Science by the Mile
Self-Guided Science Walking Trail

PARLIAMENT STATION TO MELBOURNE MUSEUM

Science by the Mile is a science walking trail designed to highlight how science is all around us and can be seen influencing everything we do, even while walking along the street. The trail is in the north-east corner of the city and has been put together with the assistance of the City of Melbourne. It commences at the Gold Treasury Museum, adjacent to Parliament Station (see Figure 1.1), and finishes at Melbourne Museum next to the Royal Exhibition Building. It follows Melbourne’s Golden Mile Heritage Trail and is marked with brass markers in the footpath every 1.5 m. Along the way are 32 ‘science objects’ and seven ‘science activities’.

There are two ways students can experience the trail:

1. **Identifying science objects**
   By simply following the brass markers, students can observe a range of ‘science objects’ en route. Science by the Mile has identified 32 science objects and questions students about each of these. These objects include: early pharmaceutical apparatus, video surveillance cameras, traffic induction cables, anemometers, trig points and water fountain float valves, to name just a few.

2. **Undertaking the science activities**
   The Science by the Mile program incorporates seven sites with activity sheets developed for each. Teachers and students are able to select which activities they would like to complete as they walk the trail. The activities cover: architecture, building materials, archaeology, meteorology, hydrology and more.

Enquires about Science by the Mile:
email: jfrancis@museum.vic.gov.au

Science by the Mile is supported by the **Department of Innovation, Industry & Regional Development**.
Fig 1.1. Science by the Mile Trail
Before your excursion:
• Carefully read and discuss the descriptions and questions below.
• Decide which science objects (1-32) you will look at.
• Discuss your excursion plans in detail so that everyone involved knows what is expected.

During your excursion:
• Use the questions to initiate discussion about the ‘science’ involved in each object/topic.
• Note that some questions do not have a particular answer.
• Be traffic conscious at all times. Take particular care when crossing roads.

After your excursion:
• Use library/internet resources to further research the topics you have discussed.
• Students could choose one topic/object to use as the basis for a project to share with the class.

1. Push button pedestrian crossing at Lansdowne Street
   This crossing’s control device makes a noise as well as showing a green and a red man. Why does it do that? How many different sounds does it make? Can you mimic them?

2. A large fountain in Gordon Reserve
   Do you know why the fountain was turned off for most of 2003?
   Why had Melbourne ‘run out’ of water even after a few months of significant rain?
   What could we do about water shortages?

3. The float-valve in the base of the Stanford Fountain
   When there is water in the fountain, how does the little black ball attached to the pipe in the fountain base control the flow of water? Is there anywhere in your own house where you might find one of these?

4. Security surveillance video camera on top of Parliament House
   See if you can see any other surveillance cameras as you walk the trail. How many can you count? How does the council attempt to hide them?

5. *The screeching noise of trams rounding the Bourke Street corner
   Listen to the noise the trams make as they round this corner.
   How would it be possible to prevent the tram wheels from making this noise?

6. Bluestone in footpaths, building foundations and bases for fences
   Melbourne sits on one of the largest bluestone plateaus in the world. Bluestone is a volcanic rock, which is also known as basalt. Melbourne’s basalt originated in lava flows from small volcanoes to the north of the city. Can you see any signs of air-pockets in the bluestone?

7. Golden Mile plaques showing brass surface has tarnished
   Exposure to air (especially polluted air) causes brass to tarnish.

8. Cast iron picket fence
   What is the difference between cast iron and wrought iron?
   Cast iron contains up to 5% carbon making it very hard, but brittle.
   Wrought iron contains a glass-like material. It resists corrosion and is more malleable, making it useful for outdoor furniture and porch railings.
   What causes corrosion?
   What does malleable mean? Why is it useful for wrought iron to be malleable?

9. Silhouettes of former buildings
   Standing in front of this vacant site on the eastern side of Punch Lane, can you see any clues on the adjacent buildings that tell you that there was formerly a building here?
Draw a sketch of the possible shape of the former buildings.

10. *Traffic light induction cables Lonsdale/Exhibition Street intersection*
Do cars pressing on the rubber tapes cause the flow of electricity that triggers the lights? No, it is triggered by the induction effect of the metal in the cars moving over these live cables.

11. Overhead car parking vacancy sign
What might trigger a change in this parking space indicator?

12. Early pharmaceutical apparatus display – Exhibition Pharmacy
Years ago, chemists used instruments like these to make medicines. Nowadays chemists buy most of their medicines ready made.
Do you have any implements like these in your kitchen and what are they used for?

13. Electronic parking ticket machine Spring Street
How many different functions does this meter perform?

14. Historic markings – bluestone slabs, edge of the Royal Society garden
What do you think these markings mean? Do you notice anything inherently wrong with the numbers written on the first and second stones?

15. Glacial boulder from Antarctica
Why do you think the Royal Society of Victoria has placed this boulder here?
Can you find any scratches on it caused by moving ice?

16. Horse drinking trough
In the 1880s, there were 20,000 horses stabled in Melbourne City.

17. Outdoor weather station – Victoria Street
This site is near traffic and tall buildings. Would this affect any readings obtained here?

18. Possum guards on the trees in the Carlton Gardens
Why do some trees have possum guards on them and not others?

19. Trig point in Carlton Gardens (# 313 Q 4)
To what area of science do trig points belong? What is ‘trig’ short for?

20. Rain sensor switch for the Carlton Gardens irrigation system
Can you find the aerial shaped pole on the top of the green box. This is a device that detects rain or recent rain. It prevents the sprinkler system from coming on and watering unnecessarily.

21. *Moss growing on trees*
Why does moss grow predominantly on the south side (not the north side) of trees in the Southern Hemisphere?

22. Anemometer to control operation of fountain
The little anemometer on the light pole just west of the fountain measures the wind speed, and turns the fountain off when the wind gets too strong. Why would the council want to do that?

23. Hochgurtel Fountain scientific reliefs
Fixed to the underside of the bowl at the top of this fountain are a number of reliefs (mouldings) depicting various areas of knowledge. Identify the two that relate to science.

24. Gold on the top of the Royal Exhibition Building dome
There are 14 square metres of gold on the top of the REB dome.
How big an area is this?
As big as a School desk, a car parking space or a school class room?
25. *Royal Exhibition Building dome  
In the 1960s, the Royal Exhibition Building was one of Melbourne’s highest points and therefore housed the Tramways radio base station.

26. 1880s sandstone obelisk, SE corner, Royal Exhibition Building  
Here’s a real science experiment still going on.  
Read about it on the plaque at the base.

27. Swipe card vehicle barrier, SE corner, Royal Exhibition Building  
Science has enabled us to use alternative security measures and ways of controlling access.  
Look at the physical structures near the Nicholson Street car entrance. What has this swipe card barrier replaced?

28. Statue featuring kangaroos in anatomically impossible poses  
What is wrong with the way these kangaroos are sitting in this statue?  
Could dogs or cats sit this way?

29. *Colonial Square featuring early architectural building material  
These old stone blocks were once part of one of the grandest buildings in the city. Read about them on the sign and see if you can determine which parts of the building they came from.

30. Expansion joints in the plaza’s concrete paving  
Why do large areas of concrete like this have expansion joints? Why don’t large areas of asphalt have expansion joints?

31. Lighting projectors to illuminate the Royal Exhibition Building  
The light bulbs in these projectors are not ordinary bulbs. They are 1,800 watt metal-halide bulbs. They create light by passing an electric charge through gas and metal particles. How do ordinary light bulbs work?

32. Electronic entry sensors on Museum’s front doors  
How do these overhead sensors know when somebody wants to come in?  
Would they trigger the doors for a dog or a cat?

For more information on the topics marked with an asterisk ‘*’ visit the Melbourne Museum home page [http://melbourne.museum.vic.gov.au](http://melbourne.museum.vic.gov.au) and place your key words in the search box provided.


For information about the Science by the Mile Trail, contact Justin Francis at Museum Victoria  
Tel. 8341 7388)
1. What shape best describes the perimeter of this reserve? 
*Oblong, Square, Triangle, Octagon or Rectangle*

2. Look at the sketch plan below (Fig 1.2). What does each circle represent? Write your answer in each circle.

3. Now draw the pathways on the sketch plan.

4. Find two objects in the reserve that have a square shape. Use the letter S to show their location on the sketch plan.
Now repeat the exercise for the following shapes.
- Circles CL
- Parallel lines PL
- Curves CV

5. Use the following list of materials to complete the table.
Iron, Sandstone, Granite, Concrete, Wood, Terra cotta, Bluestone, Asphalt

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SCIENCE BY THE MILE:
LITTLE BOURKE STREET & PUNCH LANE ACTIVITY

These streets are more than 150 years old. This activity follows the Golden Mile brass markers along Little Bourke Street and turns right into Punch Lane. Spot the signs of the past as you go.

The Princess Theatre (Northern wall, Little Bourke Street)

1. Write down the four words from the old painted sign high on this brick wall.
2. How many doorways have been bricked up in this wall?
3. Count the metal plates on the wall. These are the ends of long rods that are used to tie old buildings together.

Oakford Gordon Apartments (Little Bourke Street)

4. Did you know that in 1880 there were 20,000 horses stabled in the City of Melbourne? Find the post that was used to tie up horses.

Punch Lane

5. Standing in front of the vacant site on Punch Lane (Figure 1.4), and using the sketch (Figure 1.5), draw the shape of the building that was once here. (Look for clues on the adjoining walls)

Rear of shops facing Lonsdale Street

6. How were these old buildings originally heated?
7. What do these houses have behind them that are not usually found in the city today?

Fig 1.4 Vacant site, Punch Lane
Fig 1.5 Sketch of vacant block in Punch Lane.
1. Moving Ground

Location: The Society’s Hall, at 9 Victoria Street, Melbourne was constructed in 1859 and designed by celebrated architect Joseph Reed who also designed the Melbourne Town Hall. In 1953 an extension was constructed in the identical Victorian architectural style. This extension caused the back wall of the original building to be pushed over. The dramatic cracks shown in the photos above are no longer visible following repair work in 2003.

Discuss the likely reasons for such structural damage. Research and consider:

- Subsoil conditions. Silurian underwater geology can not support the building.
- Traffic increase in 150 years. Recent access to Citylink via Exhibition Street.
- Underground loop railway location.

Use a city map to investigate these and other considerations.

2. Antarctic Rock

A chunk of Antarctic rock sits outside The Society’s building (see photo above).

- When was it brought back from Antarctic?
- What is its significance?
- Why were we interested in finding out about this remote place?
- Were we entitled to bring it to Melbourne?
- Would we do the same today?
Note for teachers: Make sure you bring at least one compass along.

• Look at the ground below the boulder.
• An arrow points towards the South Pole.
• Does your compass point in the same direction? If not can you explain why?
• Place the compass on the boulder. Does the needle change its position? What might cause a change?
• Do you believe that the boulder might be radioactive?
• If so, what might the rock contain?

3. BURKE AND WILLS EXPEDITION

The ill-fated Burke and Wills expedition originated at The Royal Society of Victoria.

• What were the political motivations for the expedition?
• Who were the players involved and describe what they may have been like?
• What did The Society hope to learn from the expedition adding to our scientific knowledge of this continent?
• The Society can provide you with a comprehensive stocktake of supplies taken on the expedition – after reading this list, try to construct a list for today. Note how innovations in preservation techniques, new materials (clothing and construction), modes of transport, methods of navigation and communication have all impacted on our lives.
• Are we right in judging the failures of the expedition in today’s terms? Eg. The expedition leaders failure to acknowledge indigenous knowledge.
• What have we learned from that?
4. VOICE FOR SCIENCE

- What does scientific thinking mean compared with ancient and medieval thinking?
  Research this.

5. BLUESTONE BLOCKS

Look for the bluestone blocks edging the grounds around The Society’s building on its south-west corner, with particular markings on them:

- Who made them?
- What do they represent?

Draw the markings on three marked kerbstones in the boxes:

What is strange about these markings?

What do you think V and VV mean?

Does 1/4 or 3/4 suggest that these are measurements?

If V is the Roman numeral for 5, what might VV mean?

How did the Romans identify fractions?

Have you heard of the quadrans and the dodrans?

Did the Romans use a decimal system or another system?

6. SCIENTIFIC WRITING

Traditionally scientific writing has been in the passive third person. Have a look at some extracts from our early papers inside the Royal Society. Students are most welcome to visit the Royal Society of Victoria. Larger groups should book.

- How does this writing method affect how the content is read?
- Why is this the chosen method?
- Is this changing today?

EDUCATION SERVICES CONTACTS:

The Society Hall is listed in the Historic Buildings register and classified by the National Trust. The Hall contains offices and formal and informal meeting facilities. The lecture theatre is available for hire seating 100.

Contact The Society’s Education Officer for customised resources and activities designed for your specific leaning needs. The Royal Society also offers regular free public lectures on many aspects of contemporary scientific research.

For further details check out The Society’s website: www.sciencevictoria.org.au or phone (03) 9663 5259.
Fig 1.6. Weather Instruments Map. Melbourne Weather Observation Site
SCIENCE BY THE MILE: 
BUREAU OF METEOROLOGY MELBOURNE OBSERVATION SITE

Observation Site History.

Melbourne meteorological observations have been performed at three different sites. From 1840 to 1862 meteorological observations were performed in the vicinity of the Flagstaff Gardens. From 1862 to 1912 observations were performed at the Melbourne Observatory in the Domain Gardens. In 1908, the year the Bureau was formed, observations commenced at the current site, the Royal Society Gardens, on the corner of Latrobe Street and Victoria Parade. Observations from the current site have been performed continuously for 95 years.

History of the Current Site.

Tall buildings and the proximity of busy roads affect exposure at the current site. Comparable records going back to the 1850s demonstrate how urbanisation and growth have affected Melbourne’s CBD climate.

For many of the 95 years at the current site, observations were primarily manual. Reading of thermometers, barometer and the rain gauge was done by human eye. Chart recording instruments for temperature, humidity, pressure and rainfall were changed daily by hand. The installation of the automatic weather station in 1986 saw the most dramatic change. However, elements such as weather, visibility and cloud are still derived manually by the human eye. Other significant instrument changes include the replacement of a manually read barometer in 150 Lonsdale Street with an electronic barometer in 1998. In 1999 the anemometer on the roof of No 2 Drummond Street was moved to the current site. Small screens replaced large screens in 2001.

Activity: Once you have located each of these instruments on site, read what each does. Then discuss with members of your class how you think each of them works.

Instruments and Measurements at the Current Site.

An anemometer measures **wind speed and direction**. The vane determines the wind direction. The rotating cups determine the wind speed.

A temperature probe in the weather screen measures **air temperature**. 24 hour maximum and minimum temperatures are derived at 0900 each morning. Manual thermometer measurements are maintained for comparison. Wet and dry probes, also in the weather screen, measure **humidity**. Manual thermometer measurements are maintained for comparison.

An electronic barometer installed in the AWS electronics cabinet measures **air pressure**.
Rainfall is measured by a tilting bucket rain gauge. Totals for various periods can be derived, but the most commonly used is the 24-hour total derived at 0900 each morning.

Manual rain gauge measurements are maintained for comparison.

A Dines tilting-siphon pluviograph is a rain gauge that records onto paper. It is also being maintained for comparison.

Weather, cloud and visibility are assessed manually by observers and entered into a computer interface at 150 Lonsdale Street, which combines the data with the automatically generated data, every three hours. The automatic weather station also generates a one-minute data stream.

Evaporation is measured manually once every 24 hours at 0900 each morning by adjusting the water level in the evaporation pan. Measurements of water temperature and ‘wind run’ are also recorded to qualify evaporation readings. The bird-guard ensures all water losses are due to evaporation.

The terrestrial minimum thermometer measures the minimum air temperature at ground level.

Thermometers at depths of 10 and 20 cm measure soil temperatures.
The 25 blocks making up the Colonial Square sculpture, between Melbourne Museum and the Royal Exhibition Building next to Nicholson Street represent most of the ornamentation that was seen on the old Colonial Mutual Life building which stood on the North West corner of Elizabeth and Collins Street.

The blocks give an indication of the size of the building and the superb workmanship that went into the stonemasonry.
1. See Figure 1.7 for a photograph of the Colonial Mutual Life Building. The circles indicate the former positions of some of the stones.

Can you identify which stones came from each of these places?

2. Now move across to the nearest corner of the Royal Exhibition Building – the north-east corner. Look at the lower area of the building just to the left of the doorway. Can you determine what substance the building is made from?

3. The Royal Exhibition Building hosted a special event in 1901, partly because it had the largest seating capacity of any building in Australia. Do you know what that event was?
   • An International Exhibition,
   • The first Home Show
   • The opening of Federal Parliament

How many people do you think it can hold?
   • 300
   • 1300
   • 13,000

4. Waygood & Sons installed a new device in this building for the 1888 exhibition to assist people to get up to the roof to admire the view. It was the first time many Victorians had been in such a device. What was the new device?

5. In the 1880 International Exhibition, Victoria exhibited an object representing the volume of the 1503 tons of gold mined in the Victorian Gold Rushes. How big an object would 1503 tons of gold be?
   As big as:
   • a house
   • a school classroom
   • or a mini-van

The object representing that volume of gold was a 14 sided prism called a Rhombic Dodecahedron. Draw one in the space below.

6. Can you name the roofing material on the dome of the Royal Exhibition Building?
   Iron sheet, terra cotta, zinc tiles or slate.

7. Because this building is tall and on the top of a hill it could easily be struck by lightning. What can be done to buildings to prevent damage from lightning strikes? Can you see evidence of this here?
Fig 1.7 Mutual Life building which stood on the North West corner of Elizabeth and Collins Street. The circles indicate the former positions of some of the stones lying outside the Exhibition Buildings.
SCIENCE WALK – CARLTON GARDENS

Fig 1.8 Avenue of London plane trees

TEACHER’S NOTES

This is a short activity exploring Carlton Gardens South. It should take groups approximately 30 minutes to complete.

Use the enclosed map (Figure 1.9) to lead the group to each location shown. Read the trail notes and questions to the group.

Introduction

The landscape you see today in Carlton Gardens South was laid out in the late 1870s. Both the Gardens and the Royal Exhibition Building were constructed for the Melbourne International Exhibition held in 1880.

The Gardens are a man-made landscape that requires a high level of management. This trail explores how science is helping us to manage the Gardens.

1. THE HOCHGURTEL FOUNTAIN

The fountain was named after sculptor Joseph Hochgurtel. It is turned off whilst water restrictions are in force.

Read the plaque in the grass on the southern side of the fountain.

What is depicted on the fountain basin to represent
A book, a skull, a telescope, a globe and scientific apparatus.

When operating, the impressive fountain sprays water from a variety of points. It is run by an electric pump. The water is recycled through a filter at the base of the fountain.

What environmental conditions may contribute to water loss?
Warm dry weather will lead to evaporation.

Windy conditions will blow the water outside the fountain pool.

Have a look around the area. Can you identify a mechanism that helps monitor the wind speed?
A wind sensor located on a lamp post to the south west of the fountain

During periods of high wind it was observed that large quantities of water were being blown out of the fountain. A sensor was installed to measure the wind speed and cut off the flow of water when the wind is too strong.

How do you think this works?

NB. You may use some of the information below to prompt for answers:
The sensor converts the wind energy into an electrical current through a small dynamo. The current registers on a voltmeter in the control box. The higher the wind, the greater the voltage generated. Once the needle on the voltmeter reaches a certain point, the water flow to the fountain is shut off. In order to allow for gusty days the wind must be below the required speed for five minutes in order for the fountain to re-commence.

2. AVENUE OF LONDON PLANE TREES (see Figure 1.8)

The mature trees are one of Carlton Garden’s most important features. Many of these, including the impressive avenue of plane trees here, are over 120 years old. It is important that the City of Melbourne manages these trees carefully. Science helps us to understand how to keep the trees healthy.

What is the process whereby trees transform carbon dioxide and water into carbohydrate (food)?
Photosynthesis.

What gas is released as part of this process?
Oxygen.

Which part of a tree is the primary site for photosynthesis?
The leaves (although some photosynthesis occurs in the tree’s immature fruit and young stems)

The transformation requires light as a source of energy. The pigment chlorophyll captures the light energy and gives the leaves their green colour.

Water is a vital component in photosynthesis. It is absorbed through the small, fine roots of the tree. What are the other functions of the tree root system?
To absorb minerals from the soil.
To anchor and provide stability to the tree
Once absorbed, the water is transported up the trunk to the leaves. Up to 95% of the water absorbed by the tree evaporates. This process is called transpiration.

**What environmental conditions will lead to high levels of transpiration?**
The presence of light, high temperature, low humidity, windy conditions and an adequate water supply.

**How much water do you think a large mature tree may transpire on a hot summer day?**
Up to 2000 litres (NB. This is an isolated tree with a canopy spread of 12 metres)

Almost all transpiration occurs through the leaves. It is vital the trees receive enough water to remain healthy.

### 3. IRRIGATION CONTROL BOX

As you walk down the avenue look for the second green box on the eastern side (This has a mast attached).

In order to provide the trees, shrubs and lawns with enough water to survive, there is an extensive irrigation system under the ground.

The system is computer controlled. This control box regulates the days, times and watering programmes for the Gardens.

The control box is linked to the many sprinkler heads located in the Gardens. When the irrigation is switched on, the water pressure pushes the sprinkler heads up and irrigates the area.

**Why can the system only irrigate a small area at a time?**
The water pressure is insufficient to irrigate the entire Gardens at once.

On the top of the control box is an antenna. Radio waves received by the antenna allow the irrigation system to be operated remotely from a computer in the Fitzroy Gardens approximately two kilometres away.

You may notice a sensor is located towards the top of the mast.

**What do you think the sensor monitors?**
Rainfall

The sensor will shut down the irrigation system if it’s raining. The rain enters the top of the sensor and is absorbed by some cork located inside.

**What happens to cork when it gets wet?**
It expands

When wet, the expanding cork triggers a switch to shut off the irrigation system. Once it has stopped raining the cork dries out and the irrigation re-commences.

**What potential drawbacks exist with this system?**
It only responds to weather in the past or present, it cannot forecast weather in the future, eg. the system will irrigate overnight regardless of any rainfall forecast for the morning.

A new irrigation system is being trialed which uses satellites to measure cloud densities in order to predict future rainfall and alter irrigation programmes in advance.
4. TREE GUARDS

What are the metal collars for around the trees?
To protect against possums

The Gardens have proved to be an excellent habitat for the Common Brushtail Possum. Some of Melbourne’s Parks have 12 times the number of possums that would naturally be found in the bush. The possums feed on the leaves and young buds of the trees (where photosynthesis takes place).

What conditions have led to the parks supporting so many possums?
The vegetation is more nutritious.

There is a concentrated food source (surrounded by an urban environment)
There is a level of supplementary feeding by park visitors
There is a lack of natural predators

The City of Melbourne is trying to protect the park’s important trees whilst ensuring a sustainable number of possums live within the Gardens. Guards are placed only on those trees that show significant levels of damage.

5. POND WILDLIFE

The lake provides a habitat for a range of wildlife including waterbirds.

How many species of birds can you see here?
There are five species of waterbirds commonly seen here:
Pacific Black Duck
Australian Wood Duck
Little Pied Cormorant
Moorhen
Silver Gulls

The lake is a popular location for park visitors to feed the birds. Often there are large quantities of bread left floating in the water.

What implications does this feeding have for the pond and the wildlife?
It can harm the birdlife, as bread is not their normal diet. They normally feed on invertebrates and plant material.

The decomposition of any surplus bread within the pond can reduce the water quality. This may lead to conditions where harmful bacteria can grow.

Visitors are requested not to feed the wildlife in the parks

This completes the walk.
Fig 1.9  Carlton Gardens South.
Each individual tree is recorded on the City of Melbourne Database, updated regularly to include species, maintenance details and the health of the tree.

Courtesy of City of Melbourne Parks & Recreation Division
CSIRAC was the first computer in Australia, and probably the fourth in the world. It is the only complete first generation computer left in the world. CSIRAC stands for Commonwealth Scientific and Industrial Research Automatic Computer and is pronounced ‘sy-rack’. The development of CSIRAC began in 1948 in Sydney. It was moved to the University of Melbourne in 1956, continuing its service in training and computing. In 1964, CSIRAC was switched off for the last time and donated to the Museum.

Visit the CSIRAC display in the Museum’s Science and Life Gallery.

Compare CSIRAC with a modern PC
Circle your best answer

1. CSIRAC occupied 40 square metres of floor space.
   A modern PC occupies:
   0.2   2   3   4

2. CSIRAC weighed over 2000 kg
   A modern PC weighs:
   10   20   30   50

3. CSIRAC’s power rating was 30 kW - equivalent to 100 TV sets or 40 electric irons.
   A modern PC requires:
   0.1   1   2   5

4. CSIRAC used paper tapes to permanently store programs. Circle four modern items that can store programs permanently:
   Computer chip  modem  hard drive  compact disc
   internet  floppy drive  scanner  printer
## COMPARISON OF CSIRAC WITH A MODERN PC

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