Pathfinder Honour as per the curriculum outlined on www.pathfindersonline.org/honors/vocational/607-mobile-technology

An overview of Mobile communications, Cell Phone Technology & practical use.

Presented by Daryl Gungadoo
 MOBILE TECHNOLOGY

1. **What** is a mobile device? (4 examples)
2. Draw a diagram showing how mobile technology uses **cell sites** (show Coverage, Density, Location tracking, Call hand-off)
3. **Safety** precautions concerning the use of a mobile device.
4. Create a list of **different types** of mobile devices. (discuss advantages and disadvantages of each mobile device listed).
5. With a group, discuss ways in which mobile technology can be used to **benefit society** and industry such as: Business, Personal Recreation, Safety and Protection, Education, Health Care, Transportation, Homework
6. Describe the following types of cell sites: **Camouflage, Off-grid System, Temporary Setup**
7. Illustrate through drawings, sketches, or photographs a **cell tower**. Be able to identify a cell tower in an open area.
8. Create a speech, presentation, video, or game that illustrates what you have learned about mobile technology while earning this honour.
9. Discuss with a group some of the ways in which mobile technology can be integrated into **ministry to share the gospel** throughout the world. (also answers 4b)
10. Discuss with a group how mobile technology can be used to **enhance** the following aspects of your **spiritual life**: Devotionals, Inspirational songs, Prayer reminder, Join worship services, Share inspirational messages
11. Discuss with a group how the following Bible passages apply to the use of mobile technology: Matthew 24:14, 1 Corinthians 6:12
12. Evaluate how being a Christian should affect your use of mobile technology.
13. Do the following individually or with a group:
   - Create a temporary contact list of your friends. Gain permission to send them a daily text message. At a selected time each day, share an inspirational text with those on the contact list for a minimum of one week. Respect any requests to be removed from the list.
   - Over a period of 3 services, evaluate when people use their devices during a worship service, and for what purposes.
1&4) WHAT IS A MOBILE DEVICE?
1) WHAT IS A MOBILE DEVICE?
MOBILE GENERATIONS (1G TO 4G)

1st Car phone
40kg

1956 SWE
MOBILE GENERATIONS (1G TO 4G)

1st Public Mobile Phone Call
Dr Martin Cooper general manager at Motorola
1.1 Kg

1973 USA
Technical specs for **GSM** Standards: it focused on interoperability across national boundaries and consequent different frequency bands, call quality and low costs.

1987
MOBILE GENERATIONS (1G TO 4G)

1st SMS sent
“Merry Christmas”

1992
MOBILE GENERATIONS (1G TO 4G)

Emojis invented by Shigetaka Kurita in Japan

1999
MOBILE GENERATIONS (1G TO 4G)

1G
Analog
from 1979

2G
Digital (GSM)
from 1991 MMS
50 kbps

2.5G
Digital (GPRS/Edge)
from 1995
0.1 - 0.3 Mbps

3G
Digital (HSDPA)
from 1998
0.3 - 42 Mbps

4G
Digital (LTE)
from 2008
150 - 600 Mbps
MOBILE GENERATIONS (5G+)

3G
Digital (HSDPA)
from 1998
0.3 - 42 Mbps

4G
+Speed (LTE/MIMO)
from 2008
150 - 900 Mbps
2 to 2.5 Ghz

5G
Digital (eMBB/URLLC/MMTC)
from 2020
1,000-10,000 Mbps
Up to 95 Ghz

6G
+Satellite
from 2030
1,000-10,000 Mbps
100+ Ghz
2) HOW DOES IT WORK?

RADIO FREQUENCY
UNDERSTANDING RADIO WAVES

20,000 Hz

THE HEARING RANGE OF DIFFERENT MAMMALS

- 14 – 12,000 Hz
- 20 – 20,000 Hz
- 48 – 75,000 Hz
- 64 – 45,000 Hz
- 1,000 – 70,000 Hz
- 7,000 – 200,000 Hz

Demo
MOBILE GENERATIONS (5G)

5G Territory: 24–86 GHz

- Penetrable
- Semi-Penetrable
- Line-of-Sight

Radio Wave Spectrum

3 kHz to 300 GHz
RADIO WAVES & SPECTRUM

Ionising radiation

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 PHz</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td>3 EHz</td>
<td>X-rays</td>
</tr>
<tr>
<td>300 EHz</td>
<td>Gamma rays</td>
</tr>
</tbody>
</table>

Symptoms:
- Headache
- Stomach ache
- Cold
- Rash
RADIO WAVES & SPECTRUM

Non-ionising radiation*

Ionising radiation*

700 MHz | 2.4 GHz | 2.6 GHz | 3.4 - 3.8 GHz | 5 GHz | 26 GHz | 40 GHz | 66 GHz | 430-750 THz | 30 PHz | 3 EHHz | 300 EHHz

2G 3G 4G 5G

Terrestrial TV | 2.4 GHz wifi | Existing mobile airwaves | Current and planned 5G airwaves | 5 GHz wifi | Possible future 5G airwaves

Electromagnetic hypersensitivity (EHS)
3) TECHNICAL SAFETY

Electromagnetic hypersensitivity (EHS)
2) HOW DOES IT WORK?

Caller

Mobile Switching Centre (MSC)

Receiver
MOBILE DEVICE DISSECTION (COMPONENTS)
SIGNAL TRANSMISSION
COVERAGE CELLS
CELL TOWERS
CELL TOWERS (FOR Q 6&7)

Regular Towers ->

Camouflage
CELL TOWERS (FOR Q6) CAMOUFLAGE & OFF-GRID
LOCATION TRACKING & CALL HAND-OFF
EXAMPLE (EMMA CALLS JOHN)
3) USAGE SAFETY (TXT & CALLS)

1. Remember if you are being bullied it isn’t your fault and there is nothing so awful that you can’t speak to someone about it. Talk to a trusted adult at home or at school.
2. Don’t reply to any nasty messages you receive.
3. Don’t reply to a text from someone you don’t know.
4. Keep the messages you have been sent so you can show them to a trusted adult and make a note of the time and date of the messages or calls you receive.
5. Don’t answer calls from withheld numbers or numbers you don’t recognise, let it go to voicemail.
6. Block numbers from people who are sending you nasty messages.
7. If you are bullied repeatedly, you can change your number.
8. Don’t give your mobile number to someone you don’t know.
9. Don’t send pictures to someone you don’t know.
10. If the problem is serious you can report it to the police, cyber mentors, or childline
9&10) SHARE THE GOSPEL USING MOBILE TECH.

https://www.sdadata.org

- Encouraging TXTs
- Uplifting Podcasts
- Inspiring Short Videos
- Online Giving

Demo
9&10) SHARE THE GOSPEL USING MOBILE TECH.

Genesis 1:1-3

"And saw the ,
that it was ,
and divided the from the darkness."
Matthew 24:14 (NIV)
And this gospel of the kingdom will be preached in the whole world as a testimony to all nations, and then the end will come.

1 Corinthians 6:12 (The Message)
Just because something is technically legal doesn’t mean that it’s spiritually appropriate. If I went around doing whatever I thought I could get by with, I’d be a slave to my whims.
12) CHRISTIAN USE OF MOBILE TECH.

https://www.sdadata.org
MOBILE GENERATIONS (5G)

1G
Analog (TACS)
from 1979
150 Mhz - 900 Mhz

2G
Digital (GSM)
from 1991
MMS 64 kbps
Up to 1.9 Ghz

2.5G
+Camera (GPRS/Edge)
from 1995
0.1 - 0.3 Mbps
Up to 1.9 Ghz

3G
+Video Call (CDMA/UMTS)
from 1998
0.3 - 8 Mbps (2 avg)
1.6 to 2.1 Ghz

4G
+Speed (LTE/MIMO)
from 2008
150 - 900 Mbps (15 avg)
2 to 2.5 Ghz

5G
Digital (eMBB/URLLC/MMTC)
from 2020
1,000-10,000 Mbps
Up to 95 Ghz
5G ANTENNAS
5G ANTENNAS

4G/5G Low Band (700 - 2200 MHz)

5G mmWave (20 - 50 GHz)

BASE STATIONS

4G Macro

5G Macro (Massive Mimo)
5G ANTENNAS

5G SPECTRUM

<table>
<thead>
<tr>
<th>Existing Mobile Spectrum</th>
<th>New Mobile Spectrum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coverage &amp; Capacity</strong></td>
<td><strong>Capacity</strong></td>
</tr>
<tr>
<td>Below 1 GHz</td>
<td>30 GHz</td>
</tr>
<tr>
<td>TV</td>
<td>mmWave band</td>
</tr>
<tr>
<td>WiFi</td>
<td>100 GHz</td>
</tr>
<tr>
<td>Existing Mobile</td>
<td>Fixed links and Satellite</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro cells</td>
<td>Macro and small cells</td>
</tr>
<tr>
<td></td>
<td>Small cells</td>
</tr>
</tbody>
</table>
5G FREQUENCY SPECTRUM

**United States**
- 600 MHz
- 24 GHz
- 28 GHz
- 37 GHz
- 39 GHz
- 47 GHz
- 64-71 GHz

**Europe**
- 700 MHz
- 3.4-3.8 GHz
- 26 GHz

**Russia**
- 4.4-4.5 GHz
- 4.8-4.9 GHz
- 26 GHz
- 40 GHz
- 66-71 GHz

**Japan**
- 3.6-4.2 GHz
- 4.4-4.9 GHz
- 28 GHz

**South Korea**
- 3.4-3.7 GHz
- 26 GHz
- 28 GHz

**UAE**
- 1.4 GHz
- 3.3-3.8 GHz
- 26 GHz

**India**
- 3.3-3.7 GHz
- 24 GHz
- 26 GHz

**China**
- 3.3-3.4 GHz
- 3.4-3.6 GHz
- 4.8-5 GHz

**African Telecom Union (ATU):**
- 3.3-3.4 GHz
- 3.4-3.6 GHz

**Australia**
- 3.4-3.7 GHz
- 26 GHz

**Chile**
- 3.4-3.6 GHz
- 28 GHz

**Brazil**
- 3.4-3.6 GHz
- 26 GHz
- 40 GHz
- 66-71 GHz
ANTENNAS

5G NETWORK ARCHITECTURE

- LOCAL SERVER
- 5G Macro
- 5G Small Cell
- CENTRAL SERVER
- LOCAL SERVER
- 4G Macro
- 5G Small Cell
ANTENNAS

5G NETWORK ARCHITECTURE

LOCAL SERVER

5G Macro

5G Small Cell
ANTENNAS

MIMO BEAMFORMING

4G Macro

Elevation (Vertical) Beamforming

Azimuth (Horizontal) Beamforming

5G Macro (Multiple beams)
ANTENNAS

Macrocells for wide area coverage

In-building and street small cells

Home small cells
MOBILE GENERATIONS (1G TO 4G)

Emojis invented by Shigetaka Kurita in Japan

Bonus 2
Quiz (guess the bible character)
Quiz (guess the bible character)
Quiz (guess the bible character)