



1
00:00:10,080 --> 00:00:19,429
congratulations

2
00:00:25,029 --> 00:00:23,349
hello to donald boyer from ashland ohio

3
00:00:26,710 --> 00:00:25,039
donald says

4
00:00:28,550 --> 00:00:26,720
i've always wondered about fire in a

5
00:00:30,150 --> 00:00:28,560
zero gravity environment if you could

6
00:00:33,030 --> 00:00:30,160
light a match in your spaceship with the

7
00:00:34,950 --> 00:00:33,040
match uh fire tip go upward as it does

8
00:00:36,470 --> 00:00:34,960
down here with gravity or would it just

9
00:00:38,470 --> 00:00:36,480
become a round ball of fire since

10
00:00:41,270 --> 00:00:38,480
there's no gravity around the flame or

11
00:00:42,069 --> 00:00:41,280
does gravity have any effect on fire

12
00:00:45,510 --> 00:00:42,079
and

13
00:00:46,869 --> 00:00:45,520

could demonstrate it for you um but they

14

00:00:49,190 --> 00:00:46,879

won't let me lay

15

00:00:51,990 --> 00:00:49,200

any fires up here unfortunately

16

00:00:53,910 --> 00:00:52,000

uh but it's um well what happened you

17

00:00:55,510 --> 00:00:53,920

know the the thing that happens in

18

00:00:59,430 --> 00:00:55,520

in uh

19

00:01:01,670 --> 00:00:59,440

on the earth is that gravity and um and

20

00:01:03,830 --> 00:01:01,680

convection due to

21

00:01:06,310 --> 00:01:03,840

due to the density of air depending on

22

00:01:08,710 --> 00:01:06,320

its temperature causes the the flame as

23

00:01:10,230 --> 00:01:08,720

you see it so in other words

24

00:01:12,630 --> 00:01:10,240

when when

25

00:01:14,950 --> 00:01:12,640

when the fire heats up the air the air

26
00:01:16,870 --> 00:01:14,960
expands and that air that's expanded now

27
00:01:18,950 --> 00:01:16,880
is a lower density than the air that's

28
00:01:21,190 --> 00:01:18,960
around it and so the lower density air

29
00:01:22,710 --> 00:01:21,200
flows up just like a hot air balloon

30
00:01:25,429 --> 00:01:22,720
wants to go up it's

31
00:01:28,550 --> 00:01:25,439
it's a it's a volume with a lower

32
00:01:30,469 --> 00:01:28,560
density so the air around it basically

33
00:01:32,149 --> 00:01:30,479
points he pushes it up

34
00:01:35,109 --> 00:01:32,159
so what happens is the hotter air wants

35
00:01:37,510 --> 00:01:35,119
to rise and the colder air then comes in

36
00:01:41,429 --> 00:01:37,520
beneath the flame and that that creates

37
00:01:43,030 --> 00:01:41,439
a convection which drives the flame

38
00:01:44,870 --> 00:01:43,040

and of course the air that's closest to

39

00:01:46,870 --> 00:01:44,880

the flame is always hottest so that

40

00:01:49,429 --> 00:01:46,880

convection keeps going and causes the

41

00:01:51,429 --> 00:01:49,439

flame to to

42

00:01:53,109 --> 00:01:51,439

do the interesting things that it does

43

00:01:54,710 --> 00:01:53,119

up here

44

00:01:57,590 --> 00:01:54,720

of course the air that's closest to the

45

00:01:59,910 --> 00:01:57,600

flame would get hot

46

00:02:01,670 --> 00:01:59,920

but it would have no reason to rise

47

00:02:02,630 --> 00:02:01,680

because it's not light i mean it's not

48

00:02:04,310 --> 00:02:02,640

lighter

49

00:02:05,510 --> 00:02:04,320

you know than the cold the colder air

50

00:02:06,709 --> 00:02:05,520

around it

51
00:02:09,589 --> 00:02:06,719
the gravity is not going to have that

52
00:02:11,750 --> 00:02:09,599
effect here so the hot air it does

53
00:02:13,910 --> 00:02:11,760
expand and it would basically expand

54
00:02:16,309 --> 00:02:13,920
into the ball and it would push the

55
00:02:19,030 --> 00:02:16,319
other other air away

56
00:02:20,070 --> 00:02:19,040
you know symmetrically more or less

57
00:02:21,990 --> 00:02:20,080
and

58
00:02:24,390 --> 00:02:22,000
so the two things from that one is you

59
00:02:26,630 --> 00:02:24,400
don't get you know a flame that that

60
00:02:29,270 --> 00:02:26,640
would rise and look like a flame on the

61
00:02:31,350 --> 00:02:29,280
earth but also what happens is

62
00:02:34,150 --> 00:02:31,360
um it is the fire essentially puts

63
00:02:36,070 --> 00:02:34,160

itself out because as the

64

00:02:38,150 --> 00:02:36,080

warm air expands you know the oxygen is

65

00:02:39,910 --> 00:02:38,160

burned up inside that sphere

66

00:02:42,949 --> 00:02:39,920

and there's no convection to bring new

67

00:02:44,470 --> 00:02:42,959

oxygen back into where the flame is so

68

00:02:46,229 --> 00:02:44,480

what you'd expect

69

00:02:47,830 --> 00:02:46,239

here with a flame is that a flame would

70

00:02:50,390 --> 00:02:47,840

burn itself out

71

00:02:53,030 --> 00:02:50,400

and hopefully that's

72

00:02:55,190 --> 00:02:53,040

a benefit for us up here with a lot of

73

00:02:56,869 --> 00:02:55,200

electrical systems and everything that

74

00:02:59,030 --> 00:02:56,879

unless you have some kind of circulation

75

00:03:00,790 --> 00:02:59,040

to bring new oxygen to a

76

00:03:02,470 --> 00:03:00,800

fire or flame