

INTD255, Safe Return Doubtful: Midterm 1

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1 Early Antarctic and Oceanographic Exploration

1. Who was Captain James Cook? List several notable achievements of his three main expeditions.

Captain James Cook was a British explorer, navigator, and cartographer known for his extensive voyages in the Pacific Ocean.

First Voyage: Observed the Venus transit in Tahiti, charted New Zealand, and mapped the east coast of Australia.

Second Voyage: Crossed the Antarctic Circle, proving the existence of a vast Southern Ocean but found no Terra Australis.

Third Voyage: Searched for the Northwest Passage, mapped the Hawaiian Islands, and was killed in Hawaii in 1779.

2. What was the significance of the *venus transit* on one of the Cook expeditions? What other, more secret, mission did Capt. Cook have in the Southern Ocean?

The Venus transit was used to calculate the Earth-Sun distance, refining astronomical measurements.

Cook's secret mission (from the British Admiralty) was to search for Terra Australis, a hypothetical southern continent.

3. **Kepler's Laws:** If the units of orbital radius r are AU, and the units of orbital period T are years, then $T^2 = r^3$. (a) If the orbital radius of Uranus is 19.22 AU, what is its orbital period in years? (b) If the orbital period of Mars is 1.88 years, what is its orbital radius? (c) What parameter in orbital mechanics was fixed by the observations of the venus transit in the late 18th Century by scientists who accompanied the Cook expedition?

(a) $T^2 = r^3 \rightarrow T^2 = 1.215 \text{ tons}^2 \cdot 19.22^3 \rightarrow T = 84.2$ years

(b) $T^2 = r^3 \rightarrow 1.88^2 = 3.534 r^3 \rightarrow 3.53 = r^3 \rightarrow r = 1.52$ AU

(c) The astronomical unit (AU), the average Earth-Sun distance, was fixed using Venus transit observations.

4. List some of the achievements in early polar exploration attained on the following expeditions:

- *The Belgica* First expedition to winter in Antarctica, led by Adrien de Gerlache.

- *The Fram*, with Nansen Used by Fridtjof Nansen to drift with Arctic ice, proving no land existed at the North Pole.

- *The Gjoa* Led by Roald Amundsen, first ship to successfully navigate the Northwest Passage.

- *The Discovery*, with Scott Led by Robert Falcon Scott, reached "Furthest South" at 82°S.

5. Who were the *Dorset* and the *Thule*? How did they survive in their environment?

Dorset: Pre-Inuit Arctic people (500 BCE–1500 CE), survived by hunting seals and caribou.

Thule: Ancestors of modern Inuit, adapted to Arctic survival with sled dogs and whaling.

6. Who are the Chinook? Where did Capt. Cook approach their territory?

The Chinook were indigenous people of the Pacific Northwest.

Cook encountered them near the Columbia River on the Oregon coast during his third voyage.

7. Discuss the risks and rewards of cultural exchange, in light of the writings of Barry Lopez in *Horizon*. As examples, consider the stories of Ranald MacDonald, Captain James Cook, Captain Amundsen and the Netsilik.

Risks: Misunderstandings, exploitation, and cultural loss (e.g., Cook's violent death in Hawaii).

Rewards: Knowledge sharing (e.g., Amundsen learning from the Netsilik).

2 Survival Skills: Work, Energy, Food, and Physics

1. How many kcal of energy is stored in 2 kg of pemmican? (Treat this as a fatty food, not a protein).

Energy in 2 kg of pemmican (fat-based food, ~900 kcal per 100g):
 $2000 \times 9 = 18,000$ kcal.

2. How many kg of wheat biscuits are required for 500 kcal of energy? (Treat this as mostly carbohydrates).

Wheat biscuits (mostly carbs, ~4 kcal per gram) for 500 kcal:
 $500 \div 4 = 125$ g or 0.125 kg.

- How many Joules of energy are required to pull 1000 kg across 5 km of snowy tundra, if the relevant coefficient of friction is 0.1?

$$W=(980\text{N})\times(5000\text{m})=4.9\times 10^6\text{J}$$

- Take your result from the previous exercise, and divide the energy among 10 sled dogs. How much energy is required of each dog? Now feed each dog that much pemmican. How many kg of food, per dog, is required?

$$4.9\times 10^6\text{J}\div 37,000\text{J/g}=13.24\text{ g per dog.}$$

- What food related health risk is associated with spending long durations at sea and in polar regions?

Scurvy (Vitamin C deficiency).

3 Navigation: Distance, Time, Speed, Longitude and Latitude

- How many nautical miles correspond to travelling 2.5 degrees directly South?

$$2.5\times 60=150\text{ nautical miles.}$$

- If we travel due North by 400 km, what is our change in latitude?

$$400\div 111\approx 3.6\text{ degrees}$$

- If we are travelling due West at a latitude of 60 deg North, what distance corresponds to a change of 1.5 degrees longitude?

$$1.5\times 60\times \cos(60\text{degrees})=45\text{ nm.}$$

- If a ship sails East at 10 knots, how many nautical miles are travelled in 48 hours?

$$10\times 48=480\text{ nautical miles.}$$

4 The British, The Norwegians, and Cultural Exchanges

- Having read the first part of the story of the race for the South Pole, describe the differences in style between the Norwegian/Scandinavian expeditions and the British ones. **Bonus:** Connect your ideas to indigenous cultural exchange, or our reading in *Deep Survival*.

British vs. Norwegian polar exploration:

British: Traditional, hierarchical, relied on man-hauling.

Norwegians: Adapted indigenous techniques (sled dogs, fur clothing).

- List five technologies for polar survival that the Norwegians learned from the *Netsilik*.

Sled dogs, fur clothing, igloos, seal-oil lamps, ice fishing techniques.

- What was the primary role of the Royal Geographic Society in British Antarctic exploration?

Funded and organized British Antarctic expeditions.

- (a) How did the British travel and move gear in the polar regions, before motorized craft were developed?
(b) How did this differ from the Norwegians?

British used man-hauling, Norwegians used dog sleds and skis.

- In your view, what are the major risks to ships and explorers when exploring the polar regions in this period?

Icebergs, extreme cold, isolation, scurvy, lack of food.

- When American ambassadors first arrived in Japan, after a period of intense isolationism in Japan, they found the Imperial court already knew how to speak English? How did this happen? Who helped them to learn English, and of the desire of Western nations to trade?

From Ranald MacDonald, a Scottish-Japanese interpreter, and earlier Dutch traders.

7. Consider the following quote “Whether the change facing a people comes on swiftly ... or slowly ... the responsibility of the wisdom keeper is to recognize the early signs of significant change, to look into the past, and locate, again, a through line to the future.” Apply this idea to a story we have encountered in the course, or a problem facing our community today.

Example: Climate change—learning from indigenous resilience strategies.

5 Exploration Achievements

1. Discuss the cultural significance of Nansen’s first crossing of Greenland to the nation of Norway.

Inspired national pride, proving Norway’s Arctic expertise.

2. Was Roald Amundsen the first leader to cross the North-West Passage? On whose progress did he build?

First to complete it; built on John Franklin’s failed expeditions.

3. What were the highlights of Robert Falcon Scott’s “furthest South” on the *Discovery* expedition?

Reached 82°S, paved way for future Antarctic missions.

4. Scientifically, why was important for explorers in the early 20th century to locate the magnetic North and South poles?

Helped understand Earth’s magnetic field and navigation.

6 Survival and Psychology

1. Using the terminology found in *Deep Survival*, what is the difference between a *primary emotion*, and a *secondary emotion*?

Primary: Instinctual (fear, anger).

Secondary: Learned (pride, guilt).

2. Using the terminology of emotional bookmarks, how are secondary emotions formed, and how do they protect you?

Past trauma or success creates learned emotional responses.

7 Reflections

1. While on Skraeling Island, the write Barry Lopez interacts with a research team responsible for finding artifacts from Dorset, Thule, *and Norse* cultures in Northern Canada. What is the significance of these diverse finds, in your view?

Evidence of ancient cultural interactions in the Arctic.

2. While reflecting on the Pacific Ocean in Cape Foulweather, Lopez notices that you can never see the entire Pacific, because the Southern Ocean covers more than one hemisphere of area of our planet. What an area of life or academic topic that you wish you understood, but might not ever fully understand?

Example: Quantum mechanics or human consciousness—both remain mysterious despite advancements.