

Based on the examination papers provided (2024, 2023, 2022, 2019, and 2018) for **Animal Nutrition Paper-II**, here are the detailed answers for all **Q.4 (Short Note)** questions.

These answers are synthesized based on standard veterinary nutrition principles (e.g., *Principles of Animal Nutrition and Feed Technology* by D.V. Reddy).

Year: 2024

4.1 Nutrient requirements of broiler birds as per BIS, 2007 ¹

According to the Bureau of Indian Standards (BIS, 2007), broiler nutrient requirements are divided into Pre-starter, Starter, and Finisher phases to match rapid growth rates.

- **Pre-Starter (0-7 days):** Requires high protein (23% CP) and energy (\$3000~Kcal/kg\$ ME) to support early tissue development.
- **Starter (8-21 days):** Protein remains relatively high (22-23% CP) with energy levels around \$3100~Kcal/kg\$ ME.
- **Finisher (22 days-marketing):** Protein requirement drops (20% CP) while energy density increases (\$3200~Kcal/kg\$ ME) to support fattening.
- **Minerals:** Calcium typically ranges from 1.0-1.2% and Available Phosphorus around 0.45-0.5%.

4.2 Total Mixed Ration (TMR) ²

TMR is a method of feeding dairy cattle where all feed ingredients (forages, concentrates, grains, minerals, and vitamins) are blended into a homogenous mixture.

- **Principle:** It ensures that every mouthful of feed consumed contains the specific balanced nutrient concentration required by the animal.
- **Advantages:** It prevents selective feeding (sorting), maintains a stable rumen pH (reducing acidosis risk), and allows for the utilization of unpalatable by-products by masking their taste.
- **Efficiency:** It increases dry matter intake and milk production efficiency compared to separate feeding of roughage and concentrate.

4.3 Feeding a calf from birth to three months of age ³

- **0-3 Days (Colostrum):** Essential to feed colostrum within 1-2 hours of birth @ 10% of

body weight to ensure passive immunity (IgG absorption).

- **Milk/Milk Replacer:** Fed from day 4 onwards. Whole milk is usually fed at 10% of body weight, tapering down as solid food intake increases.
- **Calf Starter:** Introduced as early as 2 weeks. This is a high-quality, low-fiber concentrate (22-24% CP) essential for rumen papillae development.
- **Roughage:** Good quality leguminous hay is introduced gradually after 2-3 weeks to develop rumen capacity/musculature.
- **Weaning:** Usually done around 3 months or when the calf consumes 1-1.5 kg of calf starter daily.

4.4 Methods adopted for arriving energy requirements for maintenance in cattle 4

Determining maintenance energy ensures the animal maintains zero energy balance (no weight gain/loss). Major methods include:

- **Respiration Calorimetry:** Measures gaseous exchange (O_2 consumption and CO_2 /methane production) to calculate heat production using the Brouwer equation.
- **Carbon and Nitrogen Balance:** Measures all C and N intake vs. excretion. If the balance is zero, the intake equals maintenance requirement.
- **Slaughter Technique (Comparative Slaughter):** Groups of animals are slaughtered at the start and end of a trial. Energy retention is measured by analyzing carcass energy content; maintenance is the intake where energy retention is zero.
- **Long-term Feeding Trials:** Feeding graded levels of energy and monitoring body weight changes over time to find the stasis point.

4.5 Explain in detail the feeding of race horses 5

Race horses are performance animals requiring high energy density diets.

- **Energy Source:** While forage (1-1.5% BW) is needed for gut health, energy is boosted using grains (oats/corn) and increasingly, vegetable oils (fat). Fat provides cool energy without the risk of starch overload.
- **Protein:** Moderate requirement (10-12% CP), but quality (Lysine) is crucial for muscle repair.
- **Electrolytes:** Heavy sweating requires supplementation of Na, Cl, K, and Ca.
- **Management:** Feed small, frequent meals (3-4 times/day) to prevent colic and laminitis. Never feed grain immediately before or after hard exercise.

4.6 Peculiarity of cat nutrition 6

Cats are obligate carnivores with specific metabolic idiosyncrasies:

- **High Protein:** They have a fixed high rate of gluconeogenesis and cannot downregulate protein catabolizing enzymes.

- **Taurine:** Cannot synthesize enough taurine (unlike dogs); deficiency leads to Central Retinal Degeneration (CRD) and Cardiomyopathy.
- **Vitamin A:** Cannot convert beta-carotene to Retinol (lack dioxygenase enzyme); require preformed Vitamin A (animal source).
- **Arachidonic Acid:** Cannot synthesize it from linoleic acid; must be supplied in the diet.
- **Niacin:** Cannot convert Tryptophan to Niacin efficiently.

4.7 Bypass nutrients in feeding of high yielding animals ⁷

Bypass nutrients (Rumen Undegradable Protein - RUP, or Bypass Fat) escape fermentation in the rumen and are digested in the abomasum/small intestine.

- **Necessity:** In high yielders, microbial protein synthesis is insufficient to meet amino acid requirements for milk production.
- **Bypass Protein:** Sources include heat-treated soy meal, maize gluten meal, or formaldehyde-treated cakes. They increase amino acid availability for milk protein synthesis.
- **Bypass Fat:** Inert fats (calcium soaps) increase energy density without coating fiber in the rumen (which would inhibit digestion), preventing negative energy balance (NEB) and ketosis.

4.8 Ketosis and its management ⁸

- **Etiology:** A metabolic disorder in high-producing cows early in lactation due to **Negative Energy Balance**. The animal mobilizes body fat faster than the liver can process, leading to ketone body formation (Acetone, Acetoacetate, Beta-hydroxybutyrate).
- **Symptoms:** Sweetish smell of breath, drop in milk yield, nervous signs, anorexia (refusal of concentrates).
- **Management:**
 1. **Intravenous Glucose:** 50% Dextrose for immediate correction.
 2. **Glucogenic Precursors:** Oral administration of Propylene Glycol or Glycerol.
 3. **Dietary Management:** Feed high-energy rations (grains) and bypass fats pre- and post-calving. Avoid over-fattening cows during the dry period.

Year: 2023

4.1 Feeding of orphan foal 9

When a mare dies or rejects the foal, artificial rearing is required.

- **Colostrum:** If mare's colostrum is unavailable, use frozen banks or high-quality bovine colostrum (check for antibodies) within the first 24 hours.
- **Milk Replacer:** Mare's milk is higher in sugar (lactose) and lower in fat/protein than cow's milk. Replacers must mimic this (acidified cow milk with added dextrose and lime water).
- **Schedule:** Feed hourly for the first 2 days, then extend intervals to 2-3 hours. Use a bottle initially, then train to drink from a bucket.
- **Creep Feed:** Introduce solid feed and high-quality hay by 2 weeks of age.

4.2 Bypass protein 10

(See Answer 2024 Q4.7)

Additional specific context: Bypass protein refers to dietary protein that resists degradation by rumen microbes. It provides essential amino acids directly to the small intestine. According to NDDDB, high-yielding animals should have a diet where substantial protein is UDP (Undegradable Dietary Protein). Treatments to protect protein include heat treatment, formaldehyde treatment (1-1.2% of CP), or tannin treatment.

4.3 Thumb rule method 11

This is a practical method for calculating concentrate requirements for dairy cattle under field conditions.

- **Maintenance:** Provide roughly 1.0 to 1.5 kg of concentrate mixture for body maintenance (depending on body weight).
- **Production (Cows):** Provide 1.0 kg of additional concentrate for every 2.5 to 3.0 kg of milk produced.
- **Production (Buffaloes):** Provide 1.0 kg of concentrate for every 2.0 to 2.5 kg of milk produced (due to higher fat content in buffalo milk).
- **Pregnancy:** Add 1.0 to 1.5 kg extra concentrate during the last trimester (steaming up).

4.4 Creep feeding 12

Creep feeding is the practice of supplementing the diet of young nursing animals (piglets, lambs, foals, calves) with high-quality feed in an area inaccessible to the dams.

- **Design:** Uses a "creep" (enclosure with small openings).
- **Composition:** High energy, high protein (>20%), highly palatable (flavored/sweetened), and digestible (pellets/crumbles).
- **Benefits:** Increases weaning weight, promotes rumen/gut development, reduces suckling stress on the mother, and ensures uniform growth of the litter.

4.5 Cats are obligate carnivores. Justify? 13

(See Answer 2024 Q4.6)

Justification relies on evolutionary metabolic adaptations:

1. **Enzymatic Limitations:** Lack of salivary amylase (poor carb digestion), low hepatic glucokinase activity.
2. **Amino Acid Dependency:** Absolute requirement for Taurine and Arginine (deficiency causes rapid hyperammonemia).
3. **Vitamin Synthesis:** Inability to synthesize Vitamin A from carotenes and Niacin from tryptophan.
4. **Taste:** Cats generally lack "sweet" taste receptors, driving them toward protein/fat sources.

4.6 Feeding of Hippopotamus¹⁴

- **Digestive Physiology:** They are **pseudo-ruminants** (foregut fermenters) with a massive, complex, three-chambered stomach but do not chew the cud (ruminate) like true ruminants.
- **Diet:** They are nocturnal grazers. In captivity, they consume large amounts of grass hay (Timothy/Bermuda) and herbivore pellets.
- **Metabolic Rate:** They have a relatively low metabolic rate per unit of body weight compared to other ungulates.
- **Management:** Feed is often placed on dry land. Care must be taken to avoid obesity in captivity; produce (vegetables) serves as enrichment.

4.7 Comparison of feeding habits of sheep and goats¹⁵

- **Sheep (Grazers):** Prefer grass and legumes close to the ground. They have a split upper lip allowing them to graze very close to the soil surface. They are less selective than goats but more selective than cattle.
- **Goats (Browsers):** Prefer leaves, shrubs, vines, and woody plants. They have highly mobile upper lips and are bipedal stance capable (stand on hind legs to reach). They are highly selective feeders and have proline-rich saliva that binds tannins, allowing them to eat bitter plants that sheep avoid.

4.8 Importance of fibre in rabbit's nutrition¹⁶

- **Gut Motility:** Rabbits are hindgut fermenters. Indigestible fiber (lignin/cellulose) is crucial to stimulate cecal-colonic motility.

- **Prevention of Enteritis:** Low fiber diets (<10-12%) lead to hypomotility, cecal stasis, and proliferation of pathogens like *Clostridium* (Enterotoxemia).
 - **Fur Chewing:** Fiber provides satiety. Deficiency leads to behavioral vices like fur chewing (trichophagia).
 - **Caecotrophy:** Fiber separation mechanisms in the colon allow fluid/fines to return to the cecum for fermentation while large fibers are excreted as hard feces.
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Year: 2022

4.1 Feeding of ducks ¹⁷

- **Feeding Habit:** Ducks "shovel" feed. They have difficulty swallowing dry mash and waste it easily.
- **Form:** Wet mash or pellets (3.2mm for starters, larger for growers) are preferred.
- **Nutrients:** Ducks have a higher requirement for **Niacin** than chickens to prevent leg weakness and bowed legs.
- **Toxins:** They are highly sensitive to **Aflatoxins**; feed must be strictly monitored for mold.
- **Growth:** Growth rate is very fast (faster than broilers up to 4 weeks); requiring high energy (2900 kcal/kg ME) and protein (22% CP) in the starter phase.

4.2 Feeding of guinea pigs ¹⁸

- **Vitamin C:** The most critical aspect. Guinea pigs cannot synthesize Vitamin C (L-gulonolactone oxidase deficiency). Diet must contain 200 mg/kg of Vit C. Deficiency causes Scurvy.
- **Fiber:** Strict herbivores requiring high fiber (Timothy hay) ad libitum to maintain hindgut fermentation and dental health (teeth grow continuously).
- **Coprophagy:** They practice coprophagy (eating cecotropes) for B-vitamins and protein recycling.
- **Protocol:** Avoid high calcium hays (Alfalfa) in adults to prevent urolithiasis.

4.3 Write about importance of colostrum in neonatal calf ¹⁹

- **Immunity:** Calves are born agammaglobulinemic (no antibodies). Colostrum provides IgA, IgG, and IgM for passive immunity.
- **Gut Closure:** The intestinal permeability to large protein molecules (antibodies) decreases rapidly and "closes" by 24 hours. Feeding must happen immediately (first 6 hours critical).
- **Nutrition:** High in solids, protein, energy, and Vitamin A compared to normal milk.
- **Laxative:** The high magnesium salts in colostrum act as a laxative to help pass the first feces (meconium).

4.4 Discuss piglet anaemia ²⁰

- **Cause:** Iron deficiency. Sow's milk is very poor in iron, and piglets have low liver iron reserves at birth.
- **Growth:** Piglets grow extremely fast (doubling weight in a week), expanding blood volume and depleting iron.
- **Symptoms:** Pale skin/mucous membranes, "Thumps" (labored spasmodic breathing), rough hair coat, poor growth.
- **Prevention:** intramuscular injection of Iron Dextran (100-150 mg) at 3-4 days of age, or swabbing sow's udder with ferrous sulphate solution.

4.5 Write about least cost ration ²¹

- **Definition:** A formulation method (usually using Linear Programming software) that creates a diet meeting all nutritional requirements of the animal at the lowest possible financial cost.
- **Inputs:** Nutrient requirements of the animal (constraints), nutrient composition of available feed ingredients, and the current price of ingredients.
- **Application:** widely used in commercial poultry and dairy feed industries to maximize profit margins without compromising animal performance.

4.6 Write in brief about Indian feeding standards ²²

- **Sen and Ray (1964):** The first compilation of nutritional values of Indian feeds.
- **ICAR (1985/1998/2013):** The Indian Council of Agricultural Research developed standards specifically for Indian livestock (Zebu cattle/Bufalloes) and tropical feeds.
- **Difference from NRC/ARC:** Indian standards account for the lower quality of tropical roughages (crop residues like straw), the specific rumen ecology of *Bos indicus*, and the

need to compute requirements based on metabolizable energy and protein suitable for tropical environments.

4.7 What is nutritive ratio? write different nutritive ratio and their importance ²³

- Formula:

$$\text{Nutritive Ratio (NR)} = \frac{\text{Digestible Carbohydrates} + \text{Digestible Fiber} + (\text{Digestible Fat} \times 2.25)}{\text{Digestible Crude Protein}}$$

- **Narrow NR (1:3 to 1:5):** High protein proportion. Used for young growing animals, high-producing dairy cows, and breeding males.
- **Medium NR (1:6 to 1:8):** Balanced. Used for working animals and moderate production.
- **Wide NR (1:9 to 1:12):** Low protein proportion. Used for maintenance of adult animals or fattening mature animals.

4.8 Importance of bypass protein in high yielding animals ²⁴

(See Answer 2024 Q4.7)

Summary: Prevents nitrogen wastage in the rumen, supplies limiting amino acids (lysine/methionine) directly for absorption in the intestine, and supports production levels that exceed what microbial protein alone can support.

Year: 2019

4.1 Nutrient requirements of layer birds as per BIS, 2007 ²⁵

- **Chick (0-8 weeks):** 20% CP, 2800 Kcal/kg ME. Focus on skeletal frame.
- **Grower (9-20 weeks):** 16% CP, 2500 Kcal/kg ME. Restricted feeding is often used here to delay sexual maturity and prevent obesity.
- **Layer Phase 1 (21-45 weeks):** 18% CP, 2600 Kcal/kg ME. Calcium requirement jumps to 3.0-3.5% for eggshell formation.
- **Layer Phase 2 (46+ weeks):** 16% CP, 2400 Kcal/kg ME. Calcium may increase further (3.5-4.0%) as shell quality declines with age.

4.2 Write about feeding a calf from birth to three month of age 26
(Duplicate of 2024 Q4.3. See answer above.)

4.3 Explain in detail the feeding of race horses 27
(Duplicate of 2024 Q4.5. See answer above.)

4.4 Methods adopted for arriving energy requirements for maintenance in cattle 28
(Duplicate of 2024 Q4.4. See answer above.)

4.5 Urea feeding in ruminants ²⁹

- **Mechanism:** Urea is a Non-Protein Nitrogen (NPN) source. Rumen urease converts urea to ammonia (NH_3). Microbes use this NH_3 + carbon skeletons (from carbohydrates) to synthesize microbial protein.
- **Requirements:** A readily fermentable carbohydrate source (like molasses or starch) must be present to provide the carbon skeleton.
- **Limits:** Max 1% of total dry matter intake, or 3% of the concentrate mixture.
- **Adaptation:** Introduce gradually over 2 weeks to prevent ammonia toxicity.
- **Safety:** Do not feed to young calves (monogastric phase) or monogastrics.

4.6 Concept of restricted feeding in poultry ³⁰

- **Purpose:** Used primarily in broiler breeders and growing layers (pullets).
- **Goal:** To prevent obesity, which leads to poor fertility, low hatchability, prolapse, and high mortality. It delays sexual maturity to ensure eggs are of good size when laying begins.
- **Methods:**
 1. **Quantitative:** Limiting the amount of feed per day.
 2. **Skip-a-day:** Feeding ad-libitum one day and fasting the next.
 3. **Qualitative:** Diluting the diet with high fiber.

4.7 Peculiarity of cat nutrition 31
(Duplicate of 2024 Q4.6. See answer above.)

4.8 Creep feeding in swine 32

(See Answer 2023 Q4.4)

Specific to swine:

- Started at 7-10 days.
 - Use iron-fortified pellets to assist with anemia prevention.
 - High lysine content is critical.
 - Ensures piglets are accustomed to solid feed before weaning (usually at 3-4 weeks), reducing "post-weaning growth lag."
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Year: 2018

4.1 Peculiarities of feeding of cats 33

(Duplicate of 2024 Q4.6. See answer above.)

4.2 Nutrient requirement of rats ³⁴

- **Standard:** Based on NRC (1995) for Lab Animals.
- **Protein:** Maintenance ~12%, Growth/Reproduction ~15-20%. Quality protein is vital.
- **Energy:** Maintenance approx $110 \sim \text{kcal/kg} \sim \text{BW}^{0.75}$.
- **Fat:** Minimum 5% to supply essential fatty acids (Linoleic).
- **Coprophagy:** Rats naturally eat feces; preventing this increases vitamin (B-complex, K) requirements.
- **Minerals:** Ca:P ratio approx 1:1 to 1.2:1.

4.3 Energy and protein requirement of sheep for wool production ³⁵

- **Protein:** Wool is almost pure protein (Keratin) rich in cystine. The limiting factor is often S-containing amino acids (Methionine/Cystine).
- **Energy:** Wool production is energy-intensive. Severe energy deficiency halts follicle activity ("break in wool").
- **Requirement:** An adult sheep requires roughly 9-10% CP for maintenance, but wool production requires 12%+ CP with specific attention to Rumen Undegradable Protein (RUP) containing sulfur amino acids to ensure they reach the follicle.

4.4 Feeding of elephant calf ³⁶

- **Milk:** Elephant milk is lower in fat and protein than cow milk but high in lactose. Artificial rearing uses specialized formulas (often human infant formula bases modified with coconut oil/rice water).
- **Behavior:** Calves rely on milk for the first 2-3 years but start experimenting with vegetation at a few months.
- **Coprophagy:** Calves eat the fresh feces of the mother/herd to populate their hindgut with fermentative bacteria.
- **Volume:** They require massive volumes of fluid intake, fed via bottle or trunk-training in older calves.

4.5 Calf starter ³⁷

(Part of 2024 Q4.3)

- **Definition:** A dry concentrate mixture fed to young calves.
- **Specs:** High energy (>75% TDN), High Protein (22-24% CP).
- **Ingredients:** Maize (50%), Oil cakes (30%), Molasses (for palatability), Minerals/Vitamins.
- **Function:** The fermentation of starch in calf starter produces Butyrate and Propionate, which are the primary stimulants for rumen papillae development (milk/hay do not stimulate papillae as effectively).

4.6 Milk fever ³⁸

(Parturient Paresis)

- **Condition:** Hypocalcemia occurring within 48 hours of calving.
- **Mechanism:** Sudden demand for Ca for colostrum production exceeds the cow's ability to mobilize Ca from bones or absorb it from the gut. Parathyroid Hormone (PTH) response is sluggish (often due to metabolic alkalosis or hypomagnesemia).
- **Prevention:**
 - Low Calcium diet in dry period (priming the system).
 - **DCAD (Dietary Cation-Anion Difference):** Feeding anionic salts (Cl^- , S^{2-}) in the pre-partum period to induce mild metabolic acidosis, enhancing PTH sensitivity and Ca mobilization.

4.7 Importance of bypass protein in lactating cows ³⁹

(Duplicate of 2024 Q4.7 and 2022 Q4.8. See answer above.)

4.8 Feeding of ducklings 40

(See Answer 2022 Q4.1)

Specifics for ducklings:

- **Water:** Must have access to water to swallow feed (to wash down mash), but prevent drowning/chilling.
- **Form:** Crumbles or pellets (3mm) preferred over mash to prevent "pasting" of the beak.
- **Protein:** Starter diet (0-2 weeks) requires 22% CP.
- **Energy:** ~2700-2900 kcal/kg ME.
- **Management:** Feed ad-libitum. Avoid moldy feed strictly.