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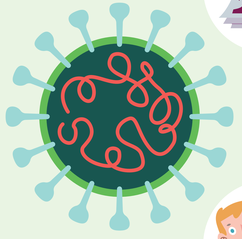
COVID-19
The World's Shared Battle

COVID-19: The world's ongoing battle against SARS-CoV-2

Symptoms include fever, shortness of breath and loss of taste and smell; infected individuals may also be asymptomatic

First case detected end of 2019



Bat origin

May be transmitted to humans via an intermediate host, which is yet to be identified

Transmission via close contact with infected individuals and respiratory droplets from coughs or sneezes, and contact with contaminated surfaces

Pocket Fact:
SARS-CoV-2, the virus that causes COVID-19, is short for severe acute respiratory syndrome coronavirus 2

Preventive measures are key to slowing and stopping the spread of COVID-19.

Virus Hunter Icon:
Noor Hisham Abdullah, the Director-General of Health in Malaysia is recognized for managing the team handling COVID-19 pandemic in Malaysia.

What are steps taken to prevent the spread of COVID-19?

Frequent Hand Washing
Hands should be washed with soap for at least 20 seconds. Hand sanitizer can also be used if soap and water is not conveniently available.

Pocket Fact:
Soap particles disrupt the envelope of viruses, destroying them!

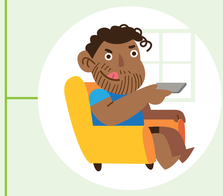
Mask Wearing
Masks are worn to protect other individuals in case the wearer is infected. This is particularly important as many COVID-19 cases are asymptomatic.

Daily Health Monitoring
Each person must be assessed to ensure absence of COVID-19 symptoms, especially before going into public or shared spaces for work, studies, or errands.

Pocket Fact:
Infrared thermometers are used in public places as they do not require physical contact with those being tested!

Clean & Disinfect
Surfaces touched frequently should be cleaned and disinfected regularly as COVID-19 can be transmitted indirectly via contact with contaminated surface.

Social Distancing
As measures like hand washing, mask wearing as well as cleaning and disinfecting are not fool proof and does not eliminate the risk of encountering the virus completely, social distancing must be practiced whenever possible. Better yet, stay at home to stay safe!



Pocket Fact:
A sneeze can send droplets of mucus and saliva more than 5 metres away!

Try this:
What are social distancing new norms practiced in your school?

Contact Tracing
Identifying individuals who were in close contact with infected people allows targeted testing and preventing further spread of the virus.

Pocket Fact:
Samples are usually obtained through nasal swab, which is then analysed using RT-PCR to identify infected individuals.

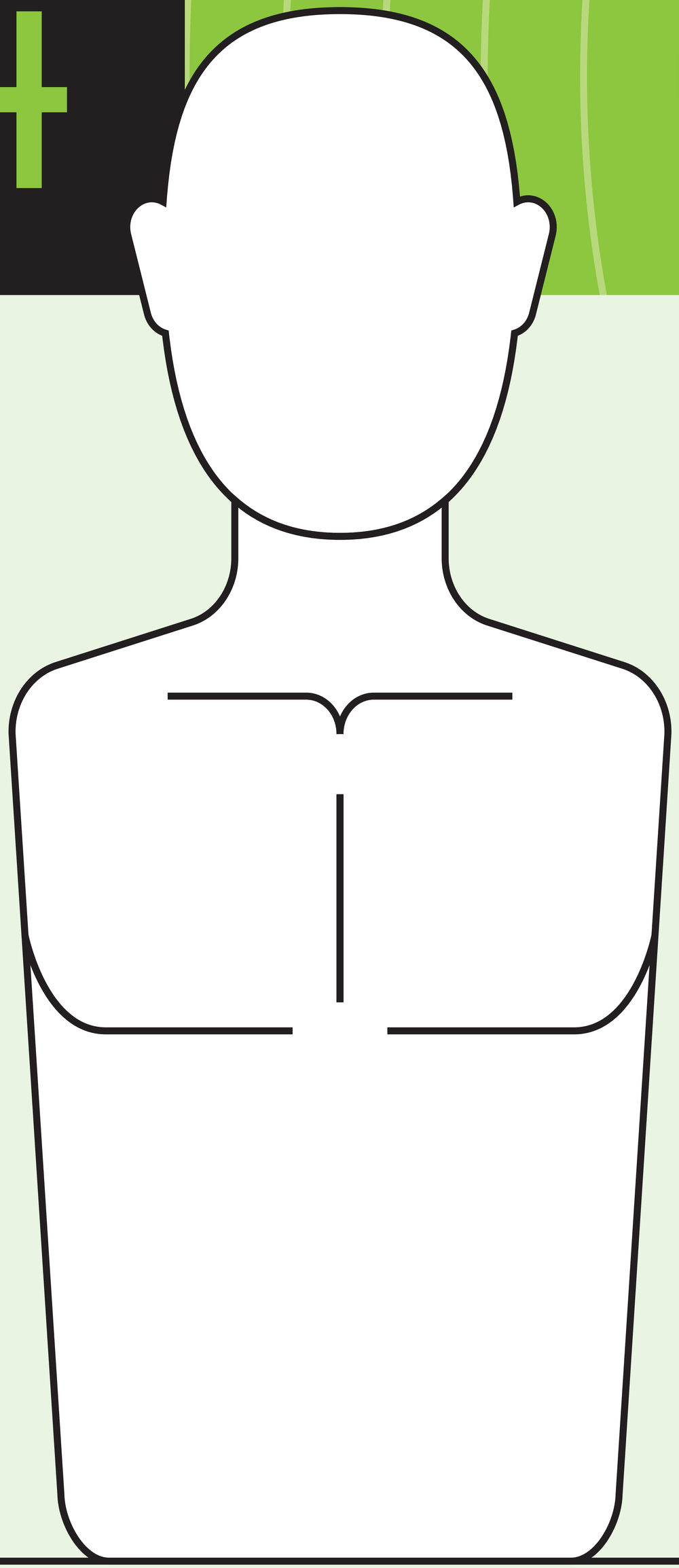
Get Educated
Public understanding why each step measure is taken, and how it would help curb this global outbreak is important to ensure continuous practice and compliance.

What's Next?
Even with all our ongoing efforts and the health measures currently in place to battle COVID-19, a vaccine effective against the disease is still our best hope to end the pandemic in the long run.

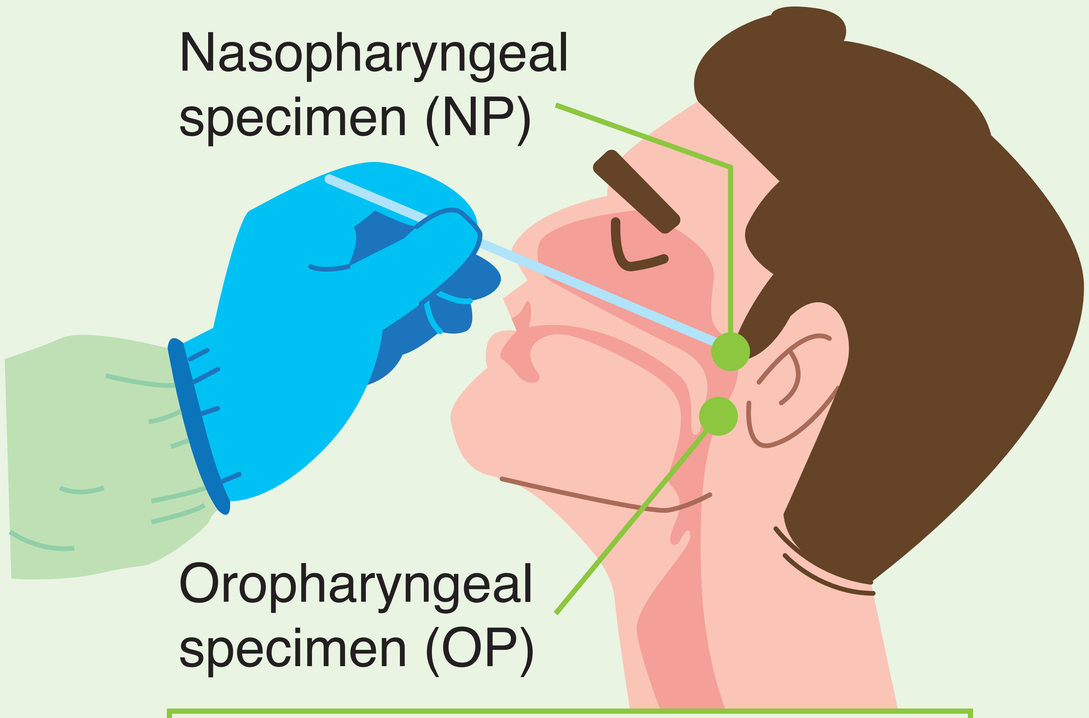
Let's continue virus hunting!

4

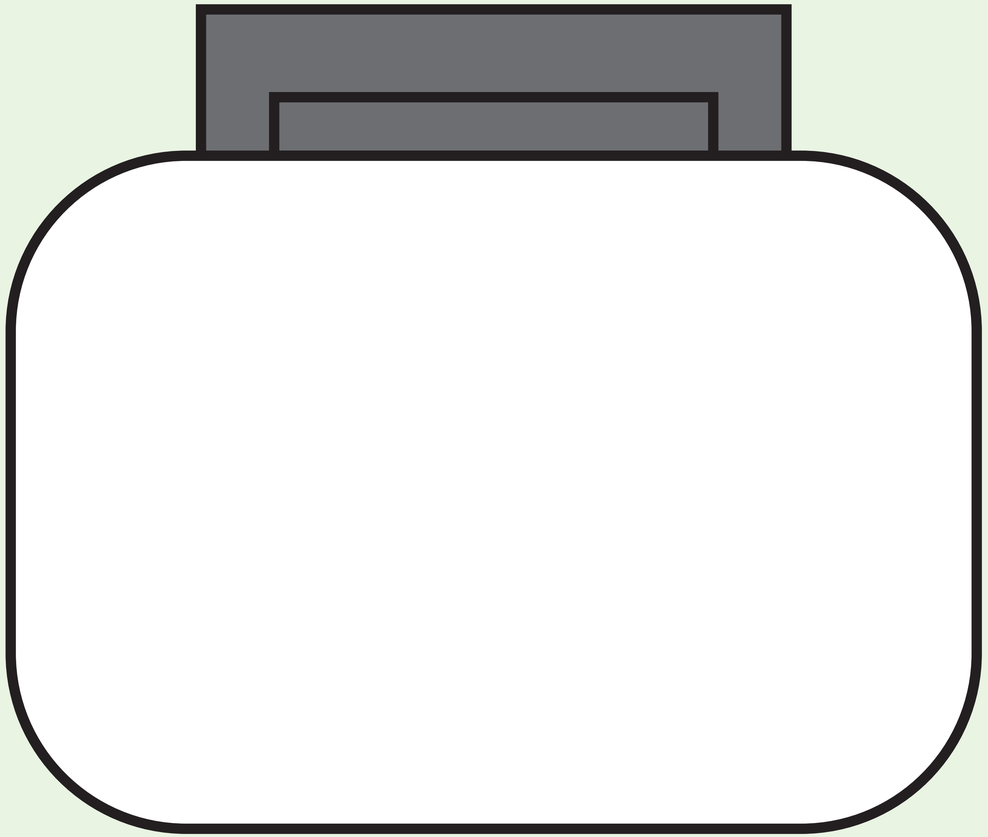
COVID-19



Collecting samples for COVID-19 test



Pocket Fact:
CDC is now recommending collecting only the NP swab



This is the NP swab used to collect samples in actual COVID-19 test.

Please do not remove!

Performing COVID-19 Test **Part 1**
Nasopharyngeal (NP) Sample Collection

1

1. Hold the swab by its handle. Do not touch the tip!
2. Insert the swab into the left nostril and continue until you feel a resistance.

Check:
The LED will light up and you will hear a “beep” when you reach the right position!

Pocket Fact:
In an actual COVID-19 test, the swab has to be inserted about 8 to 12 cm into the nasal cavity!

3. Roll and rotate the swab twice in the nasal cavity to collect the sample
4. With the same swab, repeat steps 1 to 4 by inserting the swab in the right nostril.

Pocket Fact:
The virus, when present, is usually found in nasal tissues—in the nose!

5. Place the swab into the blue tube.
6. You have collected the NP samples!

What’s Next:
Let’s continue to **Part 2: RNA Extraction** and **Part 3: RT-PCR** in the laminar flow hood!

This is only a simulation of COVID-19 testing. Please do not try this at home!

Performing COVID-19 Test **Part 2**
RNA Extraction

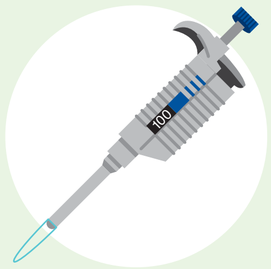
The following are the apparatus and materials required for this section.

Try this:
Can you spot all of them in the laminar flow hood?

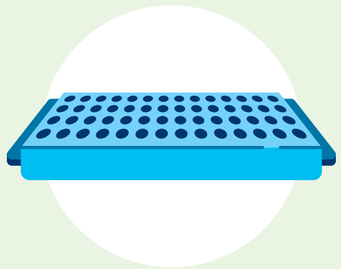
Gloves

Sample Tube

Centrifuge Tubes



Micropipette

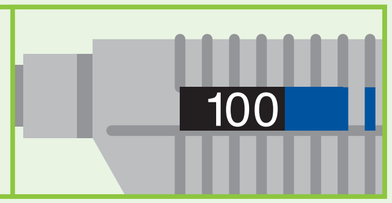


Centrifuge Tube Holder

Before you start this activity, please watch the video on how to use a micropipette! Once you've watched the video, let's begin!

1. Insert both your hands into the gloves.
2. Take the sample tube (labelled "Sample") and open the lid.
   Note: The sample tube contains the NP sample that you collected in **Part 1: Nasopharyngeal (NP) Sample Collection**.
3. Using a micropipette, pipette out 100µL of the NP sample.

Check:
Make sure that the counter on the side of micropipette shows 100µL!



4. Place 100µL of the NP sample in the centrifuge tube (labelled "Lysis Buffer").
5. Close the centrifuge tube (labelled "Lysis Buffer") and place it in the centrifuge tube holder.
6. Now, RNA is extracted in your centrifuge tube.

What's Next:
Let's continue to **Part 3: RT-PCR**!

Pocket Fact:
A purification step is usually carried out at this point to remove unwanted molecules (cell debris, protein and DNA) from the RNA.

Performing COVID-19 Test **Part 3**
RT-PCR

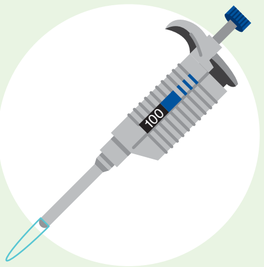
The following are the apparatus and materials required for this section.

Try this:
Can you spot all of them in the laminar flow hood?

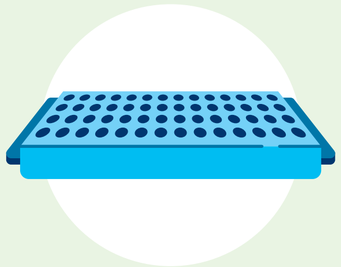
Gloves

Centrifuge Tubes

PCR Tube



Micropipette

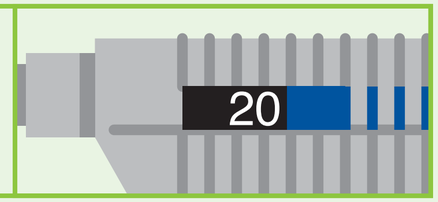


Centrifuge Tube Holder

Mini PCR

1. Insert both your hands into the gloves.
2. Take the centrifuge tube (labelled “Extracted RNA”) and open the lid. Note: The centrifuge tube contains the RNA you extracted in **Part 2: RNA Extraction**.
3. Using a micropipette, pipette out 20µL of the RNA.

Check:
Make sure that the counter on the side of micropipette shows 20µL!



4. Place 20µL of the RNA in the PCR tube (labelled “PCR Mix”).
5. Close the PCR tube (labelled “PCR Mix”) and place it in one of the slots on the miniPCR, then gently close the lid of the miniPCR.
6. At this stage, you will see the miniPCR light up!

Check:
- Red : Something is wrong! Please close the lid properly.
- Yellow: PCR has started. Please wait.
- Green: PCR is complete!

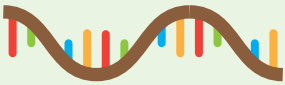
What’s Next:
The lab staff will use the PCR product to determine the presence of target DNA, and whether the patient is COVID-19 positive or negative!

Pocket Fact:
If DNA of SARS-CoV-2 is present, that means the person is COVID-19 positive.

COVID-19 Testing Using RT-PCR

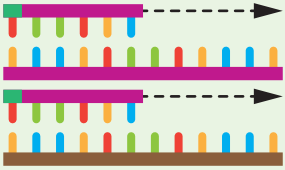
1 Sample collection

2 RNA extraction



3 Reverse transcription (RT)

4 PCR



Closer Look at PCR

Denaturation: The double-stranded cDNA is heated, separating (or denaturing) it into two single-stranded cDNA templates.

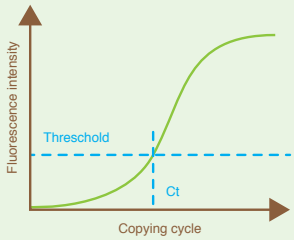
Annealing: A primer attaches (or anneals) itself to the single-stranded cDNA template.

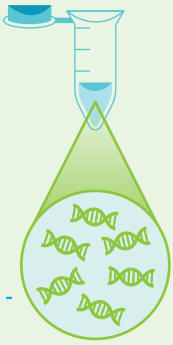
Extension: DNA strands extend out, starting from the primer, making new strands of DNA based on the cDNA template.

The PCR process will repeat to produce billions of exact copies of DNA!

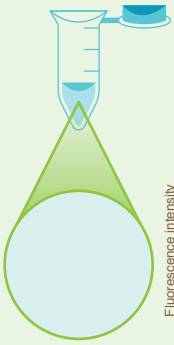
5 Results

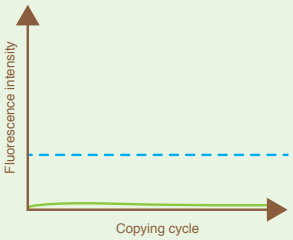
Positive





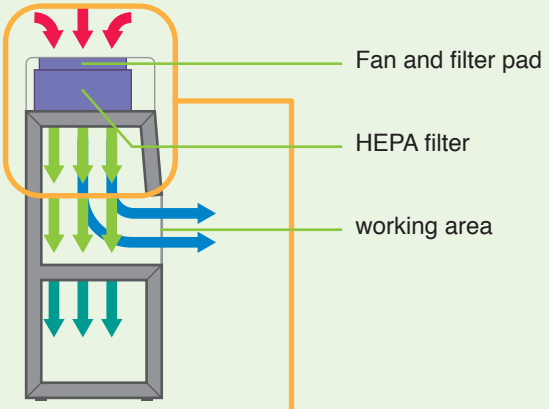
Negative



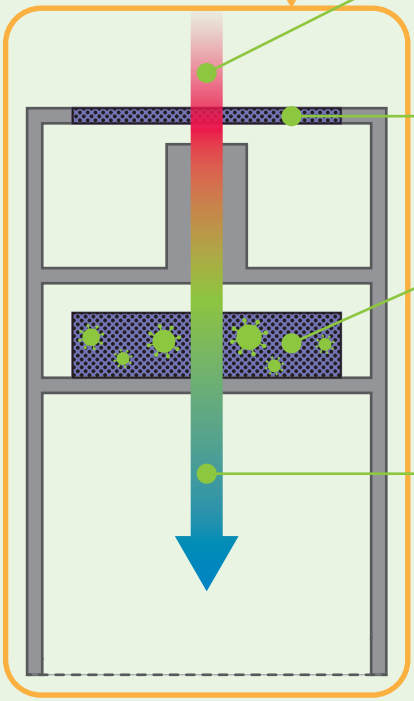


Pocket Fact:
cDNA (complementary DNA) is produced by the enzyme reverse transcriptase (RT) using RNA template!

Processing samples inside a laminar flow hood



Side view of a laminar flow hood



1. The fan sucks air from the surrounding into the laminar flow hood.
2. A filter pad is used to trap the dust.
3. A HEPA(High Efficiency Particulates Air) filter removes contaminating fungi and bacteria
4. Sterile air flows into the working area.

Pocket Fact:
Laminar flow hood provides a filtered airflow across the work area, protecting the sample from airborne contamination.