

# neco 2014 animal husbandry practical specimens Printable PDF

**neco 2014 animal husbandry practical specimens** are an essential component of the National Examination Council (NECO) practical exams, designed to assess students' understanding and proficiency in animal husbandry. These specimens serve as practical tools that help students demonstrate their knowledge of animal management, health care, breeding, and nutrition. Understanding the significance, types, and proper handling of these specimens is crucial for success in the NECO examination and for aspiring animal husbandry practitioners.

## Understanding NECO 2014 Animal Husbandry Practical Specimens

### What Are NECO Animal Husbandry Practical Specimens?

NECO animal husbandry practical specimens are real or preserved samples used during the examination to test students' practical skills and theoretical understanding. These specimens encompass various animals, parts of animals, or related materials that are relevant to the curriculum. They are designed to simulate real-life scenarios in animal management, enabling students to showcase their ability to identify, handle, and interpret different specimens.

### Objectives of Using Practical Specimens

- To evaluate students' ability to identify different animals and parts.
- To assess understanding of animal health and disease symptoms.
- To test knowledge of breeds, nutrition, and management practices.
- To develop practical skills in handling animals and specimens safely and effectively.

## Types of Practical Specimens Used in NECO 2014

The specimens used in NECO 2014 cover a broad range of animals and related materials. They are categorized based on their purpose and the part of animal husbandry they represent.

### 1. Live Animals

Live specimens are often used to test students' handling, restraint, and observation skills. Common live specimens include:

- Cattle (e.g., zebu, Friesian)
- Goats (e.g., dwarf, boer)
- Pigs (e.g., Large White, Landrace)
- Sheep (e.g., Entebbe, Merino)
- Chickens (broilers and layers)

Note: Handling live animals requires knowledge of proper restraint techniques and safety precautions.

## 2. Animal Parts and Organs

Specimens such as organs are used for diagnosing diseases, understanding anatomy, or demonstrating proper slaughtering procedures. Examples include:

- Heart
- Liver
- Kidneys
- Stomach (rumen, abomasum)
- Intestines

## 3. Preserved Specimens

These are specimens preserved in formalin or other preservatives for study without the need for live handling. They include:

- Fungal-infected tissues
- Pathological specimens
- Breed-specific skins or hides

## 4. Feed and Nutritional Samples

Samples of feedstuffs such as:

- Hay
- Silage
- Concentrates

These are used to demonstrate proper feeding practices and nutritional analysis.

## Importance of Practical Specimens in NECO Animal Husbandry

Practical specimens are vital in ensuring a comprehensive understanding of animal husbandry. Their importance includes:

### Enhancing Practical Skills

Students learn how to handle animals properly, recognize disease symptoms, and perform basic management procedures.

### Improving Diagnostic Abilities

Specimens such as organs and tissues help students identify pathological changes, aiding in disease diagnosis.

### Bridging Theory and Practice

They facilitate the application of theoretical knowledge in real-world scenarios, preparing students for actual farm management.

### Assessment and Evaluation

Specimens serve as tangible evidence of students' competence during practical examinations.

## Handling and Care of NECO Practical Specimens

Proper handling and care are critical to maintain the integrity of specimens and ensure safety.

### Safety Precautions

- Always wear protective gear such as gloves, lab coats, and eye protection.
- Handle live animals gently to prevent stress or injury.
- Use appropriate tools for specimen dissection or examination.
- Dispose of biological waste according to safety guidelines.

### Storage and Preservation

- Preserved specimens should be kept in labeled, sealed containers with appropriate preservatives.

- Live animals should be housed in clean, secure enclosures with adequate ventilation.
- Regular monitoring for signs of deterioration or disease.

## Transporting Specimens

- Use secure, ventilated containers.
- Avoid rough handling to prevent damage.
- Ensure specimens are transported with proper documentation.

## Common Challenges and Solutions

Handling practical specimens may pose challenges; understanding these and their solutions is essential.

### Challenge 1: Decomposition of Specimens

Solution: Proper preservation and storage methods should be employed, such as refrigeration or chemical preservatives.

### Challenge 2: Misidentification of Specimens

Solution: Regular training on specimen identification and thorough study of specimen labels.

### Challenge 3: Safety Risks

Solution: Strict adherence to safety protocols, including the use of PPE and safe handling procedures.

## Tips for Success in NECO 2014 Animal Husbandry Practical Exams

To excel in practical exams involving specimens, students should consider the following tips:

- Familiarize thoroughly with all specimen types and their characteristics.
- Practice handling live animals to build confidence and skill.
- Learn proper dissection and examination techniques for organs and tissues.
- Understand safety procedures and adhere to them at all times.
- Keep specimens well-organized and properly labeled.
- Review the theoretical aspects related to each specimen to answer related questions confidently.

## Conclusion

NECO 2014 animal husbandry practical specimens are indispensable in assessing the practical skills and theoretical knowledge of students aspiring to excel in animal husbandry. Whether through live animals, preserved specimens, or feed samples, these practical tools provide invaluable hands-on experience that bridges classroom learning and real-world application. Proper handling, storage, and understanding of these specimens are essential to perform well in exams and to develop competent animal husbandry professionals. Continuous practice and adherence to safety standards will ensure that students are well-prepared to face the challenges of animal management and contribute effectively to the agricultural sector.

### NECO 2014 Animal Husbandry Practical Specimens: An In-Depth Review

Animal husbandry practicals are a crucial component of the NECO (National Examination Council) agricultural science examinations, especially for students aspiring to excel in agricultural sciences. The 2014 NECO Animal Husbandry practical specimens serve as an invaluable resource for students, educators, and examiners aiming to understand the core concepts, identification skills, and practical knowledge required in animal husbandry. This article offers a comprehensive review of the 2014 practical specimens, highlighting their significance, characteristics, and the essential details students need to focus on for successful examination performance.

## Understanding the Role of Practical Specimens in NECO Animal Husbandry

In the realm of agricultural sciences, especially animal husbandry, practical specimens are tangible tools that bridge theoretical knowledge with real-world identification and management skills. They enable students to:

- Recognize different animal breeds, types, and species.
- Understand physiological features and anatomical structures.
- Develop skills in specimen handling, observation, and recording.
- Prepare for identification questions and practical assessments.

The 2014 specimens, in particular, are a reflection of the key animals and breeds relevant at that time, emphasizing the importance of species diversity, breed characteristics, and husbandry practices.

## Major Categories of 2014 NECO Animal Husbandry Practical Specimens

The specimens for the 2014 NECO practicals can be broadly categorized into several groups based on animal types and their purpose in practical assessment:

- Livestock Species
  - Cattle
  - Goats
  - Sheep
  - Pigs
  - Poultry (Chickens, Turkeys, Ducks)
  - Equines (Horses, Donkeys)
- Breeds and Types

Each species encompasses various breeds, each with distinctive features vital for identification and husbandry management.

- Physiological and Anatomical Specimens

These include parts or whole animals used to demonstrate reproductive, digestive, or skeletal systems.

## In-Depth Review of Key 2014 Practical Specimens

This section elaborates on the most significant specimens students are expected to identify, describe, and understand, based on the 2014 practicals.

### 1. Cattle (*Bos taurus* and *Bos indicus*)

Significance: Cattle are central to animal husbandry due to their economic importance for meat, milk, and draught power.

Specimens Included:

- Breed Identification:
  - Friesian (for dairy production): Known for high milk yield, black-and-white coloration, large

frame.

- Red Bororo or Sokoto Gudali (for beef/draught): Noted for their hump, color, and adaptability.
- Anatomical Parts:
  - Skull and horns
  - Udder and teats (for dairy breeds)
  - Hooves and legs

Features to Note:

- Hump presence in *Bos indicus* breeds
- Coat color variations
- Horn shape and size
- Body conformation

Practical Skills:

- Differentiating between dairy and draught breeds
- Recognizing signs of good health and signs of disease (e.g., mastitis signs in udder)

## 2. Goats (*Capra aegagrus hircus*)

Significance: Goats are vital for meat, milk, and skins, especially in semi-arid regions.

Specimens Included:

- Breed Identification:
  - Sahel (dairy type): Characterized by small size, straight hair, and erect ears.
  - Boer (meat type): Noted for rapid growth and muscular build.
  - Nubian (dual-purpose): Known for large ears and high milk yield.
- Anatomical Features:
  - Horn shape and position
  - Beard and wattles
  - Udder and teats

Features to Note:

- Body size and conformation
- Coat color and pattern
- Behavior and adaptability signs

Practical Skills:

- Identifying breeds based on physical features
- Recognizing signs of good breeding stock

### 3. Sheep (*Ovis aries*)

Significance: Sheep are primarily raised for wool, meat, and milk.

Specimens Included:

- Breed Identification:
  - Improved White (Shetland or Dorset): Fleece quality and body size
  - Hair sheep (e.g., Dorper): Less wool, more meat-oriented
- Anatomical Features:
  - Wool type and fleece characteristics
  - Horns (for horned breeds)
  - Body conformation

Features to Note:

- Wool quality (fine or coarse)
- Skin pigmentation
- Growth rate and body size

Practical Skills:

- Recognizing wool types



- Differentiating between breeds for specific purposes

#### **4. Swine (*Sus scrofa domesticus*)**

Significance: Pigs are raised mainly for meat (pork).

Specimens Included:

- Breed Identification:
  - Large White: White with erect ears
  - Berkshire: Black with white points and drooping ears
  - Pietrain: Spotted or patterned
- Anatomical Features:
  - Snout shape
  - Body size and build
  - Skin and hair characteristics

Features to Note:

- Body conformation (muscle development)
- Ear orientation
- Color patterns

Practical Skills:

- Recognizing breed-specific traits
- Understanding husbandry needs for different breeds

#### **5. Poultry (Broilers, Layers, Ducks, Turkeys)**

Significance: Poultry provides eggs and meat.

Specimens Included:

- Chicken Breeds:

- Layer breeds: Leghorn, Rhode Island Red
- Broiler breeds: Cornish Cross, White Plymouth Rock

- Ducks and Turkeys:
- Indian Runner (duck)
- Broad Breasted White (turkey)

Features to Note:

- Plumage color and pattern
- Body size and shape
- Comb and wattles
- Egg-laying traits

Practical Skills:

- Breed identification
- Recognizing signs of good health and productivity

## **6. Equines (Horses and Donkeys)**

Significance: Used for transport, draught, and recreation.

Specimens Included:

- Horse Breeds:
- Arabian: Slim, high tail carriage
- Thoroughbred: Lean, tall
- Donkeys:
- Somali or African donkey ? smaller size, robust build

Features to Note:

- Body conformation

- Coat color and markings
- Head and ear shape

Practical Skills:

- Breed recognition
- Handling and management cues

## Physiological and Anatomical Specimens

Apart from whole animals, the practical specimens also include parts demonstrating key physiological systems:

- Reproductive organs: Ovaries, testes, uterus
- Digestive tract sections: Rumen, reticulum, omasum, abomasum in ruminants
- Skeletal parts: Limb bones, vertebrae

These specimens aid students in understanding the internal systems vital for animal health and productivity.

## Tips for Students Preparing for NECO 2014 Animal Husbandry Practical

- Familiarize with Breed Characteristics: Study the physical features, coat types, and behavioral traits of common breeds.
- Practice Specimen Handling: Be comfortable with observing, handling, and recording specimen features.
- Understand Anatomical Terminology: Know the names and locations of key anatomical parts.
- Recognize Signs of Good and Poor Health: Be able to identify signs of disease or malnutrition.
- Develop Observation Skills: Pay attention to details like body conformation, coloration, and physical traits.

## Conclusion

The NECO 2014 animal husbandry practical specimens serve as a vital educational tool, encapsulating the diversity of domesticated animals and their breed-specific traits. Mastery of these specimens requires diligent study of their physical features, physiological structures, and husbandry practices. For students aiming to excel, a thorough understanding of these specimens will not only

aid in practical examinations but also lay a solid foundation for future careers in animal science and husbandry.

By focusing on the detailed features, breed distinctions, and husbandry requirements highlighted in the 2014 specimens, learners can confidently approach their practicals, demonstrating both knowledge and skill essential for success in animal husbandry.

**QuestionAnswer** What are the main practical specimens required for Neco 2014 Animal Husbandry practical? The main practical specimens include various live animals such as cattle, goats, sheep, pigs, poultry, and their respective carcasses, as well as preserved specimens like skins, wool, and reproductive organs. How should live specimens be handled during Neco 2014 Animal Husbandry practical exams? Live specimens should be handled humanely and carefully, ensuring proper restraint techniques are used to prevent stress or injury, and maintaining cleanliness and safety protocols throughout the examination. What are the key features to observe in carcasses during the practical exam? Key features include body condition, fat deposits, muscle development, internal organ placement, and signs of disease or abnormalities to assess animal health and meat quality. Are there specific specimens required for reproductive system identification in Neco 2014? Yes, specimens such as reproductive organs (testes, ovaries, uterus) are required to demonstrate knowledge of reproductive anatomy and functions in different animals. What is the significance of preserved specimens in the Neco 2014 practical exam? Preserved specimens like skins, wool, and reproductive organs help students identify and understand the anatomical and physiological features of various animals in a controlled environment. How do students prepare for practical identification of animal diseases using specimens? Students should familiarize themselves with common signs of diseases in animals and their specimens, including abnormal tissues, lesions, or discharges, and practice identification techniques prior to the exam. What safety precautions are necessary when handling animal specimens in the practical? Safety precautions include wearing gloves, lab coats, and protective eyewear, properly disposing of biological waste, and ensuring specimens are handled with care to prevent contamination or injury. What role do specimen identification and labeling play in the practical exam? Accurate identification and labeling of specimens demonstrate a clear understanding of animal anatomy and physiology, which is crucial for scoring well in the practical assessment. Are there any common mistakes to avoid when handling and presenting specimens in Neco 2014 Animal Husbandry practicals? Common mistakes include improper handling leading to specimen damage, incorrect labeling, failure to observe key features, and neglecting safety protocols. Proper preparation and attention to detail are essential for success.

**Related keywords:** NECO 2014 animal husbandry practical specimens, animal husbandry practical specimens, NECO 2014, animal husbandry specimens, practical specimens, animal husbandry NECO, 2014 NECO practical, livestock management specimens, practical exam animal husbandry, NECO practical specimens

## Animal husbandry practical specimens

**Animal husbandry practical specimens** are essential tools for students, veterinarians, and professionals involved in the care, management, and study of domestic animals. These specimens serve as invaluable educational resources, offering hands-on experience and a deeper understanding of animal physiology, anatomy, diseases, and husbandry practices. In this article, we will explore the significance, types, and applications of animal husbandry practical specimens, emphasizing their role in enhancing learning and ensuring animal health and productivity.

## Understanding Animal Husbandry Practical Specimens

### What Are Animal Husbandry Practical Specimens?

Animal husbandry practical specimens are preserved or prepared biological materials derived from domestic animals such as cattle, sheep, goats, pigs, poultry, and others. These specimens are used for educational and training purposes, enabling learners to observe anatomical structures, pathological changes, and physiological features without the need for live animals.

They can include:

- Anatomical specimens (e.g., organs, tissues)
- Pathological specimens (e.g., diseased organs)
- Demonstration models
- Dissection samples

### Importance of Practical Specimens in Animal Husbandry

Practical specimens bridge the gap between theoretical knowledge and real-world application. They help:

- Improve understanding of animal anatomy and physiology
- Recognize signs of common diseases
- Demonstrate proper husbandry and management techniques
- Train students and practitioners in diagnostic procedures
- Promote ethical learning by reducing the need for live animals in initial training stages

## Types of Animal Husbandry Practical Specimens

## Anatomical Specimens

Anatomical specimens are preserved organs and tissues that showcase the internal structures of animals.

Common Anatomical Specimens Include:

- Heart, lungs, liver, kidneys, stomachs
- Skeletal parts like limb bones and vertebrae
- Reproductive organs such as ovaries and testes

Preparation Methods:

- Formalin fixation
- Plastination
- Dry preservation (e.g., skeletal remains)

## Pathological Specimens

Pathological specimens are tissues or organs affected by diseases, providing insight into disease progression and impact.

Examples:

- Liver with cirrhosis
- Lungs affected by pneumonia
- Tumorous tissues
- Abscesses and parasitic infestations

Purpose:

- Aid in diagnosing diseases
- Recognize pathological changes
- Understand disease etiology and effects

## Models and Dissection Kits

In addition to real specimens, models and dissecting kits are used for detailed study.

Advantages:

- Reusable
- Safer for students
- Can be designed to highlight specific features

## **Demonstration and Teaching Aids**

These include charts, diagrams, and 3D models that supplement practical specimens, providing visual clarity.

## **Applications of Animal Husbandry Practical Specimens**

### **Educational Use**

Specimens form the backbone of veterinary and animal husbandry education, allowing students to:

- Practice specimen identification
- Learn anatomical landmarks
- Understand disease pathology
- Develop diagnostic skills

### **Veterinary Practice and Diagnosis**

Veterinarians utilize specimens for:

- Confirming diagnoses
- Planning treatment strategies
- Teaching pet owners and farmers about disease signs

### **Research and Development**

Specimens are vital in research, including:

- Studying disease mechanisms

- Testing new treatments
- Improving husbandry practices

## Selection and Preservation of Practical Specimens

### Criteria for Selecting Specimens

Choosing quality specimens is crucial for effective learning:

- **Authenticity:** Specimens should accurately represent typical cases
- **Condition:** Well-preserved specimens with minimal deterioration
- **Relevance:** Specimens should align with the curriculum or research focus
- **Ethical sourcing:** Animals should be obtained ethically and legally

### Methods of Preservation

Proper preservation ensures longevity and safety:

- **Formalin Fixation:** Common for soft tissues; preserves tissue structure
- **Plastination:** Creates durable, odorless, and non-toxic specimens
- **Dry Preservation:** Uses drying and coating for skeletal remains
- **Embedding in Resin:** For detailed anatomical studies

## Ethical and Legal Considerations

Using animal specimens raises ethical questions. It is essential to adhere to:

- Animal welfare regulations
- Proper consent and documentation
- Minimizing animal suffering
- Promoting alternatives like models where possible

Institutions should establish clear guidelines and ensure all specimens are obtained legally and ethically.

## Challenges and Future Perspectives

### Challenges in Using Practical Specimens



- Deterioration over time
- Storage space requirements
- Handling safety concerns
- Ethical issues surrounding animal use

## Future Trends

Advancements in technology are transforming the use of practical specimens:

- 3D printing of anatomical models
- Virtual dissection and augmented reality tools
- Digital databases of specimen images and videos
- Improved preservation techniques

These innovations aim to supplement or replace traditional specimens, enhancing accessibility and ethical standards in education and practice.

## Conclusion

Animal husbandry practical specimens are invaluable educational resources that facilitate a comprehensive understanding of animal anatomy, physiology, and pathology. They are instrumental in training veterinary students, assisting practitioners, and advancing research. To maximize their benefits, it is essential to select high-quality specimens, preserve them appropriately, and adhere to ethical standards. As technology evolves, integrating digital and virtual specimens will further enrich learning experiences, making animal husbandry education more effective, ethical, and accessible worldwide.

### Animal Husbandry Practical Specimens: A Comprehensive Expert Review

In the realm of animal husbandry education and practical training, the importance of well-curated specimens cannot be overstated. These specimens serve as vital tools for students, researchers, and professionals to develop hands-on skills, deepen understanding of animal anatomy, and improve diagnostic and management capabilities. Whether utilized in veterinary colleges, agricultural universities, or training workshops, animal husbandry practical specimens are instrumental in bridging theoretical knowledge with real-world application. This article offers an in-depth review of these specimens, exploring their types, significance, preparation methods, and best practices for utilization.

## Understanding Animal Husbandry Practical Specimens

Animal husbandry practical specimens are preserved or prepared samples that represent various anatomical, pathological, or physiological aspects of farm animals. Their primary purpose is educational: providing tactile and visual learning opportunities that complement textbooks and lectures. These specimens can include entire animals, organs, tissues, or specific pathological samples, each serving distinct learning objectives.

Key Objectives of Using Practical Specimens:

- Enhancing anatomical knowledge
- Recognizing pathological conditions
- Understanding physiological processes
- Practicing diagnostic techniques
- Developing manual skills such as palpation or dissection

## Types of Animal Husbandry Practical Specimens

The diversity of specimens reflects the wide scope of animal husbandry. Each type serves a specific purpose in training and education.

### 1. Whole Animal Specimens

Definition: Entire animals preserved for study, typically used to demonstrate overall anatomy, conformation, and sometimes pathological conditions.

Applications:

- Teaching gross anatomy
- Demonstrating normal and abnormal features
- Practicing handling and restraint techniques

Preparation Considerations:

- Proper preservation to prevent decomposition
- Ethical sourcing and humane euthanasia
- Use of preservatives like formalin for long-term storage

Advantages:

- Provides a comprehensive view of animal structure
- Useful for students to familiarize themselves with live animal handling

Limitations:

- Large size may require significant storage space
- Preservation chemicals can be hazardous

## 2. Organ and Tissue Specimens

Definition: Isolated organs (like the heart, liver, kidney) or tissues used for detailed study.

Applications:

- Comparative anatomy
- Pathological examination
- Demonstrating organ functions and abnormalities

Preparation Considerations:

- Proper dissection and preservation techniques
- Fixation in formalin or other preservatives
- Labeling for identification

Advantages:

- Focused study on specific organs
- Easier handling and storage

Limitations:

- May lack contextual relationship to the whole animal

## 3. Pathological Specimens

Definition: Samples showing disease conditions, such as tumors, abscesses, or parasitic

infestations.

Applications:

- Recognizing disease signs
- Training in diagnostic procedures
- Understanding disease progression

Preparation Considerations:

- Ethical collection from diseased animals
- Proper fixation to preserve pathological features
- Clear documentation of case history

Advantages:

- Vital for veterinary diagnosis training
- Enhances understanding of disease mechanisms

Limitations:

- Handling infectious or hazardous specimens requires safety precautions

## 4. Model Specimens and Simulants

Definition: Artificial or synthetic models that mimic real animal parts, often used for practicing invasive procedures.

Applications:

- Injection techniques
- Ultrasound practice
- Surgical training

Preparation Considerations:

- High-quality materials for realism
- Reusable design for cost-effectiveness

Advantages:

- No ethical concerns
- Safe for repeated practice

Limitations:

- May lack the tactile properties of real tissues

## **Preparation and Preservation of Practical Specimens**

Creating high-quality practical specimens requires meticulous preparation and preservation techniques to ensure longevity, safety, and educational value.

### **Preservation Methods**

- **Formalin Fixation:** The most common method, using 10-20% formalin solution to fix tissues, preventing decomposition and preserving morphology. It is suitable for both whole animals and organs.
- **Alcohol Preservation:** Used for tissues that need to be flexible or for specimens that cannot tolerate formalin. Ethanol solutions are common.
- **Plastic Embedding:** For creating durable, lightweight models, especially for bones and certain tissues, using resins or plastics.
- **Drying and Desiccation:** For skins or horns, natural or artificial drying methods can be employed.

### **Preparation Techniques**

- **Dissection:** Carefully exposing organs or tissues for removal and preservation.

- Embedding: Encasing tissues in resin or paraffin for detailed study.
- Injection: Filling hollow organs or cavities with preservatives or contrasting agents to maintain shape and reveal internal structures.
- Labeling: Clear, durable labels indicating specimen details, origin, and preservation method.

## Safety and Ethical Considerations

- Obtain specimens ethically, ensuring humane euthanasia and adherence to

**Question** What are the common practical specimens used in animal husbandry for livestock management training? Common practical specimens include skeletal models, reproductive organs, digestive system models, and skin/hide sections of various animals, which aid in understanding anatomy, reproduction, and health management. How are practical specimens used to diagnose livestock diseases in animal husbandry? Practical specimens such as infected tissues, organs, or skin scrapings help students identify pathological changes, understand disease progression, and learn diagnostic techniques like microscopy and histopathology. What role do practical specimens play in teaching reproductive management in animal husbandry? Specimens like reproductive organs and fetus models assist students in understanding reproductive anatomy, estrous cycles, and breeding techniques, enhancing practical knowledge for effective reproductive management. Which specimens are essential for teaching dairy cattle management in practical sessions? Essential specimens include udder models, milk secretion samples, and reproductive organ models, which help students learn about milking procedures, udder health, and reproductive health management. How do practical specimens help in understanding animal nutrition and digestive physiology? Models of the digestive system and feed samples allow students to study digestion, nutrient absorption, and the effects of different diets, facilitating practical understanding of animal nutrition. What safety precautions should be taken while handling animal husbandry practical specimens? Students should wear protective gear, handle specimens with care to avoid contamination, dispose of biological waste properly, and follow hygiene protocols to ensure safety during practical sessions.

**Related keywords:** animal husbandry, practical specimens, livestock management, animal breeding, animal nutrition, veterinary practices, farm animals, animal health, livestock science, animal reproduction

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