05,692

NOW, I'M GOING TO SEND IT

66

00:02:05,692 --> 00:02:06,726

BACK TO EARTH SO YOU CAN

67

00:02:06,726 --> 00:02:08,027

START YOUR EXPERIMENTS.

68

00:02:08,027 --> 00:02:09,462

SEE YOU AGAIN REAL SOON.