Based on the provided compilation of the Animal Nutrition Paper-II (Q.4 Short Note type questions) from the years 2024, 2023, 2022, 2019, and 2018, here are the answers for all requested questions.

2024 Examination (Q.4 Short Notes) 📝

4.1 Nutrient requirements of broiler birds as per BIS, 2007

The Bureau of Indian Standards (BIS, 2007) specifies nutrient requirements for broiler chickens across three phases: Pre-starter (0-7 days), Starter (8-21 days), and Finisher (22-42 days).

Nutrient	Broiler Pre-starter (0-7 days)	Broiler Starter (8-21 days)	Broiler Finisher (22-42 days)
Metabolizable Energy (ME, kcal/kg)	3000 min	3100 min	3200 min
Crude Protein (CP, min %)	23	22	20
Crude Fibre (max %)	5	5	5
Calcium (min %)	1.0	1.0	1.0
Available Phosphorus (min %)	0.45	0.45	0.45
Lysine (min %)	1.3	1.2	1.0
Methionine (min %)	0.5	0.5	0.45

These specifications ensure proper growth and feed efficiency for meat production.

4.2 Total mixed ration

Total Mixed Ration (TMR), or complete ration, is a feeding system where all the forage and grain ingredients are blended together, formulated to a specific nutrient concentration, and fed free-choice.

* Advantages: TMR ensures that cows consume the desired proportion of forages and grains, reducing the risk of digestive upsets. It improves feed efficiency, allows for greater use of unpalatable or unconventional feeds (like NPN sources), and increases accuracy in feeding management.
* Disadvantages: It requires a significant equipment investment (a mixer) and necessitates grouping cows (at least two production groups plus a dry group).

4.3 Write about feeding a calf from birth to three month of age

The first three months are a critical "pre-ruminant" period where the calf's digestive system transitions from monogastric to ruminant.

* Colostrum (Birth to 3 Days): The calf must be fed colostrum, the first milk, within 2 hours of birth and continued for 3 days. It provides essential antibodies (immunoglobulins) via absorption through pinocytosis, and has a laxative effect. It should be fed at one-tenth (1/10^{th}) of the body weight.
* Milk/Milk Replacer (4 Days to 3 Months): After colostrum, whole milk (or a replacer for economy) is the major feed. The milk bypasses the undeveloped rumen via the esophageal groove to the abomasum. The quantity is gradually reduced from 1/10^{th} of body weight to 1/20^{th} or 1/25^{th} by 3 months.
* Calf Starter (From 10 days): A highly palatable concentrate feed, containing 23-26% Crude Protein (CP) and 70-75% Total Digestible Nutrients (TDN), is offered to promote early rumen development by providing fermentable carbohydrates for Volatile Fatty Acid (VFA) production.
* Roughage: Small amounts of roughage can be offered ad-lib (free-choice) from about 3 weeks of age.

4.4 Methods adopted for arriving energy requirements for maintenance in cattle.
The energy requirement for maintenance in ruminants, which is the minimum energy to keep the animal in energy equilibrium, can be determined by two primary methods:
* Basal and Fasting Metabolism (BMR/Resting Metabolism):
  * This determines the fasting catabolism (heat production) of an animal in a thermally neutral and post-absorptive state.
  * It is practically measured as Resting Metabolism in ruminants since achieving a true post-absorptive state takes about 5 days of starvation.
  * Heat production is measured by calorimetry (Direct or Indirect).
  * The results are standardized using metabolic body weight ($W^{0.75}$), with an average fasting metabolism value of 70-77~kcal per $\text{Kg} \cdot W^{0.75}$ per day.
* Feeding Trials:
  * This method attempts to determine the amount of feed (in terms of energy like TDN or ME) that is sufficient to maintain a constant body weight for an extended period.
  * The feeding trial essentially measures the net energy required for maintenance (weight constancy) and commonly uses digestion and metabolic trials to express the value in terms of TDN or ME.

4.5 Explain in detail the feeding of race horses.
Feeding race horses aims to meet the exceptionally high energy demands of intensive work, maintain peak performance, and manage the risk of metabolic issues like Azoturia.
* High Energy Density: The energy requirements for fast trotting, cantering, and galloping are very high, often 70% or more above maintenance. It's impossible to meet this need with roughage alone, so the ration's energy density must be increased, primarily using cereal grains (concentrate mixture) or supplementing fat (up to 10%).
* Glycogen and Fat Use: High-intensity speed work relies mainly on muscle glycogen (carbohydrate), while endurance conditioning increases the use of fatty acids.
* Feeding Schedule (Pre-Work): To avoid working on a full stomach and manage the fuel source for high-intensity exercise, a specific schedule is followed:
  * Remove hay four hours prior to competition.
  * Feed grain four hours before competition.
* Nutrient Requirements: Requirements for protein, minerals (especially salt lost in sweat), and vitamins increase proportionally to energy intake during the breeding season. Supplementation with antioxidants (like Vitamin E) is important to counteract oxidative stress from intense exercise.

4.6 Peculiarity of cat nutrition
Cats are obligate carnivores, meaning they have unique metabolic adaptations and nutrient requirements that can only be met from animal flesh.
* High Protein Requirement: Cats require a high protein intake because their gluconeogenic pathways (which produce glucose from amino acids) are continuously active, meaning they use protein as a primary energy source, even when dietary protein is restricted.
* Essential Nutrients: They have an absolute dietary requirement for:
  * Preformed Vitamin A: They lack the enzyme to convert beta-carotene (from plants) to active Vitamin A.

  * Taurine: This amino acid is essential because their ability to synthesize it from precursors (methionine and cysteine) is limited, and they lose a lot of it by using it exclusively to conjugate bile acids. Deficiency leads to retinal degeneration (FCRD) and dilated cardiomyopathy (DCM).
  * Arachidonic Acid: They cannot synthesize this essential fatty acid from linoleic acid.
  * Niacin (Vitamin B_3): They cannot synthesize adequate amounts of niacin from tryptophan.

4.7 Bypass nutrients in feeding of high yielding animals

Bypass nutrients, also known as protected nutrients, are essential for high-yielding ruminants (like high-producing dairy cows) because their requirements often exceed the capacity of the rumen to supply them, even with high-quality microbial protein.

 * Bypass/Protected Protein: This protein resists degradation in the rumen (Undegradable Protein, UDP) by microorganisms, allowing it to pass to the small intestine where it is digested and absorbed directly by the animal. This supplements the microbial protein and reduces nitrogen wastage as urea. Methionine and Lysine are the most limiting amino acids, and protected forms are used to prevent their degradation.
  * Methods of Protection: Heat treatment, chemical treatment, and identifying naturally protected proteins.
 * Bypass/Protected Fat: This fat is inert or protected from rumen degradation, preventing it from interfering with carbohydrate ruminal digestion (which high-fat intake otherwise causes). This is crucial during early lactation when energy demands are high and appetite is low. Calcium soaps are a common type of protected fat.

4.8 Ketosis and its management

Ketosis is a metabolic disorder in dairy cattle, most commonly occurring in fresh cows at a high level of production (early lactation), when energy demands exceed energy intake, resulting in a negative energy balance (NEB).

 * Cause: Due to NEB, the cow mobilizes large amounts of body fat for energy. If this fat mobilization is faster than the liver's ability to properly metabolize it, ketone production exceeds utilization, leading to ketosis. Ketotic cows often have low blood glucose.
 * Symptoms: Decreased feed intake and an increased risk of other diseases like fatty liver and displaced abomasum.
 * Nutritional Management/Intervention:
  * Prevention: The primary goal is to minimize the severity of the negative energy balance during the transition period.
  * Niacin: Supplementation (6-10 g/head/day) in the ration before calving can help prevent ketosis.
  * Glucose Precursors: Feeding precursors like propionate (as \text{Ca}^{+} propionate) and propylene glycol increases glucose production by the liver, reducing the need for excessive body fat mobilization.

2023 Examination (Q.4 Short Notes) 📝

4.1 Feeding of orphan foal

An orphan foal is one separated from its mother's milk, requiring immediate intervention to ensure immunity and nutrition.

 * Immunity: The foal must receive colostrum or be injected with horse serum immediately after birth for passive immunity.

 * Milk Substitute (Hand Rearing): If fostering is not possible, the foal must be hand-reared using a modified cow's milk formula:
   * Modified Cow Milk: 600~\text{ml} cow milk + 150~\text{ml} lime water + 1 teaspoon sugar.
 * Feeding Schedule: The frequency is high in the first two weeks (12 times/day, or once every 2 hours), gradually decreasing to four times a day by the third week and continuing until weaning.
 * Creep Feed: An additional creep feed (18% CP, 75% TDN) is introduced from about 1.5 months of age to prepare for weaning and support growth. It is fed at 0.5 to 1\% of the foal's body weight.

4.2 Bypass protein

Bypass protein, or Undegradable Protein (UDP), is the portion of dietary protein that resists microbial degradation in the rumen of a ruminant animal.

 * Function: It "bypasses" the rumen and passes to the abomasum and small intestine where it is dig jiested by the animal's enzymes, supplying Metabolizable Protein directly to the animal. This protein supplements the microbial protein synthesized in the rumen.
 * Importance: It is crucial for high-producing animals (high-yield cows, rapidly growing young, etc.) whose protein needs exceed what microbial protein alone can provide, maximizing the efficiency of high-quality, essential amino acids like Lysine and Methionine.
 * Methods of Protection: Techniques used to protect protein from rumen microbes include heat treatment and chemical modification.

4.3 Thumb rule method

The thumb rule method is a simplified, practical approach to estimate the concentrate feeding requirement for lactating cattle and buffaloes based on the amount of milk produced. It provides a quick guide for farm feeding without complex ration calculation.

 * For Cattle (Cow): For every 1~\text{kg} of milk production, 0.4~\text{kg} of concentrate mixture should be given.
 * For Buffaloes: For every 1~\text{kg} of milk production, 0.5~\text{kg} of concentrate mixture should be given.
 * Total Ration: This amount is fed in addition to the maintenance ration (for roughage/body-weight maintenance) to meet the energy and protein needs for milk production.

4.4 Creep feeding

Creep feeding is the practice of self-feeding concentrates (a creep ration) to young animals away from their mothers, typically through a separate enclosure (a creep) that the dam cannot access.

 * Purpose: It ensures that the young animal's rapidly increasing nutrient requirements for growth (especially in large litters like piglets) are met, as the mother's milk alone becomes insufficient after the first few weeks.
 * In Pigs: It is introduced from the second week of age. The creep ration is high in protein (20% CP) and energy (3360 kcal/kg ME), with low crude fibre.
 * In Foals: Creep feed (18% CP, 75% TDN) is typically introduced around 1.5 months (5-6 weeks) to prepare them for weaning.

4.5 Cats are obligate carnivores. Justify?

Cats are classified as obligate carnivores because their unique metabolic pathways have evolved to require certain nutrients found naturally only in animal tissue, a result of millions of years on a strictly carnivorous diet.

 * Essential Nutrients: They cannot synthesize, or cannot synthesize in sufficient quantities, the following nutrients:
   * Taurine: Required for bile acid conjugation; deficiency causes retinal degeneration and cardiac issues.
   * Preformed Vitamin A: They cannot convert plant \beta-carotene to active Vitamin A.
   * Arachidonic Acid: They cannot synthesize this essential fatty acid from linoleic acid.
 * High Protein Metabolism: They maintain high activity in the enzymes of the gluconeogenic and urea cycles, requiring a high protein intake to use amino acids as a primary energy and glucose source, even under protein restriction.

4.6 Feeding of Hippopotamus

Hippopotamuses are large, herbivorous game animals classified as pseudo-ruminants. They are bulk and roughage eaters (grazers) with a digestive strategy similar to other wild ruminants.
 * Natural Diet & Classification: As bulk grazers, they have capacious stomachs normally filled with relatively low-quality grass.
 * Captive Diet: A representative diet chart for a Hippopotamus in captivity includes:
   * Roughage: 100~\text{kg} Grass
   * Concentrates/Supplements: 10~\text{kg} Wheat bran, 250~\text{g} White Bengal Gram, 250~\text{g} Salt, 800~\text{g} Bread, 50~\text{g} Multivitamin Mixture.
   * Fruits/Vegetables: 2 Apples, 500~\text{g} Potato, 2~\text{kg} Carrot, 1~\text{kg} Cabbage, 250~\text{g} Onion, 10 Bananas, 1~\text{kg} Greens.

4.7 Comparison of feeding habits of sheep and goats

Both sheep and goats are ruminants, but they exhibit different feeding habits classified as follows:

Feature	Sheep	Goat
Feeding Habit	Predominantly grazers (bulk eaters).	Browsers/Intermediate feeders (concentrate selectors).
Diet Selection	Less selective, primarily consume grasses.	Highly selective, prefer leaves, flowers, and fruits of forbs and shrubs (browsing).
Adaptability	Adapted to consuming low-quality roughage (grass).	Have a high efficiency for utilization of cellulose; can graze on very short grasses.
Body Size & Metabolism	Lower Basal Metabolic Rate (BMR) and Thyroxine production than goats.	Higher BMR and Thyroxine production, hence a somewhat greater maintenance ration is required per \text{kg} \cdot W^{0.75}.
Tolerance	More susceptible to copper toxicity than goats.	Higher tolerance for toxic/bitter taste plants (e.g., tannic acid) and can distinguish between tastes.

4.8 Importance of fibre in rabbit's nutrition

Rabbits are hindgut fermenting herbivores that practice coprophagy, making dietary fibre absolutely essential for both gut motility and nutrient supply.
 * Gut Health and Motility: Fibre is necessary to stimulate the gut for proper motility. A low-fibre diet can lead to gastrointestinal disturbances and potential stasis. Rabbits can tolerate up to 15\% Crude Fibre (CF) in their diet.

 * Caecotrophy: Fibre over 0.3~\text{mm} long forms hard pellets and is excreted, but the finer fermentable contents are separated and passed to the caecum. The caecum ferments this material and produces cecotropes (soft/night pellets).
 * Nutrient Supply: The rabbit consumes these cecotropes directly from the anus (coprophagy) to obtain essential nutrients produced by the hindgut microbes, especially:
   * High-value proteins and microbial products.
   * Water-soluble vitamins (B-complex and Vitamin K).
 * Dental Health: Rabbits have constantly growing incisors and molars. The grinding action required to chew roughage wears down the teeth, preventing overgrowth and painful spikes (enamel spurs).

2022 Examination (Q.4 Short Notes) 📝

4.1 Discuss feeding of ducks

Duck feeding practices depend on the rearing system (free range or commercial) and life stage (starter, grower, breeder/layer).
 * Digestive System Peculiarities: Ducks lack a crop, have a cylindrical proventriculus, and a quicker feed passage rate than chickens. They have a bill that is poorly adapted for dry mash, which tends to cake and leads to feed wastage when they try to wash it off in water.
 * Feed Form: Pelleted rations are superior to dry mash, as they increase growth and improve feed utilization efficiency. If pellets are unavailable, a thick, non-watery wet mash is recommended.
 * Nutrient Requirements (Starter 0-8 wks): 20\% Protein, 2850~\text{kcal/kg} Energy.
 * Watering: Plenty of clean drinking water should be available. Water should be restricted at night for breeder/market ducks over 3 weeks of age to maintain dry litter, but this should be avoided during hot periods (>90^{\circ}\text{F}).
 * Toxicity: Ducks are highly sensitive to aflatoxin (from groundnut meal), tolerating only 0.03~\text{ppm} compared to 0.2~\text{ppm} for chickens.

4.2 Discuss Feeding of guinea pigs

Guinea pigs are small laboratory animals classified as herbivores and hindgut fermenters.
 * Key Nutritional Requirement (Vitamin C): The most critical requirement is for an external, dietary source of Vitamin C (ascorbic acid), which they cannot synthesize. The minimum daily requirement is 10-30~\text{mg/day}. Since Vitamin C is unstable, feed should be used within three months of milling.
 * Diet Composition: Their diet should contain plenty of grass hay and greens, with limited concentrates. A typical diet should have 18\% Protein and 15\% Fibre, with Vitamin C supplemented at 1~\text{gram} per \text{kg} of ration.
 * Caecotrophy: Like rabbits, they practice coprophagy (ingesting their own soft faeces/cecotropes) to obtain protein and B-vitamins produced by the gut microflora.
 * Dental Health: They have continuously growing incisors and molars, necessitating roughage and pellets that require gnawing to wear down the teeth.

4.3 Write about importance of colostrum in neonatal calf

Colostrum, the first milk produced by the cow/buffalo after parturition, is essential for the neonatal calf's health and survival.
 * Passive Immunity: The most vital role is providing high levels of antibodies (immunoglobulins), which are absorbed intact via the process of pinocytosis in the calf's digestive tract. This

absorption must occur within the first few days of life before proteolytic enzymes break down the globulins.
 * Nutrient Source: It is highly concentrated, containing 17\% protein compared to 3.5\% in normal milk, and a high concentration of vitamins and minerals.
 * Laxative Effect: Colostrum has a laxative effect, helping to remove the muconium (first feces) from the calf's digestive system.
 * Feeding: It should be fed within 2 hours of birth and continued for 3 days at the rate of one-tenth (1/10^{th}) of the body weight.

4.4 Discuss piglet anaemia

Piglet anaemia, or "thumps", is a common nutritional disorder in newborn piglets, particularly those housed on concrete floors under intensive rearing systems.
 * Cause: Piglets are born with very low body stores of iron (50~\text{mg}). They require 7~\text{mg} of iron daily, but sow's milk only supplies about 1~\text{mg/day}. This deficit of 6~\text{mg/day} rapidly depletes body reserves within a week.
 * Symptoms: Anaemic piglets are characterized by being listless and flabby, with wrinkled skin and an unhealthy hair coat.
 * Nutritional Intervention: The condition is preventable by supplying iron orally or via injection. A common practice is giving iron dextrose injection (100~\text{mg}) on the third day of birth, followed by 50~\text{mg} on the 21st day.

4.5 Write about least cost ration

Least Cost Ration (LCR) refers to a ration formulation method aimed at creating a complete feed that meets all the animal's nutrient specifications using the combination of available feed ingredients that minimizes the total cost of the ration.
 * Goal: To achieve a complete and balanced diet for maintenance and production (e.g., meat, eggs, milk) at the lowest possible cost.
 * Methodology: LCR often involves using a linear programming approa