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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 who led three major Pacific expeditions during the late 18th century.

- **1st Expedition:** Mapped the coastline of New Zealand and the east coast of Australia. He also observed the Transit of Venus.
- **2nd Expedition:** Became the first European to cross the Antarctic Circle.
- **3rd Expedition:** Explored the North Pacific, including the Hawaiian Islands, and searched for the Northwest Passage.

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 1769 Venus Transit was an astronomical event that Cook's expedition observed from Tahiti. Their goal was to gather data that would help determine the distance between the Earth and the Sun.

The British government gave Cook the secret mission of searching search for a mythical southern continent that they believed existed and called Terra Australis. He debunked its existence in the South Pacific.

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

T = √((19.22)^3) = √(7100.03) = **84.26 Years**

(b) If the orbital period of Mars is 1.88 years, what is its orbital radius?

R = ∛((1.88)^2)) = ∛(3.5344) = **1.5232 AU**

(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?

The Venus Transit observations made during James Cook's expedition helped determine the Astronomical Unit (AU), the average distance between the Earth and the Sun.

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

• **The Belgica:** This was the first expedition to pass the whole winter in Antarctica after becoming trapped in sea ice. Roald Amundsen was part of the expedition.
• **The Fram, with Nansen:** Fridtjof Nansen designed his ship, the Fram, to withstand Arctic ice pressure. He attempted to drift with Arctic ice toward the North Pole.
• **The Gjoa:** Roald Amundsen successfully led the first complete navigation of the Northwest Passage, proving it was possible to sail through the Arctic.
• **The Discovery, with Scott:** This expedition was led by Robert Falcon Scott and explored the Antarctic interior, reaching a new farthest south point.

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

The Dorset were the people who lived in Canada and Greenland before the Inuits. They hunted seals, caribou, and walrus, and lived in subterranean houses for insulation to survive.

The Thule are ancestors of the Inuit, they were the ones who developed dog sleds, kayaks, and umiaks. To survive, they lived in the igloos they built and they were very skilled at whale hunting.

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

The Chinook were the Native American people that lived in the Pacific Northwest. Captain Cook approached their territory along the Oregon and Washington coast, at Cape Foulweather. His arrival was the first European contact with the Pacific Northwest Indigenous groups.

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.

Using some examples from Barry Lopez, in Horizon:

- Ranald MacDonald entered Japan during its period of isolation and helped teach English to Japanese interpreters. His experience showed that a friendly conversation can end up in a mutually beneficial interaction for both cultures.
- Captain James Cook encountered some Pacific Islanders in Hawaii, and their culture exchange didn't go very well, as he ended up dying there in 1779 after a violent interaction with them.
- Captain Amundsen and the Netsilik: Amundsen learned survival skills from the Netsilik Inuit, including dog sledding and using fur clothing, which helped him reach the South Pole first in 1911.

Therefore, cultural exchange can lead to a beneficial interaction, but you always have to be respectful and open to learning from others.

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).

Since pemmican contains 9 kcal per gram.
2 kg = 2000 g
Energy stored: 2000 g * 9 kcal/g = **18,000 kcal of energy**

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

Since carbohydrates contain approximately 4 kcal per gram.
Mass required: 500 kcal / (4 kcal/g) = 125 g
125 g = **0.125 kg**

3. 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?

$W = F \cdot d$, $F = \mu mg$ $F = (0.1)*(1000\ kg)*(9.81\ m/s^2) = 981\ N$
$d = 5\ km = 5000\ m$

W= (981 N)*(5000 m)= **4905000 J**

4. 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?

Energy per dog: (4905000 J) / (10 dogs) = **490500 J per dog**
Energy per dog in kcal: (490500 J) / (4184 J/kcal) = 117.23 kcal
Pemmican provides 9 kcal/g so (117.23 kcal) / (9 kcal/g) =13.03 g
Food required in kg: 13.03 g = **0.013 kg**

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

Scurvy, and it is caused by vitamin C deficiency.

3. NAVIGATION: DISTANCE, TIME, SPEED, LONGITUDE AND LATITUDE

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

1 degree of latitude = 60 nautical miles
2.5 * 60 = **150 nautical miles**

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

Using $S = R * \theta$, where S = 400 km, R = earth's radius = 6371.
$\theta = S / R = 400 / 6371 = 0.0628$ radians
0.0628 radians * (360 degrees) / (2π radians) = **3.6 degrees**

Answer: 3.6 degrees north

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

Using $S= \phi * R * \cos(\theta)$, where:
ϕ = 1.5 degrees = 1.5 * (2π radians) / (360 degrees) = 0.0262 radians
R = 6371 km
θ = 60 degrees
S = 0.0262 * 6371 * cos(60) = **83.46 km**
Answer: 83.5 km

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

1 knot = 1 nautical mile per hour
Distance = 10 knots * 48 hours = **480 nautical miles**

4. THE BRITISH, THE NORWEGIANS, AND CULTURAL EXCHANGES

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

The Norwegian/Scandinavian expedition style meant traveling in smaller groups and was very open to learning from the indigenous people from that area. They used dogsleds and skis, which they mainly learned from the indigenous techniques.
On the other hand, the British expeditions relied more on themselves pulling their sleds, which exhausted them more. They traveled in larger teams with a lot of professionals from different fields. Also, they focused more on scientific discovery than exploration.

Bonus: The indigenous cultural exchange with the Inuits, helped the Norwegians survive in the Arctic conditions during their expeditions, they taught them key techniques to survive in extreme cold. However the British relied on traditional methods that were less suited for the environment.

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

- Using dogsled for transportation.
- Fur-based clothing to prepare for extreme cold.
- Building Igloos as snow shelters.
- Ski techniques for transportation. (avoiding friction)
- Hunting techniques in extremely cold environments.

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

The Royal Geographic Society's primary role was to finance and promote the British Antarctic expeditions.

4. (a) How did the British travel and move gear in the polar regions, before motorized craft were developed?

The British primarily pulled their sleds themselves, and it exhausted them a lot. They also relied on spreading food depots during their trip.

(b) How did this differ from the Norwegians?

The Norwegians used dogsleds and skis, making their travel much more efficient and less exhausting.

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

The major risks for ships and explorers are the ice, as ships could become trapped, the extreme cold, limited visibility, lack of food and supplies, and sickness and diseases like scurvy.

6. 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?

Japan had already learned English through people like Ranald MacDonald, who secretly entered Japan and became an English teacher for samurai scholars. Which prepared them for Western trade negotiations.

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.

This quote can apply to the problem we have nowadays with global warming and the climate change. Now that we have recognized the problem we should be consequent enough to start acting for it and apply our measures to stop or slow its growth before it is too late and we regret it.

5. EXPLORATION ACHIEVEMENTS

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

Fridtjof Nansen's first crossing of Greenland in 1888 was a major achievement for Norway. It boosted Norwegian national pride and contributed to its identity as a strong and independent nation.

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

Yes, Roald Amundsen was the first leader to successfully cross the North-West Passage. He did so, by improving on earlier attempts by John Franklin and Robert McClure. Amundsen succeeded by using Inuit survival techniques after spending two winters learning from the local Netsilik Inuit.

3. What were the highlights of Robert Falcon Scott's "furthest South" on the Discovery expedition?

Robert Falcon Scott's Discovery expedition reached a new furthest south, discovered the polar plateau, which helped understand Antarctica's geography at that time, and conducted key scientific studies during the journey.

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

Locating the magnetic North and South poles helped improve navigation, advance in geophysic studies, explain auroras borealis

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 emotions are innate and natural, They are hardwired into our brain for survival and occur instinctively.

Secondary emotions are learned responses, shaped by our past experiences and culture.

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

Emotional bookmarks are memories that are linked to separate emotions, helping the brain quickly recognize dangers in the future.

Secondary emotions form when the brain associates a past experience with a new situation. So it helps us avoid past threats or bad experiences by triggering an alarm on us if we ever experience a similar situation.

7. REFLECTIONS

1. While on Skraeling Island, the writer 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?

In my opinion, the artifacts by the Dorset, Thule, and Norse cultures show us how experience has helped them develop those artifacts and survive all that time in those extreme conditions. If we hadn't exchanged culture with them we would have taken many years in the Arctic to develop the same artifacts and techniques.

Therefore, this highlights how knowledge exchange is needed for human survival. We should always be open to learning from other cultures and other people, especially when they have more experience in that field.

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?

One thing I wish I fully understood but probably never will is how Earth ended up with the perfect conditions for life. I have been taught about how science fully explains how planets form and how life is possible, and I understand how everything is structured, but when I think about how everything had to be just right for us to exist, I always feel amazed. The creation of the atmosphere, the distance from the Sun, gravity, the atmosphere, the food we eat, etc. If there was a minimal change in gravity, the sun was 1% closer, or any other similar change, we would die instantly. So for me, the conditions we live by right now kind of feel like everything was too perfect in a sense. I believe in science and understand how things work, but I still think it's really lucky that everything lined up so perfectly for us to exist.