2008

Essential Secondary Science Assessment (ESSA)

Essential Secondary Science Assessment

Print your name here _____
(First name) (Last name)

First name
WRITE IN CAPITAL LETTERS

Last name
WRITE IN CAPITAL LETTERS

Print the name of your school here

WRITE IN CAPITAL LETTERS

School code Region code

1. Are you a boy or a girl?
   - ○ boy
   - ○ girl

2. How old are you today?
   - ○ 13 or younger
   - ○ 14
   - ○ 15 or older

3. Are you of Aboriginal or Torres Strait Islander origin?

   If of both Aboriginal and Torres Strait Islander origin, mark both 'yes' bubbles.
   - ○ no
   - ○ yes, Aboriginal
   - ○ yes, Torres Strait Islander

4. Do you speak a language other than English at home?
   - ○ no
   - ○ yes

5. Does your mother or father or caregiver speak a language other than English at home?
   - ○ no
   - ○ yes

   If you answered 'yes' to questions 4 or 5, then answer question 6.

6. How many years have you been at an Australian school?
   - ○ less than 1 year
   - ○ 1 to 3 years
   - ○ 3 to 7 years
   - ○ more than 7 years

INFORMATION BELOW TO BE COMPLETED BY TEACHERS ONLY

Teachers – please complete this section if this student received special provisions to complete parts of the test.

The student accessed the following special provisions:

○ Large print ○ Braille ○ Assistive technology ○ Oral sign support ○ Adjustable furniture
○ Separate supervision ○ Extra time ○ Scribe ○ Reader
○ Other (specify)

The student is enrolled in a Support Class: ○ no ○ yes

Test practice items (approximately 8 minutes)

Part 1 – Extended response tasks

There are no practice items for Part 1, the extended response tasks. You do not need to refer to any of the articles in the magazine to complete Part 1.

Practice items for Part 2, short response and multiple choice items

Each article in the magazine is linked to a group of test items in this test book. As you work through Part 2, read the article in the magazine and then complete the related short response and multiple choice tasks. Some test items use information located in the article. However, many items require you to use your own scientific knowledge, understanding and skills.

For multiple choice items, choose the response you think is **best** and colour the 'bubble' next to it. If you want to change your response, rub it out thoroughly and then colour the bubble beside your new response.

For short response items, write your response in the space provided in the test book. You may need to write a word, complete a drawing or show the order of events or objects.

Practice items

Read ***SEA OTTERS*** on the back cover of the magazine.

Use information from the article to complete items A to C.

A. Sea otters can keep warm because they

- ○ have thick fur
- ○ eat sea urchins
- ○ have a thick layer of blubber
- ○ can float on a bed of seaweed

B. In which ocean do we find sea otters?

Write your answer in the box below.

C. Which of the following animals are part of the sea otter's diet? Choose *yes* or *no* for each animal.

Animals	Yes	No
clam	○	○
crab	○	○
sea lion	○	○
shrimp	○	○

Use your own knowledge, understanding and skills to complete items D and E.

D. The sea otter's body heat is produced by the cellular process of

- ○ digestion
- ○ respiration
- ○ conduction
- ○ combustion

E. The following events have happened in the history of the sea otters.
Place a number beside each event to show the correct order of these events.

- ☐ numbers of sea otters increased
- ☐ numbers decreased due to hunting
- ☐ otters become a protected species

Part 1 – Extended response tasks (approximately 20 minutes)

Complete all three tasks in Part 1. Make your responses as detailed and accurate as you can.

Task 1 – Animal footprints

Here are two Australian animals with diagrams of their footprints.

Koala

Kangaroo

Identify two differences between the footprints of these animals.

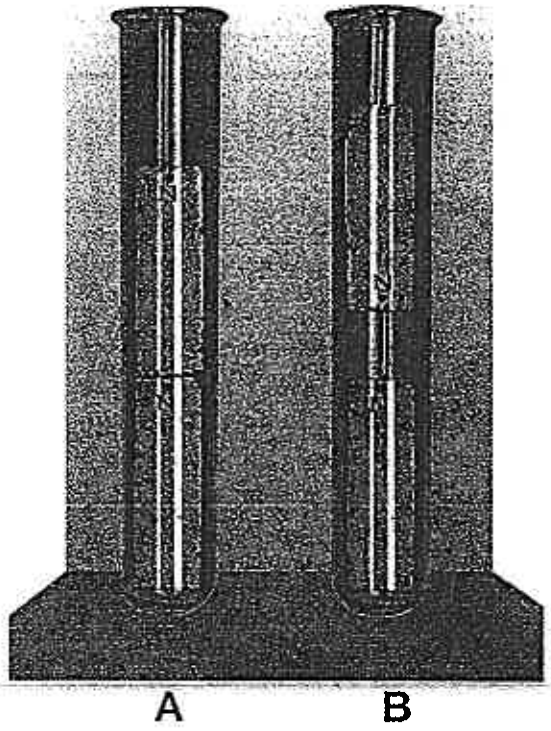
Why do the koala and kangaroo have different features? Explain your answer in as much detail as you can.

NA 0 1 2 3 4 5 6

Task 2 – Behaviour of magnets

Jack and Rana were investigating the behaviour of magnets. They stood two test tubes in a test tube rack. Then they put two bar magnets inside each test tube. The results are shown in the photograph.

Describe what A and B show.



Use your knowledge of forces to explain the behaviour of the magnets in test tube B.

Task 3 – Earth and its moon

Earth Moon

Some temperatures on Earth and the Moon are shown in the table below.

	Earth	Moon
Minimum surface temperature (°C)	–88	–233
Maximum surface temperature (°C)	58	123
Average surface temperature (°C)	15	–18

Compare the temperatures on Earth and on the Moon.

Why are temperatures on Earth different from temperatures on the Moon? Explain your answer in as much detail as you can.

Part 2 – Short response and multiple choice tasks (approximately 60 minutes)

Use the stimulus magazine to complete all the items in Part 2.

Read ***A snake that changes colour!*** on page 2 of the magazine, then complete items 1 to 5.

1. What is the scientific name of the pythons in the article?

   - ○ Green Python
   - ○ *Morelia viridis*
   - ○ snake

2. In science, the Green Python is called a consumer because

   - ○ it makes its own food
   - ○ it lives in the Australian rainforest
   - ○ it eats lizards, cockroaches, rodents and birds
   - ○ it breaks down living things into carbon dioxide and water

3. Which food chain is correct?

   - ○ grass → lizard → python
   - ○ grass → python → lizard
   - ○ python → grass → lizard
   - ○ python → lizard → grass

4. What is the source of energy for the plants that live in the rainforest?

   - ○ air
   - ○ rain
   - ○ soil
   - ○ sunlight

5. What is the ecosystem?

   - ○ all the living things that make up the food web
   - ○ the living and non-living things that affect an organism
   - ○ the producers, consumers and decomposers that live in the same place
   - ○ the group of organisms that depend on each other, the air and the soil where they live

Read ***Research using Google*** on page 3 of the magazine, then complete items 6 to 12.

6. The number of webpages found with the word 'Ptolemy' is closest to

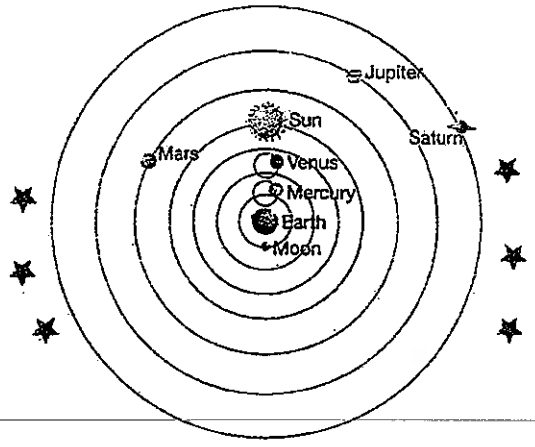
   - ○ 5
   - ○ 10
   - ○ 30 800

7. Which keywords would be most helpful in a search to find information about Ptolemy, the astronomer?

   - ○ Ptolemy OR astronomy
   - ○ Ptolemy AND astronomy
   - ○ information about Ptolemy
   - ○ information about astronomy

Here is a simplified view of Ptolemy's model of the universe.

Use it to complete items 8 and 9.



8. In the simplified view of Ptolemy's model,

   - ○ Earth is at its centre
   - ○ the planets revolve around the Sun
   - ○ Neptune's orbit was predicted before it was discovered
   - ○ distances from planets to the Sun were correctly described

9. In the simplified view of Ptolemy's model, the distance between the Sun and Earth

   - ○ cannot be predicted
   - ○ always stays the same
   - ○ changes as the Sun and Earth move

10. What is the largest object in our solar system?

    - ○ Earth
    - ○ Jupiter
    - ○ the Sun
    - ○ the Moon

11. What holds planets in orbit around the Sun?

    - ○ energy
    - ○ force
    - ○ friction
    - ○ rotation

12. Which statement below correctly compares the observations and inferences of Ptolemy and current astronomers?

    - ○ The sky looked much the same so Ptolemy made similar observations and inferences to current astronomers.
    - ○ The sky looked much the same so Ptolemy made similar observations but different inferences from current astronomers.
    - ○ The sky looked very different so Ptolemy made similar observations but different inferences from current astronomers.
    - ○ The sky looked very different so Ptolemy made different observations and inferences from current astronomers.

Read ***The history of fireworks*** on page 4
of the magazine, then complete items 13 to 19.

13. In fireworks, which chemical produces yellow light?

- ○ carbon
- ○ aluminium
- ○ sodium nitrate
- ○ calcium chloride

14. Why did the bamboo stick filled with 'fire chemical' blow apart in the fire?

- ○ The 'fire chemical' dissolved in the fire.
- ○ The solid stick expanded when heated.
- ○ The 'fire chemical' melted and needed to escape.
- ○ The pressure of gases built up inside the stick.

15. 'Fire chemical' would best be classified as

- ○ a compound
- ○ an element
- ○ a mixture

16. What is the modern term for 'green men' ?

- ○ fire lighters
- ○ fire masters
- ○ pyrotechnics
- ○ pyrotechnicians

17. What changes have occurred since fireworks were invented?

- ○ Fireworks now make less pollution.
- ○ People now think fireworks are very beautifu
- ○ The chemistry of fireworks is now better understood.
- ○ Fireworks are now used for public displays and celebrations.

18. The energy in the firework is transformed into

- ○ light and sound energy
- ○ heat and electrical energy
- ○ heat and chemical energy
- ○ colour and potential energy

19. If an astronaut let off a firework on the Moon, which of the following could be correct?

- ○ She could see and hear the firework.
- ○ She couldn't see or hear the firework.
- ○ She could see the firework but not hear it.
- ○ She could hear the firework but not see it.

Read ***Green nappies*** on page 5 of the magazine, then complete items 20 to 25.

20. Opinions about 'green' nappies might vary.

Which statement below is always correct?

- ○ Scientists have the same opinion about 'green' nappies as other people.
- ○ Scientists' opinions based on social, ethical and scientific evidence are right.
- ○ People consider scientific evidence to form their opinions about 'green' nappies.
- ○ People's opinions about 'green' nappies can depend on social, ethical and scientific evidence.

21. What is a suitable hypothesis for Mitchell's investigation?

- ○ 'Green' nappies will absorb 400 g of urine.
- ○ 'Green' nappies require 10 minutes to fill with urine.
- ○ 'Green' nappies absorb more urine than other nappy brands.
- ○ 'Green' nappies are more biodegradable than other nappy brands.

23. What does 'g' mean in the table in the article?

- ○ grams
- ○ gravity
- ○ kilograms
- ○ mass

24. How could Mitchell have improved the reliability of his results?

He could have

- ○ tested more than one nappy of each brand
- ○ weighed the bucket before adding the water
- ○ used more brands of nappies in his investigation
- ○ left the nappies in the bucket for a longer time

25. Which human body system produces urine?

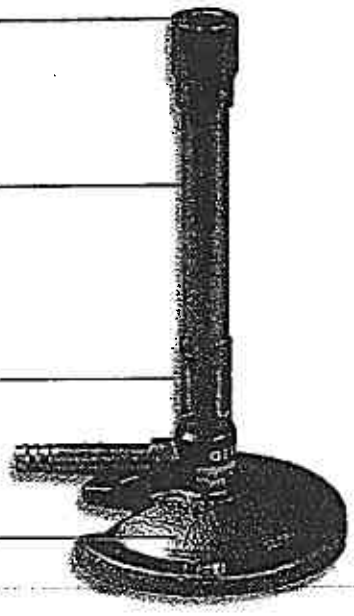
- ○ circulatory
- ○ digestive
- ○ excretory
- ○ respiratory

22. Which variables should Mitchell keep constant in order to carry out a controlled investigation?

Variable	Yes	No
Brand of nappy	○	○
Time in bucket of water	○	○
Volume of water in bucket	○	○
Mass of nappy after 10 minutes	○	○

Read ***Who invented the Bunsen burner?*** on pages 6 and 7 of the magazine, then complete items 26 to 35.

26. Which part of the Bunsen burner is called the air hole?



27. The safety flame of the Bunsen burner is easier to see.

What is another advantage of the safety flame?

- It flickers.
- It is sooty.
- It is yellow.
- It is not very hot.

28. Look at the photograph of the changing flame at the bottom of the article.

What is the most likely cause for the changes from flame 1 to flame 4?

- The gas tap is being turned towards on.
- The gas tap is being turned towards off.
- The collar is being turned to let in less air.
- The collar is being turned to let in more air.

29. What is the best way for you to work safely in your school laboratory?

- Avoid performing practical activities.
- Carefully follow the teacher's instructions.
- Only use the safety flame on the Bunsen burner.

30. The article describes two accidents that caused injuries to Bunsen and Davy.

Which of the following safety equipment would have prevented their injuries?

Here are some more items for ***Who invented the Bunsen burner?***

31. Many chemists in the 1800s had serious accidents.

    The most likely reason is

    - ○ they had a lot of bad luck
    - ○ they used faulty equipment
    - ○ they were not very good scientists
    - ○ they were doing investigations that had not been done before

32. Which chemical named in the article could have the formula NCl_3?

    - ○ coal gas
    - ○ chlorine
    - ○ carbon dioxide
    - ○ nitrogen trichloride

33. Which problem-solving strategy did Faraday use to make liquid chlorine?

    - ○ working with other scientists
    - ○ researching background information
    - ○ experimenting and learning from mistakes
    - ○ performing the same investigation as another scientist

34. What happens when chlorine is converted from a gas to a liquid?

    - ○ A chemical change occurs.
    - ○ The chlorine particles increase in size.
    - ○ The chlorine particles lose some energy.
    - ○ The chlorine particles move more quickly.

35. What is the main difference between chlorine and carbon dioxide?

    - ○ Chlorine is a gas but carbon dioxide is a liquid.
    - ○ Chlorine is a metal but carbon dioxide is a non-metal.
    - ○ Chlorine is a compound but carbon dioxide is a mixture.
    - ○ Chlorine is an element but carbon dioxide is a compound.

Read ***Making rocky road*** on page 8 of the magazine,
then complete items 36 to 40.

36. Models are useful in science because they

- ○ always work
- ○ are fun to make and use
- ○ help explain observations and facts
- ○ show exactly what science is about

37. How is rocky road similar to conglomerate?

- ○ Both are mixtures of different materials.
- ○ Both consist of particles sorted into layers.
- ○ Both are formed when a hot thick liquid cools.
- ○ Both need pressure to cause the materials to be glued together.

38. Place the steps for **forming** conglomerate in the correct order.

Write a number in each box to show the order. Start with 1 for the first step.

- ☐ Layers of sediment build up in the river.
- ☐ Rocks are weathered and eroded.
- ☐ Pebbles and silt settle to the bottom of a river.
- ☐ Pebbles and silt are compacted and cemented together.

39. In the next lesson, Mrs Smithers told the class that conglomerate was made from recycled rock fragments.

What did Mrs Smithers mean by *recycled rock fragments*?

- ○ Existing rocks combine naturally to make new rocks.
- ○ People can use the same rocks over and over again.
- ○ Conglomerate is an example of an artificially made resource.
- ○ People break up rocks into fragments to make conglomerate.

40. In another lesson, the students modelled the process of chemical weathering.

Which activity would best represent chemical weathering?

- ○ rubbing a rock with sandpaper
- ○ leaving a rock in a beaker of acid
- ○ soaking a rock in water then putting it into the freezer
- ○ heating a rock in a flame then cooling it in a beaker of water

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Read ***Roller-coaster*** on page 9 of the magazine,
then complete items 41 to 47.

41. Look at the diagram in the article.

Which of the following best describes the speed of the roller-coaster from C to D?

- ○ The roller-coaster will speed up.
- ○ The roller-coaster will slow down.
- ○ The roller-coaster will stay at the same speed.

42. The force of gravity pulls the roller-coaster

- ○ downwards from A
- ○ to the right at B
- ○ upwards from C
- ○ to the left at D

43. What type of energy does every moving object have?

- ○ chemical
- ○ electrical
- ○ kinetic
- ○ potential

44. Energy changes occur in the roller-coaster.

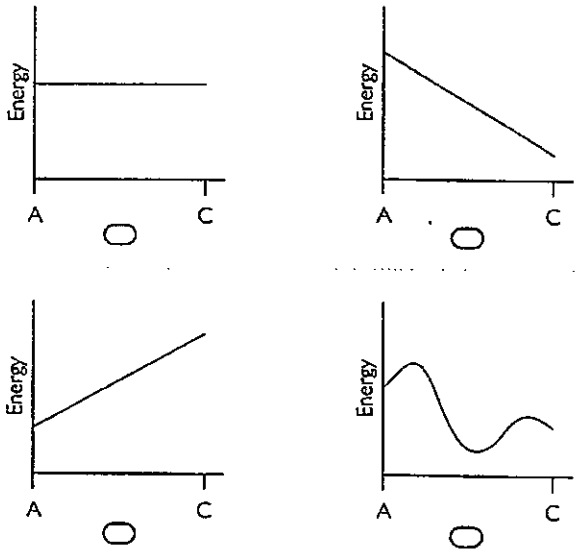
Which of the following would have similar energy changes?

- ○ burning wood in a fire
- ○ throwing a ball into the air
- ○ using electricity to light a house
- ○ bowling a ball along a slippery bowling alley

45. What effect will friction have on the speed of the roller-coaster?

- ○ Friction will make the speed increase.
- ○ Friction will make the speed decrease.
- ○ Friction will make the speed stay the same.

46. Which graph best represents the change in kinetic energy as the roller-coaster travels from A to C?



47. An energy transformation involves

- ○ creating or destroying energy
- ○ turning energy into matter in an object
- ○ changing energy from one form to another
- ○ transferring energy from one object to another

Read ***Murray cod and fish traps*** on pages 10 and 11 of the magazine, then complete items 48 to 53.

48. Which of the following set of features is used to classify the Murray cod as a fish?

- ○ backbone
- ○ eats yabbies and frogs
- ○ lives in diverse habitats
- ○ gills, scales, fins and tail

49. Choose *true* or *false* for each of the following.

Murray cod are examples of	True	False
fossil fuels	○	○
living things	○	○
food for humans	○	○
ancestral creation beings	○	○

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51. During a drought, where would Murray cod be most likely to live?

- ○ in the oceans
- ○ in larger rivers
- ○ in smaller streams
- ○ in the Brewarrina fish traps

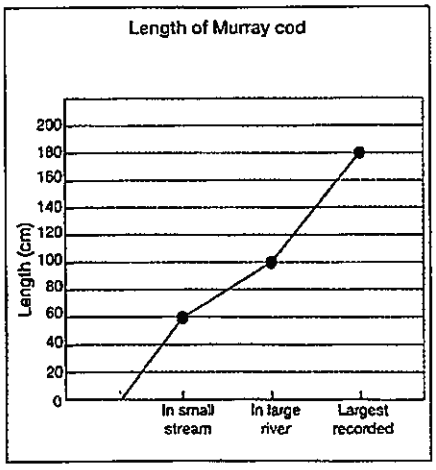
52. Why are the Brewarrina fish traps called a technology?

- ○ They make fishing fun.
- ○ They are used by people.
- ○ They make fishing easier.
- ○ They are large and made of stone.

53. The ancient Aboriginal people who used the Brewarrina fish traps must have also known scientific information about

- ○ using fishing nets
- ○ ancestral creation beings
- ○ the largest Murray cod ever caught
- ○ when fish move up and down rivers

50. Which graph below is the most appropriate for presenting data about the length of Murray cod?



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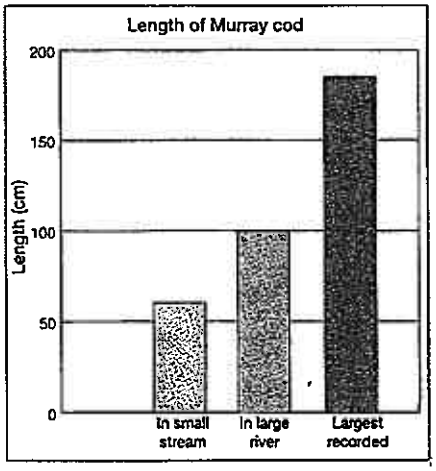
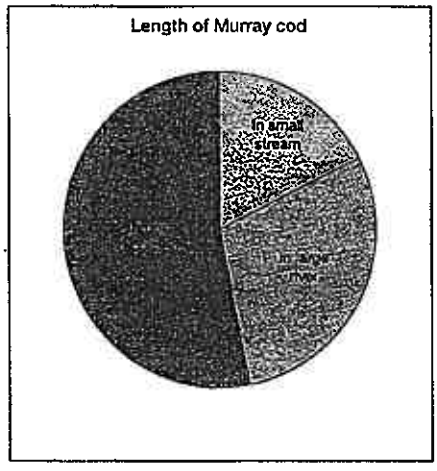


○



○

Read ***Dr Kirsten Benkendorff*** on page 12 of the magazine, then complete items 54 to 58.

54. How could Kirsten's research help our society?

- ○ improved health care
- ○ a cleaner environment
- ○ greater variety of shellfish to eat

55. Kirsten was awarded 'Young Australian of the Year for Science and Technology' for her research.

What advance in science was probably recognised by the award?

- ○ research on the Illawarra coast
- ○ discovery of new mollusc species
- ○ research about how molluscs breed
- ○ discovery of new grants to develop her research

56. When classifying animals such as molluscs, scientists usually consider an animal's

- ○ colour
- ○ diet
- ○ habitat
- ○ structural features

57. The table below lists some effects of scientists communicating regularly with the media.

Which ones are likely to **benefit** scientists? Choose *yes* or *no* for each effect.

Effect	Yes	No
Reduced time for their research	○	○
Increased criticism of their findings	○	○
Increased funding for their research project	○	○
Society is informed about important findings that might affect us.	○	○

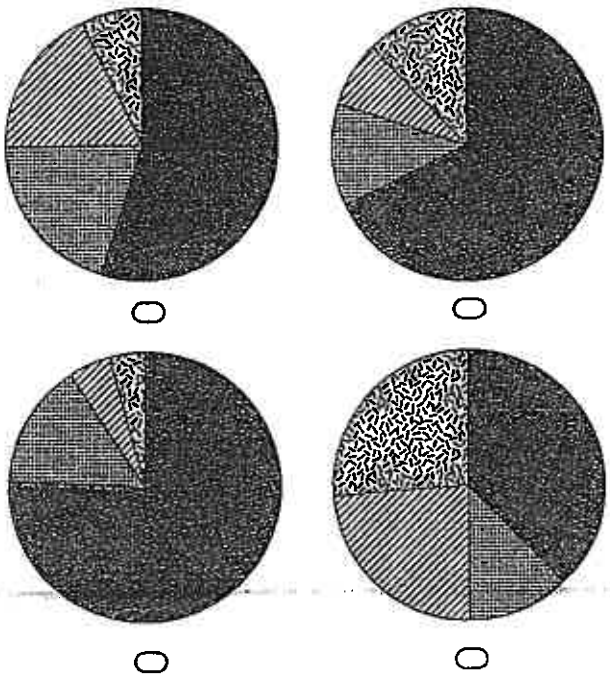
58. Scientists, like Kirsten, must use a sequence of steps in scientific investigations.

Place a number in each box to show the correct sequence.

- ☐ analyse results
- ☐ record observations
- ☐ design the investigation
- ☐ develop a hypothesis to test

Read ***Breathe in, breathe out!*** on page 13 of the magazine,
then complete items 59 to 64.

59. Which of the following is the correct graph for the composition of exhaled air?



60. Find 'oxygen' in the table in the article.

What percentage of inhaled air is used up by the body?

- ○ 4%
- ○ 6%
- ○ 15%
- ○ 21%

61. The model in diagram B does not show the

- ○ ribs moving
- ○ lungs expanding
- ○ diaphragm moving
- ○ air moving into the lungs

62. Place the steps below in the correct order to explain why air moves into the model of the lungs in Diagram B.

Write a number beside each event to show the correct order.

- ☐ The rubber floor is pulled downwards.
- ☐ A larger space is produced in the bell jar.
- ☐ Air from outside the bell jar rushes through the glass tube to fill the balloons.
- ☐ The air pressure inside the bell jar is less than the air pressure outside the bell jar.

63. What is the main function of the respiratory system in the body?

- ○ It removes water.
- ○ It provides oxygen.
- ○ It transports nutrients.
- ○ It gives a job to the diaphragm and ribs.

64. Which substances are used for respiration in cells?

Choose *yes* or *no* for each chemical.

Is it used for respiration?	Yes	No
carbon dioxide	○	○
glucose	○	○
nitrogen	○	○
oxygen	○	○
water	○	○

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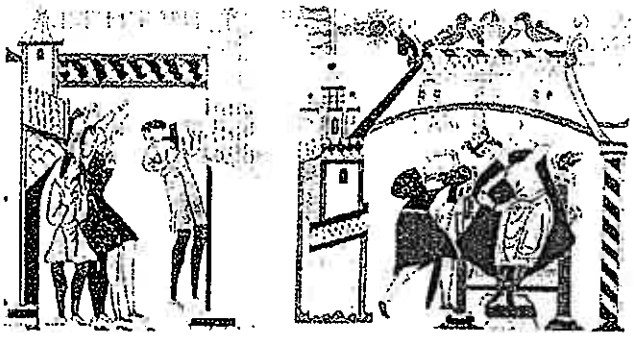
Read ***Will you be around to see it?*** on page 14 of the magazine, then complete items 65 to 69.

65. Circle Halley's comet in the picture below.



66. In 1910, why did the media warn people about poisonous gases coming from the comet?

- ○ The comet was going to hit Earth.
- ○ Earth would pass through the comet's tail.
- ○ The comet had covered Earth with poisonous gases in past visits.
- ○ Comets are feared by people and linked to devastating events.

67. What does Halley's comet orbit around?

- ○ an asteroid
- ○ Earth
- ○ the Solar System
- ○ the Sun

68. Number the following in order from the largest (1) to the smallest (4).

- ☐ Halley's comet
- ☐ the Milky Way galaxy
- ☐ the planet called Mercury
- ☐ the star called Alpha Centauri

69. What is an inference?

- ○ a graph of results
- ○ an observation based on using our senses
- ○ a description of what you think will happen
- ○ a possible explanation for a set of observations

Read ***Testing how high balls bounce*** on page 15 of the magazine, then complete items 70 to 75.

70. In the investigation shown in the photograph, the students have decided to change one variable.

The changed variable is

- ○ the type of ball
- ○ how far a ball falls
- ○ the height a ball bounces
- ○ the time taken for a ball to fall

71. The rubber ball bounced 0.7 m high.

How many centimetres is this?

- ○ 0.7
- ○ 7
- ○ 70
- ○ 700

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73. The students think that the tennis ball will bounce the highest.

This statement is an example of a scientific

- ○ investigation
- ○ observation
- ○ prediction
- ○ theory

74. Observations are

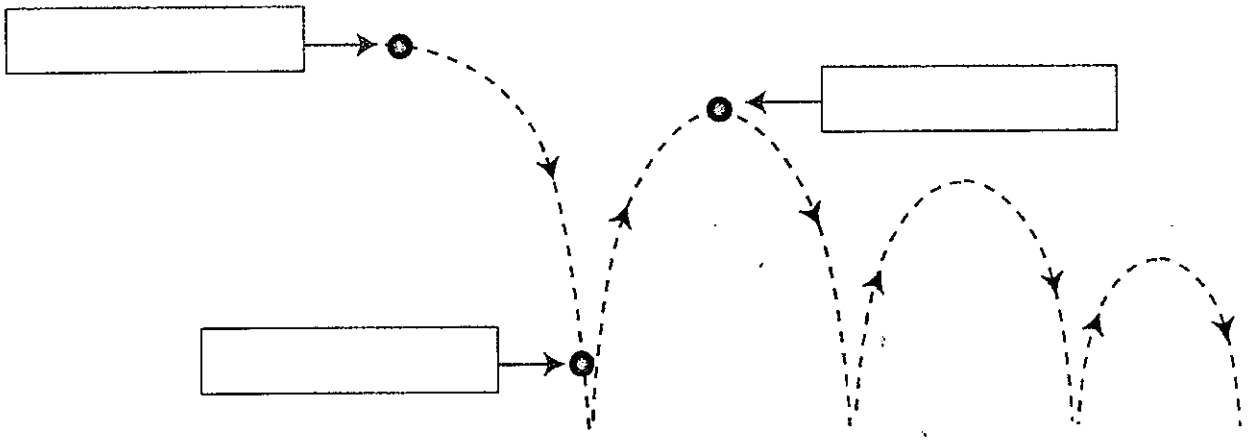
- ○ always presented in a table
- ○ educated guesses about a problem
- ○ a summary of the results of an investigation
- ○ information collected during an investigation

75. The best way to record the results for this investigation would be in a

- ○ description
- ○ diagram
- ○ flow chart
- ○ table

72. The dotted line in the diagram below shows the path of a bouncing ball.

Label the diagram with the names of the main type of energy that the ball has. Write in each box.



A snake that changes colour!

The Green Python (*Morelia viridis*) lives in the rainforests of northern Australia. It is also an interesting and popular pet for snake lovers.

The adult Green Python is, well, green! However, young Green Pythons have either bright yellow or red skin. Their skin colour changes as the snakes grow.

Young Green Pythons change colour when they are about one year old or about 55 centimetres long.

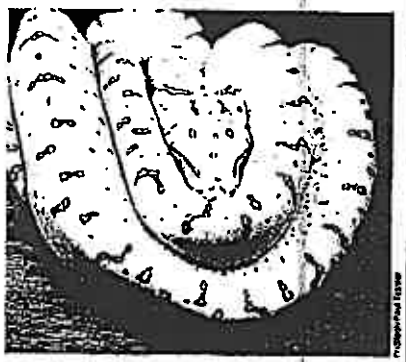
Scientists wondered why these snakes change colour, so they studied what they ate and where they lived.

Young Green Pythons live in the multi-coloured grasses and leaves at the edge of the rainforest. Here, they hunt for small prey such as lizards and cockroaches.

When they become adults, the pythons move into the rainforest, where they hunt for rats and mice on the ground and birds in the trees.

Green Pythons can reproduce when they are about four years old and can live for up to 12 years.

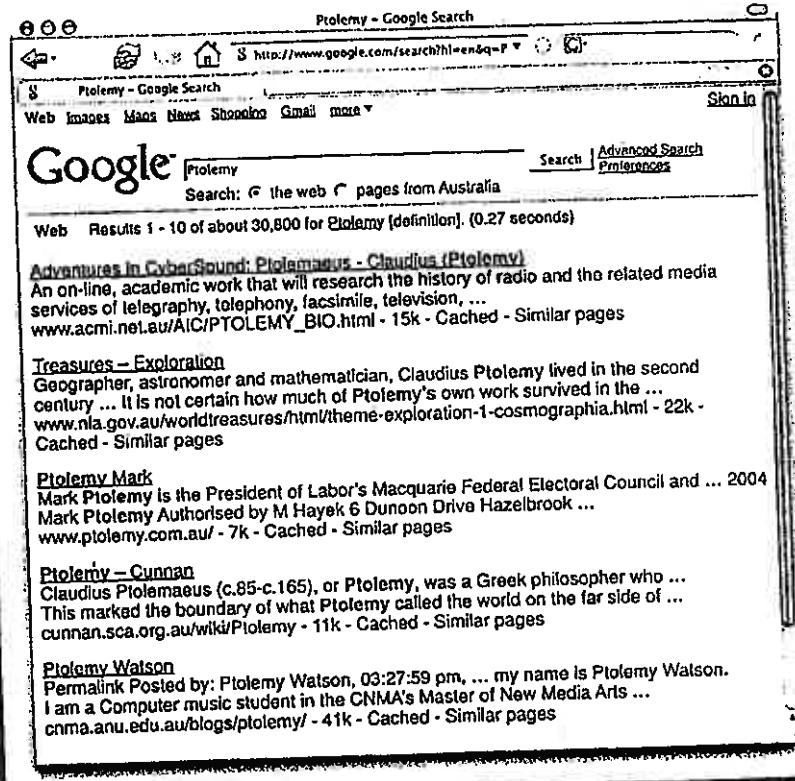
An adult Green Python is green



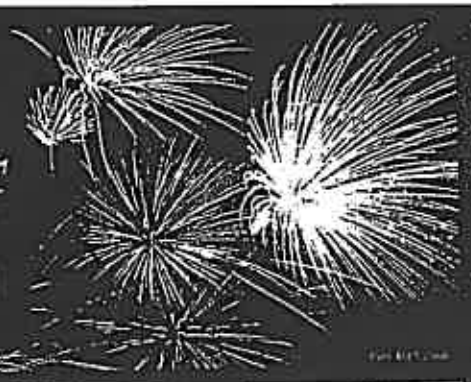
Young Green Pythons are yellow or red

Research using Google™

A student is researching historical models of the universe. He is researching the work of Ptolemy.



The history of fireworks



Whiz! Bang! Pop! Fireworks are often used as part of big celebrations.

It is believed that the first fireworks were made over 1000 years ago in China. A cook mixed together honey, sulfur and saltpetre, which were common ingredients found in ancient kitchens. The resulting black powder, called 'fire chemical', could be inserted into a hollow bamboo stick. When the stick was thrown into a fire, the gases that were produced blasted the stick apart. The basic fire cracker was born.

Before long, the knowledge of fireworks began to spread to the west, where Italian 'fire masters' spent much time creating different effects. Still, the main colours of fireworks were white and orange.

In the 1530s, fireworks were lit by fire masters called 'green men', who covered their faces in soot and dressed in leaves. They ran around lighting fuses to make displays of fireworks.

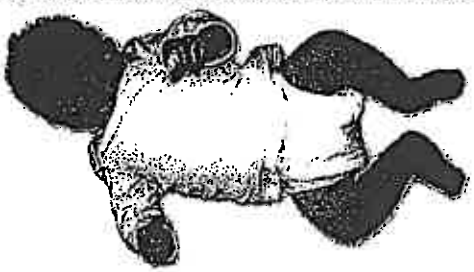
In the 1830s in southern Italy, scientific advances in chemistry enabled pyrotechnicians (the modern term for fire masters) to create reds, greens, blues and yellows.

Today designing, making and lighting fireworks involves a lot of science. However, there is still plenty to learn.

Some firework chemicals and their colours

Colour	Chemical
blue	copper (I) chloride, $CuCl$
gold	carbon, C
green	barium chloride, $BaCl_2$
orange	calcium chloride, $CaCl_2$
red	lithium carbonate, Li_2CO_3
silver	aluminium, Al
white	barium oxide, BaO
yellow	sodium nitrate, $NaNO_3$

Green nappies



The average baby creates enough dirty disposable nappies to fill 16 huge garbage bins. Scientists are trying to improve biodegradable nappies, called 'green' nappies, and hope this will help tackle our large garbage problems.

Most nappies take up to 500 years to break down. They take up lots of space in garbage dumps. The new 'green' nappies will break down in a much shorter time.

The new 'green' nappy could consist of two layers:

- an absorbent core, made from naturally occurring starch, which can absorb urine and draw it away from the skin
- a waterproof outer cover made from natural fibres.

Some people want to use nappies made from natural and recycled fibres because it is important to them that the product is biodegradable.

Mitchell decided to test how effective 'green' nappies are at absorbing urine. He compared 'green' nappies with three other brands of disposable nappies. His method and results are outlined below.

Method

1. Find the mass of a dry nappy of each brand.
2. Place the nappies in a bucket of water for 10 minutes.
3. Remove the nappies from the bucket.
4. Find the mass of each nappy again.
5. Calculate the change in mass of each nappy.

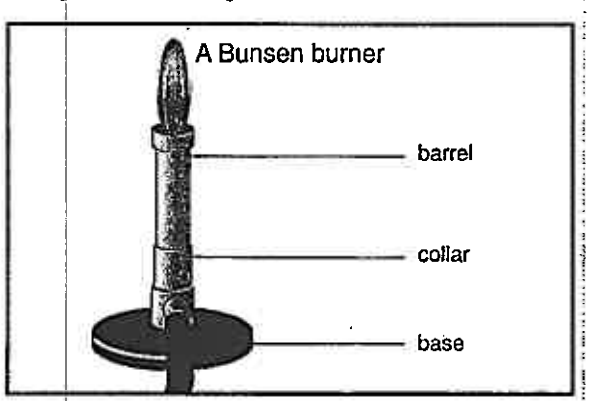
Results

Brand of nappy	Mass increase (g)
'green'	400
A	350
B	300
C	250

Who invented the Bunsen burner?

Some people say a German chemist called Robert Wilhelm Bunsen invented the Bunsen burner in 1855. He designed a heating device that had a very hot flame but did not give out a lot of light.

It was Bunsen's idea to mix coal gas with air at the bottom of a tube called a barrel. Then the mixture travelled up the barrel to the top where the coal gas was burnt.



Bunsen's laboratory assistant, Peter Desaga, worked out how to make the burner. He probably developed the rotating collar that we turn to cause either a safety flame or a heating flame.

An earlier burner was invented by an English scientist named Michael Faraday. His burner did not have an air hole. The flame was much like a safety flame because it flickered, was sooty and was not very hot.

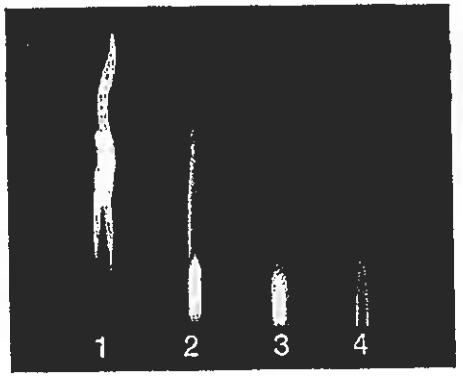
Robert Bunsen
(1811–1899)

Michael Faraday
(1791–1867)

Sir Humphry Davy
(1778–1829)

Faraday used his burner to heat gases such as chlorine and carbon dioxide. He believed they would turn to liquids if he heated them. Instead, he discovered some of them exploded, so he gave up on that idea and tried cooling them instead. That's when he succeeded in making liquid chlorine. Faraday also researched and studied the properties of magnetism and electricity.

Being a scientist in those days was not a safe occupation. Bunsen lost the sight in one eye in a chemical explosion and Sir Humphry Davy, a Welsh chemist, damaged his own eyesight in an accident with nitrogen trichloride.



The changing flame of a Bunsen burner

Making rocky road

Today's science lesson was about a sedimentary rock called conglomerate. Mrs Smithers, our teacher, said we would have a better understanding of how conglomerate forms if we modelled the process by making rocky road.

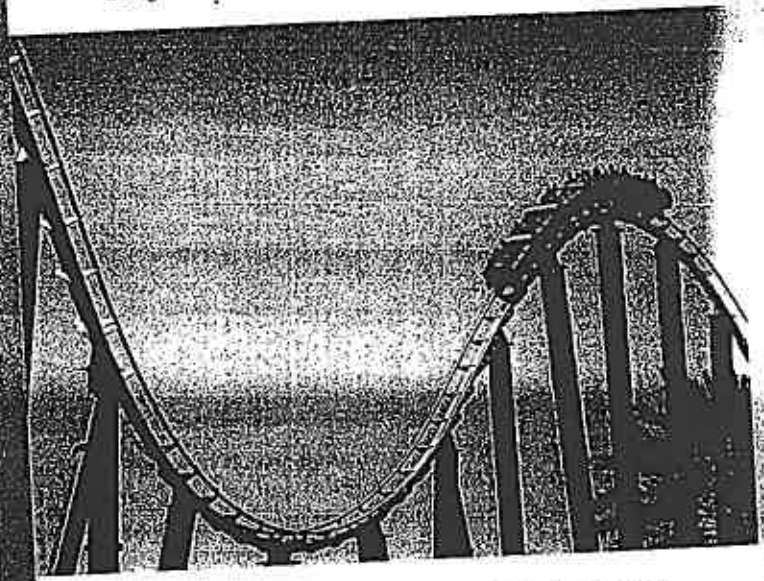
We used peanuts, marshmallows, raspberry-flavoured lollies and melted chocolate.

We mixed all the ingredients and put the mixture on a clean tray. Ten minutes later, the chocolate was set and held all the other ingredients together.

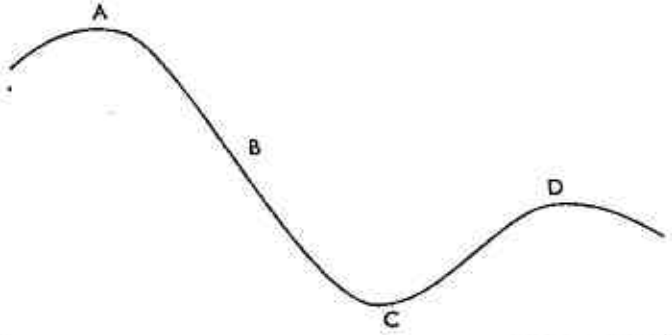
We described the rocky road, then we described a sample of conglomerate. Conglomerate is a rock made of rounded pebbles of different sizes and colours. The pebbles are cemented together by very fine-grained particles of silt or mud. We compared our model with the conglomerate, then we ate the rocky road!

Roller-coaster ride

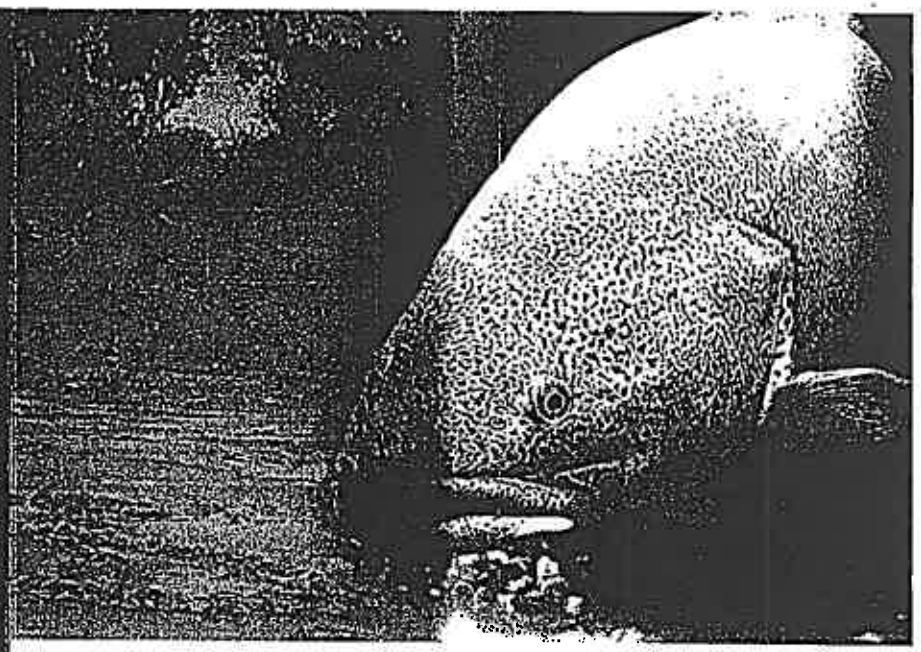
A roller-coaster is a ride at a fun park. The roller-coaster travels along a track. It rolls up and down the hills in the track.



A diagram of part of the roller-coaster ride is shown below.



MURRAY COD AND FISH TRAPS



Ecologists say the Murray cod is a remarkable fish. It is very adaptable and can live in diverse habitats. These range from quite small clear rocky streams and pools in the mountains to large meandering slow-flowing rivers such as the Murray, Darling and Barwon Rivers.

Murray cod can grow to at least 60 cm and 3 to 4 kg in small streams. In larger waterways, Murray cod usually reach 90 to 100 cm and 15 to 20 kg. The largest Murray cod ever officially recorded was 183 cm and 113 kg.

Murray cod have a varied diet consisting of other fish, spiny freshwater crayfish, yabbies, prawns, freshwater mussels, frogs, water fowl, small mammals, tortoises and other reptiles. They consider virtually anything that moves and is small enough to fit in their mouths as a possible meal!

Aboriginal people were impressed by Murray cod because, in addition to being a major food source, they were the largest, most abundant and most beautiful of the native fish species. In Brewarrina, fish traps were used to catch fish such as Murray cod.

What are the Brewarrina fish

The Brewarrina fish traps are important to many Aboriginal communities in the Brewarrina region in north-west New South Wales. The local Ngemba people know the fish traps as the Ngunnhu. According to Aboriginal tradition, the fish traps were designed and built by ancestral creation beings.

The traps are nearly half a kilometre long and consist of a series of dry-stone weirs and ponds arranged like a net across the Barwon River. Some walls are higher than others so the traps could be used during both low and high water flows.

The Brewarrina fish traps were built over forty thousand years ago. These ancient Aboriginal technologies have deep cultural significance. They demonstrate the advanced understanding by Aboriginal people of the land and its natural resources.

Dr Kirsten Benkendorff

Young Australian of the Year for Science and Technology

As a young girl, Kirsten Benkendorff was curious, a great observer and enthralled by organisms that she found living in the areas around where she lived.

As a young adult, Kirsten researched molluscs living on the Illawarra coast of New South Wales. She has discovered 154 mollusc species and a powerful antibiotic in a project that combined the knowledge of biology and chemistry.

As her scientific career has developed, Kirsten has designed research activities that contribute to improving people's lives as well as satisfying her scientific curiosity.

Dr Kirsten Benkendorff talks about her research

"Before starting my research, I needed to know what species lived along the Illawarra coast. Without planning it, I ended up with the most complete record of mollusc species living in the region. I also found important breeding sites.

"Then I confirmed that eggs from most mollusc species have chemical compounds that fight infection.

"The highlight of my research was identifying a powerful antibiotic in these chemical compounds. It is now being artificially made by the pharmaceutical industry.

"It is important for scientists to communicate their research to the general public. Since the recent media attention about my research, I have been contacted by many members of the public. Some people are interested in investing, others have given me new information that I can use to develop my research, and I've been offered a research grant."

An example of a mollusc

Breathe in, breathe out!

You breathe between 15 and 20 times per minute without thinking.

Breathing movements involve the combined action of the chest muscles and the diaphragm.

Diagram A shows what happens when you breathe in and out.

Diagram B shows apparatus that can be used to model what happens when you breathe. In science, we often use models to help explain a process or a concept.

When you breathe in, you take in a mixture of gases called air.

The table below shows the difference in the composition of the air you breathe in (inhale) and the air you breathe out (exhale).

Diagram A

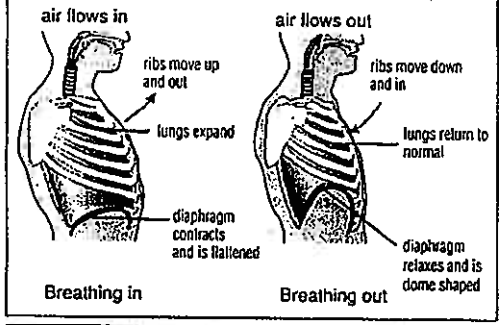
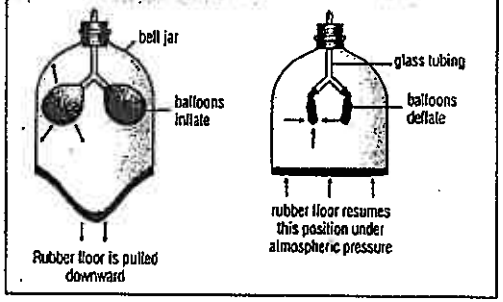


Diagram B



Composition of inhaled and exhaled air

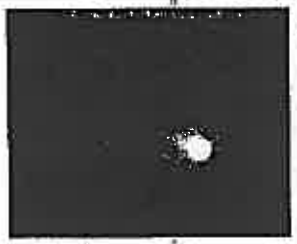
Gas	Inhaled air (%)	Exhaled air (%)
Nitrogen	78.0	76.0
Oxygen	21.0	15.0
Carbon dioxide	0.04	4.0
Water vapour	0.96	5.0

Will you be around to see it?

Halley's comet has been a regular visitor to our skies since 240 BC. It is due to return in 2061.

In 1705, Edmund Halley used Newton's new theory of gravitation to deduce the orbits of comets. He based his calculations on recorded observations in historical documents.

Halley found that the bright comets of 1531, 1607 and 1682 had almost identical orbits and so he concluded that these were different appearances of the same comet. Then he used his calculations to predict that this comet would return in 1758. Halley did not live to see his prediction tested.



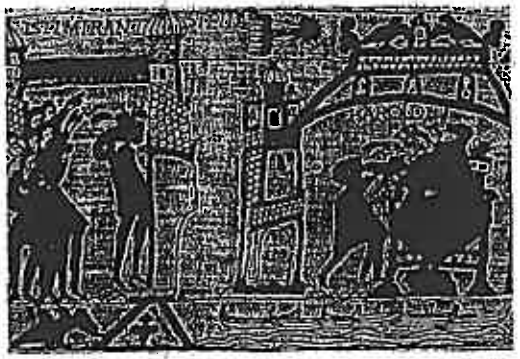
Halley's comet in a photograph taken at the Anglo-Australian Observatory

But on Christmas night 1758, the comet reappeared, which supported his bold inference. The comet Halley studied so carefully is now called Halley's comet.

A photograph of Halley's comet

The 1910 approach of Halley's comet led to the first photographs and media stories warning people about being engulfed in poisonous gases as Earth moved through the comet's tail. In reality, the gases were so thin that Earth suffered no ill effects.

The 1986 approach of the comet was unfavourable for observers on Earth as light pollution tainted the night sky. However, advances in space travel and the development of several space probes gave scientists the opportunity to study the comet at close quarters.

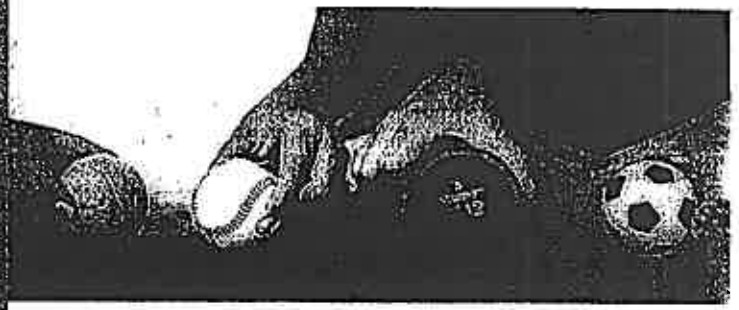


An early record of the passing of Halley's comet in 1066

The nucleus of the comet is black and shaped like a peanut. It is relatively small, measuring approximately 15 km long, 8 km wide and 8 km thick. As the comet approaches the Sun, its surface changes directly from a solid to a gas. Jets of gases burst from its surface, making it appear to have a white tail.

Testing how high balls bounce

These students are about to drop four balls to see which type of ball bounces the highest.



tennis ball baseball cricket ball rubber ball

Sea otters

Sea otters live in the shallow coastal waters of the northern Pacific Ocean, along western Alaska.

Sea otters need a lot of energy to keep warm. A sea otter eats 25 percent of its body weight every day. Among the otters' favourite foods are crabs, sea urchins, clams, mussels and shrimp.

Unlike whales and sea lions, sea otters have no layer of blubber to insulate their bodies. Instead, they have only thick fur.

For 150 years, sea otters were hunted heavily for their fur and were nearly extinct by the early twentieth century. However, protection from hunting has allowed a steady recovery of their population.