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## 北海道大学大学院理学研究科

地球惑星科学専攻・修士（博士前期）および博士（博士後期）課程  
第二次入学者選抜試験

### 外国語試験問題

試験時間 9：30～11：30

- 1．問題冊子1冊（この冊子）、答案用紙4枚、草案用紙2枚を配布する．
- 2．問題は、英文和訳2問と、和文英訳2問の合計4問である．
- 3．問題のすべて解答すること．
- 4．解答は、問ごとに指定された答案用紙に記入すること．答案用紙には受験番号を記入すること．氏名は記入しないこと．
- 5．解答は答案用紙裏面に及んでもよい．
- 6．解答の如何に関わらず、4枚の答案用紙はすべて提出すること．
- 7．問題冊子と草案用紙は持ち帰ってよい．

## 問題 1 英文和訳

2つの問, 1 - 1 と 1 - 2 に答えよ .

問 1 - 1 . 以下は「The Philosophy of Science」と題された英文の一部である .  
下線部 (A), (B) および (C) を和訳せよ .

(A) The basis of science is observation, which can take the form of a simple observation of natural phenomena, such as the temperature of a lava as it erupts from a volcano or the thickness of a sedimentary layer in a outcrop, or it can take the form of data collected from experiments, such as measuring the force it takes to break a plate of rock in the laboratory. Although earth scientists can perform many useful experiments, we rely more heavily on observations of the natural world. By now, you may well appreciate that the time scales and magnitudes of geophysical and geologic process are usually far too great to simulate in the laboratory.

Careful observation allows us to characterize the phenomena we are studying.

(B) A well-defined behavior that appears to be unchanging can be expressed as a scientific law. Although a law describes a phenomenon precisely, it does not indicate how the phenomenon works, or why. When an explanation is proposed on the basis of observation, this is known as a hypothesis, or model. On occasion, more than one explanation or hypothesis is proposed, and we talk about, "multiple working hypotheses". Experiments or observation can be performed to test the model or choose between multiple working hypotheses.

To illustrate the scientific philosophy, consider the hypothesis proposed in the Middle Ages that Earth is flat. At that time, no specific observations suggested otherwise. It looked flat, and travelers, despite having to climb and descend hills, considered, overall, that they were traversing a flat surface. This, however, is a testable hypothesis. (C) A simple experiment to test the hypothesis was what Portuguese explorer F. Magellan effectively achieved in 1522, when his expedition completed the first circumnavigation of Earth, proving it to be a globe. Today, with the development of space travel, we can directly observe the spherical shape of Earth.

[注] lava : 溶岩 , outcrop : 露頭 , Portuguese : ポルトガル人の

問 1 - 2 . 次の文は量子力学に関する論文の一部である . 下線部 ( A ) および下線部 ( B ) を和訳せよ .

### **Quantum states of neutrons in the Earth's gravitational field**

The discrete quantum properties of matter are manifest in a variety of phenomena. (A)Any particle that is trapped in a sufficiently deep and wide potential well is settled in quantum bound states. For example, the existence of quantum states of electrons in an electromagnetic field is responsible for the structure of atoms, and quantum states of nucleons in a strong nuclear field give rise to the structure of atomic nuclei. In an analogous way, the gravitational field should lead to the formation of quantum states. But the gravitational force is extremely weak compared to the electromagnetic and nuclear force, so the observation of quantum states of matter in a gravitational field is extremely challenging. Because of their charge neutrality and long lifetime, neutrons are promising candidates with which to observe such an effect. Here we report experimental evidence for gravitational quantum bound states of neutrons. (B)The particles are allowed to fall towards a horizontal mirror which, together with the Earth's gravitational field, provides the necessary confining potential well. Under such conditions, the falling neutrons do not move continuously along the vertical direction, but rather jump from one height to another, as predicted by quantum theory.

[注] quantum bound states: 量子束縛状態 , nucleons: 核子

## 問題 2 和文英訳

2つの問，2 - 1 と 2 - 2 に答えよ．

問 2 - 1 . 次の文章を英訳せよ．

地球は独特の惑星ではあるが，他の地球型惑星または太陽系自体の起源と切り離してその起源を論ずることはできない．さらに月という独特の天体が近くに存在するという事も説明されなければならない．地球の起源に関する証拠は，その惑星自体に求められるよりも，他の惑星や衛星そして隕石に求められるべきである．最近の太陽系の探査は，惑星や60個に及ぶ衛星の間の驚くべき多様性を明らかにするだけでなく，地球の起源に対しても物質科学的な制約を与えるようになった．

[注] 隕石： meteorites

問 2 - 2 . 次の文章を英訳せよ．

科学的説明は常識に反している．ここでいう常識とは，人間が日常生活の中で自然に行う推論をさす．たとえば，常識によれば，太陽は毎朝東からのぼって西に沈むのであり，物を燃やせば煙が立ち上り，何かが失われていくとを感じる．これに対して科学は，太陽は動かず，われわれの乗っている地球こそが西から東に回っているのだという．また物が燃えるときには，物に酸素が結合するのだと教える．それなのに，人々はなぜ，これらの説明に納得するのだろうか？