

What happens next...?

Some ideas and some answers

Werkgroep 20

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Education Supporting Teachers

See www.scienceinschool.org/2007/issue7/whathappens for a fuller description of strategy. Join our club at www.talkphysics.org, register and go to the What happens next? group.

Each scenario should be described and shown, and pupils in teams asked to, a) indicate what they expect to see happen next, and b) explain why what happens does.

The difficulty of these various scenarios obviously varies considerably, and you should grade them according to the class's ability and the amount of fun you want to have. *Some of the simpler ones are described first.*

Adapt this list to your own school. Maybe make your own powerpoint presentations with a few pictures – before and after, but don't let that be a substitute for doing the experiments themselves!

1 Two conical beakers are both filled approximately $\frac{3}{4}$ full of water (that is $\frac{3}{4}$ depth) (or any other liquid). What will happen when one is emptied into the other?

The easiest way to set this up is to fill one beaker and the pour half into the second. If the beakers are perfectly conical the liquid will fill each to approx 0.75 height.

The beaker fills exactly.

2 Take a selection of bottles and/or beakers. Fill one of them. Ask whether the liquid will fill or spill from the others.

This can lead to a discussion on packaging and bottle shapes and sizes which make you think that you are getting more than you are!

3 Float an orange in water. Ask what will happen once it is peeled.

The peeled orange sinks.

4 What will happen when various other fruits are “floated”? Try a lemon, a lime, and an apple.

The reasoning for this may be different. Apples float because children know from their experience, (I called it dooky apple!), whereas lemons and oranges are similar, but what about limes?).

Lime sinks, thin skin, little pith, lemon floats, thick skin.

5 Float an egg in a container of water. What will happen when a considerable amount of salt is dissolved in the water?

The egg floats in the salty water, compare with the Dead Sea or Blue Lagoon, Iceland.

6 A new unopened can of coke and a can of diet coke are to be floated in a large tank of cold water. What will happen?

Can also be done with plastic bottles.

The diet coke floats higher.

7 An individual sauce packet is balanced (with paperclips fixed to its bottom) so that it just floats in a 2 litre pop bottle which is almost full of water. What will happen if the top is screwed into the bottle and the bottle is squeezed?

Cartesian Diver.

The diver sinks.

8 Sultanas in Lemonade. Get a bottle of cheap lemonade, the cheaper the better as long as it is still fizzy. What will happen to some sultanas placed in the bottle?

The sultanas sink first, then acquire bubbles on their surface, rise to the top, loose the bubbles and sink again, then acquire more bubbles and rise etc.

9 What will happen when a peeled and an unpeeled grape are dropped into some lemonade?

The peeled grape stays at the bottom, the unpeeled grape rises and falls.

10 Tea bag (cylindrical type). Unfold bag, remove staple and empty contents (tea sweepings). Stand the bag on its end as a square based cylinder, on a £10 note if you are brave. What happens when I set fire to the tea bag cylinder?

The tea bag burns down to the bottom then the final ashes rise up away from the note.

11 Arrange three candles of different lengths so that they can fit inside an inverted glass jar. Light the candles, (from the longest one downwards), and place the inverted jar over them. Which candle will go out first?

You may also try this in three identical tall upturned cylinders so the candles are totally separate, in this way they don't interfere with each other.

The tallest candle goes out first.

12 Arrange for a toy truck with some object on the top (maybe a teddy bear) to be pushed against a barrier so that it will come to a sudden stop. What will happen to the object on the top?

The teddy bear keeps on going, if it isn't wearing a seat belt.

13 A hardboiled egg and a raw egg are spun horizontally on a table. They will be touched to stop each one. Does anything happen next?

The hardboiled egg stops, the raw egg restarts spinning.

14 Arrange some (heavy) crockery and maybe a teapot on a smooth cloth without a hem.

When the cloth is pulled away and off the table, (pull it downwards sharply) will the teapot and crockery stay on the table?

There are several similar inertia tricks, which are easily adapted as a will it / won't it experiment. They can be repeated with students attempting the "trick".

Should stay put.

15 A 1 kg mass (or similar, tin of beans etc is probably better) is connected to some thick string and the rope wrapped around a wooden cylinder (rolling pin, or even a wine bottle will do as substitute). When the rod is lifted, what will happen?

This can be done as a tie break, how many turns are needed for the tin to be lifted.

The kilogram mass is held by the rope which doesn't slip with a few turns.

16 About 1 m of string is placed over a pencil with a china cup at one end dangling over the pencil and close to it and the other longer end tied to a cork with the string held just below the horizontal. Will the cup reach the ground when released?

The cup will stop before it reaches the ground if your string is just long enough for the cup to get there.

17 Drop a table tennis ball and a golf ball. Which reaches the ground first?

Both at the same time.

18 You are going to drop a small piece of paper and a coin, a) separately, b) with the paper on top of the coin, and c) with the paper below the coin but close to it. Describe what happens.

a) coin first, b) both together, and c) coin first, paper slips off.

19 Throw into the air a plastic bottle with water issuing from a hole in the bottle. What happens to the jet?

The jet stops when the plastic bottle is in the air.

20 Arrange a plastic bottle with a screw top with plastic straw coming out vertically. Everything must be airtight. Blow air into the bottle so that the liquid rises in the straw. What happens to the liquid in the straw when you jump off a chair holding the bottle?

The water shoots out of the straw.

21 A groan tube is dropped vertically and caught. What happens to the groan?

It stops as the tube falls then starts again when it is caught.

22 A slinky spring is held vertically and then dropped. Looking carefully at the lowest part of the spring, what will happen to the spring there?

I have found it useful to fix a small model, (bendy man or similar) to the bottom turns of the spring, which makes this effect easier to see.

The lowest link of the spring remains stationary for a while.

23 Place a tennis ball on top of a basketball, and drop both together. What happens to the tennis ball?

This is the same principle as the "Astroblaster" toy. Try a table tennis ball on top of a bouncy ball. Use a tiny piece of folded sticky tape to help keep small ball in position as the greater curvature of the bouncy ball makes the feat more difficult.

The smaller ball rebounds very high.

24 Arrange two metre rules, one with a heavy weight fixed at its upper end, one in the centre. Hold the metre rules at the same angle and drop the upper end. Which will reach the ground first?

Use lumps of plastercine as weights.

The rule with the weight at the centre gets to the ground first.

25 Using the same two rules as in 24, one with a weight at its centre and the other with no extra weight. Again let the two rods fall together from the same angle. Now which will reach the ground first?

Discuss how this compares with number 17.

Both reach the ground at the same time.

26 A broom handle is rested horizontally on your fingers, one about $\frac{1}{4}$ way along and the other at the opposite end. The fingers are moved towards the centre. What happens?

The fingers meet at the centre of mass.

27 Repeat number 26 with a weight equal to the weight of the broom handle tied to the end of the broom handle.

The fingers meet at the new centre of mass.

Another alternative is to insert some lead shot into one end of some dowling so that the centre of mass is shifted.

28 A raw egg is to be thrown hard at a vertical sheet which is held by two people, (with a lip of the sheet at the bottom to catch any bits). Will the egg break?

No, but you must hit the sheet!

29 Spin a Cadbury's cream egg as quickly as possible horizontally on a slightly rough surface. Will it keep on spinning?

Try this with « minstrels » sweets too! (Same principle as a tippee top).

The egg will spin and rise up onto one of the ends.

30 Place a single sheet of newspaper on a table over a half metre length of thin wood, one end of which protrudes. The protruding end of the wood is to be struck sharply.

Hardboard works best. You need a large broadsheet paper.

The wood snaps if it is thin enough and you strike hard enough.

31 What happens when you blow between two vertical strips of paper held at the top and bottom?

The paper strips move together.

32 Newton's Cradle. What will happen to the masses in Newton's cradle when a piece of metal is placed in between stationary masses? What will happen if the mass at one end is struck with a small hammer?

If the hammer head has a mass greater than all the balls, all the balls move.

33 Newton's Cradle with bowling balls. Most bowling alleys will willingly give you their "spent" balls. Make up Newton's cradle scenarios with whatever you can get, ideally 3 x 6lb balls and an assortment of others 8, 12, 14, bowled into the three 6 lb balls, (on tracks).

A single 6 lb ball moves away with the 8 lb ball, but two with the 12 and 14.

34 Waddling animal on slope. What will happen to the speed of the animal if an additional mass is added to the animal. Does it matter where the mass is fixed?

Yes it matters, you can both speed up and slow down the animal.

35 Wine glass with (half a) cork inside. What happens when I blow sharply over the top of the glass?

The cork jumps out.

36 Shape half a lolly stick into the shape of the hull of a boat. Place in bowl of clean still water, (or better still some old (or new) guttering.) What happens when I drop a few grains of soap powder on the stern of the stick?

The "boat" chugs across the water.

37 Place 5 or 6 cocktail sticks in a circle (as radii) around a central point. Touch the central area with some absorbent material (blotting paper) and then with the edge of a bar of soap. What happens to the sticks?

The sticks move inwards first, then outwards.

38 Knees bend. What happens when you stand with your heels against a vertical wall and try and bend down to pick something on the floor?

You fall over.

38 Tie some thread round a tin of beans (or similar large object) (one thread above, one below) so that the tin can be suspended from above, and the string below pulled. Which string breaks when you pull fast and hard?

The lower string.

39 Burning the candle at both ends! Put a needle through the centre of a long candle and shave both ends. Balance the candle at its centre and light both ends, what happens?

The candle rocks up and down like a see saw.

40 Mirror writing. Place a mirror above some names, so that you see the image. What is special about what you see when you write TOM, DICK and HARRY?

Only DICK seems to be unaltered.

41 The Big Circuit. Arrange a circuit such that the wires go from the power pack all the way to the back of the room to a bulb and back again. What will happen when you switch on? Does the bulb come on immediately?

The heating of the bulb does take a moment, but you could substitute a buzzer.

Yes.

Try also with two bulbs, one near the battery and one as far away as possible.

42 Using an empty milk bottle and hardboiled egg, drop a lighted match into the bottle and then seal the top with the egg. What happens?

The egg is drawn into the bottle.

43 Suspend a broom handle horizontally by two thin threads from its ends. Take another broom handle and whack the centre of the suspended one. What breaks, one thread, two threads, or the broom handle?

The broom handle, if you hit it hard enough.

SAFETY FIRST: beware of fragments going all over the place.

44 Two blocks of ice, (identical) are going to be placed on a plastic box, which feels warm, and an upturned thick bottomed frying pan which feels cold. Will either of the blocks melt?
The ice on the metal melts very quickly, a minute or so.

45 Place a medium size (2 cm diameter by 1 cm depth) neodymium magnet on top of a pile of Japanese yen, (8 or 9). What happens when you lift the magnet quickly?
Several yen are lifted.

46 Suspend a yen on a thread. (Use adhesive to stick the thread to the yen). Move a medium sized neodymium magnet towards the yen. What will happen?
The yen moves away.)

47 “Float” a yen on some still water utilizing the surface tension. (This can easily be done by lowering the yen on tissue paper, and then removing the paper). Hold a charged rod beside the yen. What happens?
This could be done after showing attraction of a yen held by a thread as in 46.
The yen moves away from the charged rod.

48 Obtain two test tubes such that the second just fits inside the first. Fill the first with water and float the second inside the tube. Turn the two tubes upside down. What will happen?
The smaller tube rises.

49 Arrange two suspensions on thread. One a small glass rod (3 cm long) and the other a rolled up rod of aluminium foil. How will the rods line up when held beside a strong neodymium magnet?
The glass moves to be at right angles to the field, the aluminium lines up along the field lines.

50 What happens when a small but strong cylindrical magnet is rolled down a gentle slope in a N-S direction?
The path of the magnet is not straight down but circular.

51 Eclipse of Mars. Stare at the centre of a red disc for 20+ seconds. (Can be shown using a data projector). What will you see when you move away from the red disc or arrange for it to become smaller?
The disc appears with a cyan border.

52 Barbeque Skewers. Fill a polythene bag with water. What happens when you push barbeque skewers through the bag?
Most effective when the bag is held above someone’s head. Use a sharp pencil too.
The bag self seals, so water doesn’t leak.

53 Rubber gloves. Cut a strip from some rubber gloves (preferably thin surgeons). Feel its temperature and then stretch it and hold it stretched. What will happen to the temperature?
The stretched rubber is warm.
After a while feel it again and then let the glove latex unstretch. What then happens?
You can devise a simple experiment using the cuff of the glove, i.e. a complete loop, stretched between two rollers.
The stretched section feels warm, the unstretched is cool.

54 Two balloons. Inflate two identical balloons, one so that it is fairly large, the other just started. Connect the balloons in such a way that the air can flow from one to the other. (Use a tube with taps and clips and a T piece). What will happen when the taps are opened so that the air flows? Will the big balloon blow the little one up or vice versa?

The small balloon blows the big one up.

This can be done with a piece of flexible poly tubing, as it can be sealed by bending.

55 Connect two balloons to a tube and T piece so that you can blow the balloons up simultaneously. Try it. What happens?

One balloon will be blown up whilst the other stays small.

56 Float a beaker containing some weighty object in a 2 litre plastic lemonade bottle containing water. What happens to the water level in the bottle when the weight is placed separately in the bottle?

The water level falls.

57 Float an empty sealed glass jar, on a "boat" in a bowl of water. What happens to the water level when you take the glass jar out of the boat and float it in the bowl separately alongside the "boat"?

No change in level.

58 A paper clip on a piece of thread is lowered towards a strong magnet. What happens?

The paper clip spins, one way when lowered, the other when raised.

59 Take two measuring cylinders, with different diameters (say number 1 with twice the diameter of number 2). Pour some liquid from the larger measuring cylinder into the smaller, and ask how high the liquid will be in the second, (given the different diameters).

In the case cited 4 times.

60 Construct a balance with two tin cans fixed to a metre rule. Fill the cans so that the rule balances horizontally. (Or simply use a sensitive electronic balance or kitchen scales). What happens when you lower your finger into one of the cans?

61 Drop a horizontal sheet of paper and a horizontal book separately. (The paper should be smaller than the book). What happens when you drop the paper and book simultaneously with the paper, a) resting just below the book, and b) on top of the book?

62 Using a clear polythene bucket, (you often get sweets in them), part fill the bucket with water, and then float a ball on the surface. Whirl the bucket in a vertical circle over your head. We all know that the water stays in the bucket, but what happens to the ball? Does it stay on the surface or sink?

63 Balance a beaker of water on some scales with an orange (or similar object that floats) beside the beaker. Note the reading. What will happen to the reading when the orange is moved into the water in the beaker so that it floats?

64 Place one bowling ball on a low friction surface (on rails). Roll a second ball into the first. The collision is almost elastic. What happens to the first ball, (the one that was rolled) after the other one shoots away?

The first ball rotates and then follows the other ball down the rails.

65 What happens when a ring magnet falls down over a copper pipe, and a piece of wooden dowling?

66 Place a candle in a beaker and fill with water so that the water is just up to the top of the candle, (but doesn't wet the wick). What happens when the candle is lit?

The wick continues to burn down into the candle wax, leaving a wall to protect the wick from the water.

Please send me any other interesting ideas: featonby@onetel.com. If you need further explanations of any of these ideas, contact me at the email address above.