Animal Science Reviewer Based On TOS (Module D: Animal Nutrition) By Agriculture Review

50 Multiple-Choice Practice Questions with Detailed Answer Key & Explanations

Practice Examination Questions (Items 1–50)

1. A lactating dairy cow is fed a ration that exactly replaces her daily basal metabolic losses and prevents body weight change, yet her milk yield drops rapidly. Which nutritional principle explains this outcome?

- **a.** Productive functions always draw energy before basal metabolic processes
- **b.** Maintenance requirements are prioritized over productive functions when nutrient intake is restricted
- **c.** Basal metabolism ceases during peak lactation to conserve energy
- **d.** Milk synthesis relies exclusively on body fat reserves rather than dietary energy

2. Two broiler flocks reach a final live weight of 2.0 kilograms from an initial chick weight of 0.04 kilograms. Flock A consumes 3.136 kilograms of feed per bird while Flock B consumes 3.528 kilograms per bird. How does Flock A compare to Flock B in feed efficiency?

- **a.** Flock B is more efficient because it achieved higher total feed intake
- **b.** Flock A is less efficient with a feed conversion ratio of 1.80 compared to 1.60 for Flock B
- **c.** Flock A is more efficient with a feed conversion ratio of 1.60 compared to 1.80 for Flock B
- **d.** Both flocks have identical feed efficiency because they reached the same final live weight

3. When evaluating the net energy of a high-fiber roughage compared to a concentrate grain in ruminants, why is the gap between metabolizable energy and net energy significantly wider for the roughage?

- **a.** Higher heat increment generated during microbial fermentation and physical mastication
- **b.** Lower fecal energy loss during passage through the abomasum
- **c.** Higher urinary energy excretion from excess volatile fatty acids
- **d.** Complete absence of methane production during cellulose digestion

4. Beef steers kept on a restricted plane of nutrition during the dry season exhibit markedly faster daily weight gains and improved feed efficiency once placed on lush pasture during the rainy season. Which nutritional phenomenon is demonstrated by these steers?

- **a.** Basal metabolic depression
- **b.** Negative nitrogen balance
- **c.** Specific dynamic action
- **d.** Compensatory growth

5. A swine grower diet contains 18 percent crude protein and adequate metabolizable energy, yet pigs show poor lean tissue accretion and high urinary nitrogen excretion because lysine is 25 percent below requirement. What happens to the surplus amino acids in this diet?

a. They are stored intact in skeletal muscle until dietary lysine is supplied

b. They are deaminated in the liver with the nitrogen excreted as urea and carbon skeletons used for energy

c. They are converted directly into lysine by pancreatic enzymes in the duodenum

d. They pass completely undigested through the small intestine into the feces

6. In a total collection digestion trial, a sheep consumes 1.20 kilograms of dry matter containing 15 percent crude protein and excretes 0.40 kilograms of fecal dry matter containing 9 percent crude protein. What is the apparent digestibility of crude protein in this feed?

a. 66.7 percent

b. 75.0 percent

c. 80.0 percent

d. 85.0 percent

7. Why does apparent protein digestibility consistently underestimate true protein digestibility in non-ruminant feeding trials?

a. Fecal nitrogen includes metabolic fecal nitrogen from sloughed intestinal cells, digestive enzymes, and gut microbes

b. Urinary urea is reabsorbed into the rectum and measured as undigested feed protein

c. Dietary fiber binds to endogenous lipids and inflates fecal dry matter weight

d. Essential amino acids are volatilized during oven drying of the feed sample

8. When market hogs are switched from a high-protein, moderate-energy grower ration to a high-energy, lower-protein finisher ration near slaughter weight, how does this nutritional shift alter carcass tissue deposition?

a. Skeletal bone mineralization accelerates at the expense of fat deposition

b. Muscle hyperplasia replaces fat deposition as the primary growth process

c. Visceral organ mass expands faster than subcutaneous backfat

d. Adipose tissue deposition increases relative to lean muscle accretion

9. A feed laboratory performs Kjeldahl analysis on a sample of soybean meal and determines a total nitrogen content of 7.2 percent on a dry matter basis. Using the standard conversion factor, what is the estimated crude protein content of the sample?

a. 42.5 percent

b. 45.0 percent

c. 48.0 percent

d. 39.6 percent

10. Why can the standard Kjeldahl procedure overestimate the true protein value of a ruminant supplement containing urea?

a. Urea reacts with sulfuric acid to form insoluble carbohydrate complexes

b. Sulfuric acid digestion destroys essential amino acids while preserving ammonia

c. The method measures total nitrogen including non-protein nitrogen compounds rather than exclusively peptide-bound amino acids

d. The standard factor of 6.25 applies only to lipid-bound nitrogen in oilseeds

11. Proximate analysis of yellow corn on a dry matter basis yields 9.0 percent crude protein, 4.0 percent ether extract, 2.5 percent crude fiber, and 1.5 percent ash. What is the calculated nitrogen-free extract percentage on a dry matter basis?

a. 83.0 percent

b. 79.0 percent

c. 85.5 percent

d. 81.5 percent

12. A sample of fresh Napier grass contains 20 percent dry matter and 2.4 percent crude protein on an as-fed basis. What is the crude protein percentage of this forage on a dry matter basis?

a. 4.8 percent

b. 9.6 percent

c. 15.0 percent

d. 12.0 percent

13. A nutritionist evaluates dehydrated alfalfa meal using proximate analysis and notes a relatively high ether extract value, yet the actual dietary energy contribution from fat is lower than expected. Which non-nutritive compounds extracted by diethyl ether explain this discrepancy?

a. Water-soluble sugars and organic acids

b. Plant pigments such as chlorophyll, waxes, and sterols

c. Lignin and insoluble hemicellulose

d. Volatile ammonia and inorganic sulfates

14. When comparing the gross chemical composition of mature pasture grasses to that of a market-weight beef steer on a dry matter basis, which structural difference is most pronounced?

a. Animal tissues contain higher levels of structural polysaccharides than mature forage plants

b. Mature grasses contain higher ash and protein concentrations than animal carcasses

c. Plants store energy primarily as carbohydrates whereas animal bodies consist predominantly of protein and lipid with negligible carbohydrate

d. Both plants and animals store over half of their dry matter as glycogen and starch

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15. Why does a dairy nutritionist prefer Van Soest detergent fiber analysis over the traditional Weende crude fiber method when evaluating tropical grasses?

a. The Weende method dissolves variable amounts of hemicellulose and lignin, causing them to be misclassified into the nitrogen-free extract fraction

b. The Van Soest method uses sulfuric acid to measure total ash and silica simultaneously

c. Crude fiber analysis overestimates the digestibility of cellulose in monogastric animals

d. Detergent fiber analysis replaces the need for Kjeldahl nitrogen determination in forages

16. In Van Soest detergent analysis of a forage sample, neutral detergent fiber is 62 percent and acid detergent fiber is 38 percent. What does the 24 percent difference between these two fractions represent?

a. Cellulose

b. Lignin

c. Soluble sugars and starch

d. Hemicellulose

17. A feed sample analyzed on an as-fed basis contains 12 percent moisture and 8 percent ash. If a nutritionist needs to express the organic matter fraction on an as-fed basis, what value should be used?

a. 92 percent

b. 80 percent

c. 88 percent

d. 72 percent

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18. Among the major organic nutrient classes oxidized during cellular respiration, which yields the greatest amount of metabolic water per gram oxidized?

a. Starches

b. Proteins

c. Lipids

d. Structural fiber

19. A feedlot steer is transitioned from an all-forage diet to a diet containing 80 percent cracked corn and 20 percent hay. How does this dietary shift alter the molar proportions of volatile fatty acids produced in the rumen?

a. Propionate proportion increases while acetate proportion decreases, improving energetic efficiency for weight gain

b. Acetate proportion increases while propionate decreases, causing milk fat depression

c. Butyrate becomes the sole volatile fatty acid absorbed across the rumen wall

d. Total volatile fatty acid production drops to zero as starch bypasses the rumen completely

20. High-producing dairy cows fed finely ground concentrates and minimal effective fiber frequently suffer from low milk fat percentage. Which ruminal change directly drives this condition?

a. Excessive acetate production that blocks lactose synthesis in the udder

b. Complete cessation of microbial protein synthesis in the omasum

c. Overproduction of ammonia that binds circulating triglycerides in the blood

d. Reduced acetate-to-propionate ratio coupled with altered biohydrogenation intermediates that inhibit mammary fatty acid synthesis

21. Because ruminal microbes ferment most dietary carbohydrates before they reach the small intestine, which volatile fatty acid serves as the primary carbon precursor for hepatic gluconeogenesis in cattle and sheep?

a. Acetate

b. Propionate

c. Butyrate

d. Valerate

22. Beef tallow and mutton fat remain notably more saturated than pork lard even when cattle and pigs consume diets rich in polyunsaturated plant oils. Which physiological process in ruminants accounts for this difference?

a. Selective excretion of polyunsaturated fatty acids in ruminant urine

b. Absence of pancreatic lipase in the ruminant duodenum

c. Microbial biohydrogenation of unsaturated fatty acids in the rumen prior to intestinal absorption

d. Direct conversion of ruminal methane into saturated stearic acid

23. In the porcine digestive tract, which sequence of proteolytic enzymes sequentially hydrolyzes dietary protein from large polypeptides down to absorbable oligopeptides and free amino acids?

a. Pepsin in the stomach, followed by trypsin and chymotrypsin from the pancreas, and aminopeptidases at the intestinal brush border

b. Salivary amylase in the mouth, followed by bile salts in the stomach, and lipase in the colon

c. Rennin in the duodenum, followed by pepsin in the ileum, and cellulase in the cecum

d. Trypsin in the stomach, followed by pepsin in the jejunum, and lactase at the brush border

24. A rancher adds urea to a low-protein, high-straw winter ration for beef cattle without supplying any readily fermentable carbohydrate source such as molasses or corn. What is the primary nutritional risk of this feeding practice?

a. Urea passes unchanged into the abomasum and causes severe osmotic diarrhea

b. Rumen pH drops below 5.0 due to rapid lactic acid accumulation

c. Microbes convert urea directly into insoluble oxalate crystals in the kidneys

d. Ammonia is released faster than rumen microbes can capture it for microbial protein synthesis, leading to ammonia toxicity

25. Sheep grazing on pastures deficient in cobalt develop severe anemia, emaciation, and loss of appetite even when forage quantity is abundant. Why does cobalt deficiency produce these clinical signs in ruminants?

a. Cobalt is a structural component of hemoglobin needed for oxygen transport

b. Ruminal microbes require cobalt to synthesize vitamin B12, which is essential for propionate metabolism

c. Cobalt directly activates pepsinogen in the abomasum for protein digestion

d. Without cobalt, ruminants cannot absorb fat-soluble vitamins across the rumen wall

26. A commercial flock of high-producing laying hens fed a diet with a 1-to-1 calcium-to-phosphorus ratio begins laying thin-shelled eggs and exhibiting cage layer fatigue. What physiological imbalance is occurring?

a. Excess dietary calcium is binding dietary phosphorus into insoluble phytate complexes

b. High dietary vitamin D is accelerating calcium excretion through the kidneys

c. Insufficient dietary calcium forces the hens to mobilize medullary bone calcium to form eggshells

d. Excessive phosphorus intake is stimulating premature ovulation before shell calcification

27. Newly weaned piglets raised on corn grown in selenium-deficient soils suffer sudden death with pale, necrotic cardiac muscle lesions. Why does supplementing both vitamin E and selenium prevent this disorder more effectively than either nutrient alone?

a. Vitamin E prevents lipid peroxidation in cell membranes while selenium functions as a cofactor for glutathione peroxidase to destroy peroxides

b. Vitamin E synthesizes selenium in the liver while selenium activates intestinal bile salts

c. Both nutrients directly replace sulfur amino acids in skeletal muscle myosin

d. Selenium converts beta-carotene into vitamin E within the porcine cecum

28. Swine and poultry utilize only a small fraction of the phosphorus present in corn and soybean meal unless exogenous phytase is added to the diet. What causes this low bioavailability?

a. Plant phosphorus is exclusively locked inside indigestible lignin rings

b. Gastric hydrochloric acid precipitates plant phosphorus as insoluble calcium carbonate

c. High dietary sodium competes with phosphorus for active transport across the duodenal mucosa

d. Monogastric animals lack sufficient endogenous intestinal phytase to hydrolyze phosphorus bound to myo-inositol in plant seeds

29. Mature beef cattle on a balanced forage-concentrate diet rarely require dietary supplementation of B-complex vitamins, whereas growing pigs require strict dietary inclusion. What accounts for this species difference?

a. Cattle absorb B-complex vitamins directly through the skin upon exposure to sunlight

b. Ruminal microorganisms synthesize adequate B-complex vitamins that are subsequently absorbed in the lower digestive tract

c. Porcine intestinal bacteria destroy dietary B-complex vitamins before absorption

d. Cattle store a lifetime supply of B-complex vitamins in their adipose tissue at birth

30. In young broilers with impaired bile secretion due to hepatic damage, which group of micronutrients will exhibit the most severe secondary deficiency?

- **a.** Thiamine, riboflavin, and niacin
- **b.** Sodium, potassium, and chloride
- **c.** Vitamins A, D, E, and K
- **d.** Ascorbic acid and choline

31. Under the International Feed Nomenclature system, a dry feedstuff containing 22 percent crude fiber and 14 percent crude protein on a dry matter basis belongs to which official feed class?

- **a.** Dry forages and roughages
- **b.** Energy feeds
- **c.** Protein supplements
- **d.** Silages

32. Under the International Feed Nomenclature system, a feed ingredient containing 10 percent crude fiber and 24 percent crude protein on a dry matter basis is classified into which feed class?

- **a.** Energy feeds
- **b.** Dry forages and roughages
- **c.** Non-nutritive additives
- **d.** Protein supplements

33. A swine producer replaces 50 percent of the yellow corn in a grower ration with dried cassava root meal on an equal-weight basis without rebalancing the diet. Which nutrient adjustment is most critical to prevent reduced growth performance?

- **a.** Add extra crude fiber to slow down gastric emptying
- **b.** Increase the inclusion of protein supplements and synthetic amino acids to compensate for the very low crude protein content of cassava
- **c.** Reduce dietary calcium because cassava contains excessive calcium carbonate
- **d.** Eliminate trace minerals because cassava roots are hyper-concentrated in zinc and copper

34. Raw, unprocessed soybeans fed to broiler chicks cause severe growth depression and pancreatic hypertrophy. Which heat-labile antinutritional factor is responsible for this condition?

- **a.** Gossypol
- **b.** Mimosine
- **c.** Trypsin inhibitors
- **d.** Hydrocyanic acid

35. Including high levels of untreated ipil-ipil leaf meal above 10 percent in poultry and swine diets leads to alopecia, poor growth, and reduced reproductive performance. Which toxic amino acid derivative causes these effects?

a. Mimosine

b. Tannins

c. Glucosinolates

d. Aflatoxin

36. When formulating rations for laying hens, why is the inclusion of standard cottonseed meal strictly restricted compared to beef cattle rations?

a. Cottonseed meal contains high levels of erucic acid that dissolves eggshell membranes

b. Laying hens cannot digest the high starch content of cottonseed hulls

c. Ruminants lack the enzymes required to break down cottonseed protein

d. Free gossypol causes olive-green yolk discoloration in eggs and exhibits greater toxicity in monogastrics than in ruminants

37. Fine rice bran is widely used as an energy feed in tropical livestock production, yet prolonged storage in warm, humid barns sharply reduces its palatability and nutritional value. What biochemical process causes this deterioration?

a. Spontaneous fermentation of starch into acetic acid by anaerobic bacteria

b. Activation of endogenous lipase enzymes that rapidly hydrolyze unsaturated fats into free fatty acids, leading to rancidity

c. Rapid volatilization of lysine and methionine into ammonia gas

d. Crystallization of phytate phosphorus into indigestible silicate stones

38. Copra meal is an abundant local protein byproduct in Southeast Asia, yet nutritionists limit its inclusion in starter diets for young pigs and broilers. Which combination of characteristics limits its high-level use in monogastric starter rations?

a. Excessive soluble starch that triggers severe lactic acidosis

b. High levels of prussic acid that inhibit cellular respiration

c. High crude fiber content, low digestible energy, and deficiency in lysine and methionine

d. Complete absence of residual oil resulting in extreme dustiness

39. Why does incorporating 3 to 5 percent high-quality fish meal into a corn-soybean meal starter diet for weaned piglets typically improve growth rate beyond what crude protein levels alone predict?

a. Fish meal supplies highly digestible protein with an excellent balance of lysine and methionine, alongside bioavailable calcium and phosphorus

b. Fish meal provides abundant structural cellulose that stimulates hindgut fermentation

c. Fish meal eliminates the need for dietary carbohydrates in weaned piglets

d. Fish meal contains high concentrations of vitamin C that prevent gastric ulcers

40. During the ensiling of chopped whole-plant corn, packing the silo tightly and sealing it rapidly to exclude oxygen is essential to achieve which biochemical outcome?

a. Encourage aerobic molds to pre-digest lignin into soluble sugars

b. Raise the internal temperature above 60 degrees Celsius to caramelize plant proteins

c. Stimulate butyric acid bacteria to preserve high moisture levels

d. Promote anaerobic lactic acid bacteria to rapidly lower silage pH to around 3.8 to 4.2, inhibiting clostridial spoilage

41. Adding 5 percent cane molasses to a dusty, high-roughage ruminant ration provides multiple nutritional and physical benefits. Which effect is most directly associated with this inclusion level?

a. Doubles the crude protein concentration of the total mixed ration

b. Improves palatability, reduces dustiness, and supplies readily fermentable sugars to stimulate rumen microbial activity

c. Serves as a primary source of bypass fat for late-lactation dairy cows

d. Acts as an ionophore to eliminate all ruminal protozoa

42. As Napier grass advances from the early vegetative stage to the late bloom and mature seed stage, how do its chemical composition and feeding value change?

a. Digestible energy and soluble sugars peak while dry matter content falls

b. Both crude protein and neutral detergent fiber decrease at the exact same rate

c. Crude protein and digestibility decline sharply while cell wall lignin and crude fiber increase

d. Lignin is converted into starch, making mature grass more digestible than young shoots

43. Beef cattle feedlots frequently include monensin in high-concentrate finishing rations. What is the primary nutritional mechanism by which this ionophore improves feed efficiency?

a. Selectively inhibits Gram-positive rumen bacteria, shifting fermentation toward greater propionate production and lower methane loss

b. Directly hydrolyzes dietary cellulose into glucose in the abomasum

c. Stimulates appetite so cattle consume 30 percent more dry matter per day

d. Buffers gastric acid in the small intestine to enhance starch absorption

44. A feed formulator needs to prepare a 16 percent crude protein swine grower ration using yellow corn containing 9 percent crude protein and soybean meal containing 44 percent crude protein. Using the Pearson Square method, what percentage of soybean meal is required in the mixture?

a. 25.0 percent

b. 16.0 percent

c. 80.0 percent

d. 20.0 percent

45. A nutritionist is formulating a 100-kilogram poultry ration requiring 20 percent crude protein. Fixed ingredients consisting of mineral premix, vitamin premix, and salt occupy 4 percent of the total diet and contribute zero crude protein. To balance the remaining 96 percent of the ration using corn and soybean meal via the Pearson Square method, what adjusted crude protein target must be placed in the center of the square?

a. 19.20 percent

b. 20.83 percent

c. 24.00 percent

d. 20.00 percent

46. When compounding a ration that must simultaneously meet exact targets for both metabolizable energy and crude protein using multiple ingredients with upper and lower inclusion limits, why is linear programming superior to the Pearson Square method?

a. The Pearson Square method cannot be used with protein concentrates containing more than 30 percent crude protein

b. Linear programming eliminates the need to know the nutrient composition of feed ingredients

c. Linear programming simultaneously satisfies multiple nutrient constraints and ingredient limits while minimizing total ration cost

d. The Pearson Square method only calculates rations on an as-fed basis and cannot handle dry matter values

47. A dairy cow ration is formulated on a dry matter basis to supply 8.0 kilograms of corn silage dry matter per day. If the corn silage contains 32 percent dry matter, how many kilograms of as-fed corn silage must be weighed and fed to the cow daily?

a. 25.0 kilograms

b. 2.56 kilograms

c. 16.0 kilograms

d. 20.5 kilograms

48. A swine producer is choosing between two protein sources purely on cost per kilogram of crude protein. Source A contains 44 percent crude protein and costs 35.20 pesos per kilogram, while Source B contains 20 percent crude protein and costs 18.00 pesos per kilogram. Which source is more economical per kilogram of crude protein?

a. Source B at 18.00 pesos per kilogram of crude protein compared to 35.20 pesos for Source A

b. Both sources have identical cost per unit of crude protein

c. Source B at 80.00 pesos per kilogram of crude protein compared to 90.00 pesos for Source A

d. Source A at 80.00 pesos per kilogram of crude protein compared to 90.00 pesos for Source B

49. A broiler starter ration is inadvertently formulated with excessive metabolizable energy while keeping crude protein and essential amino acids at standard levels. Because broilers eat primarily to satisfy their energy requirements, what is the expected consequence on bird performance?

a. Feed intake increases sharply, resulting in faster muscle growth and lower abdominal fat

b. Feed intake decreases, causing inadequate intake of protein and amino acids, which reduces lean growth and increases carcass fatness

c. Birds excrete the excess energy unchanged in the feces without altering feed consumption

d. Water intake drops to zero and birds develop immediate calcium toxicity

50. A 400-kilogram growing beef steer is expected to consume dry matter at 2.5 percent of its body weight daily. If the total mixed ration contains 12 percent crude protein on a dry matter basis, how many kilograms of crude protein does the steer consume per day?

a. 1.00 kilogram

b. 2.50 kilograms

c. 1.20 kilograms

d. 0.85 kilograms

Detailed Answer Key & Rationales (Items 1–50)

No.	Ans	Correct Answer & Explanation
1	b	**Maintenance requirements are prioritized over productive functions when nutrient intake is restricted** Nutrients are partitioned hierarchically. Basal maintenance functions (circulation, respiration, thermoregulation, tissue repair) take physiological precedence over productive functions such as milk synthesis, growth, and reproduction.
2	c	**Flock A is more efficient with a feed conversion ratio of 1.60 compared to 1.80 for Flock B** Body weight gain is 2.00 kg − 0.04 kg = 1.96 kg. Feed Conversion Ratio (FCR) = Feed Intake ÷ Weight Gain. For Flock A: 3.136 ÷ 1.96 = 1.60; for Flock B: 3.528 ÷ 1.96 = 1.80. Lower FCR indicates higher feed efficiency.
3	a	**Higher heat increment generated during microbial fermentation and physical mastication** Net Energy (NE) equals Metabolizable Energy (ME) minus Heat Increment (HI). High-fiber roughages require greater chewing effort, rumen motility, and microbial fermentation work, yielding a much higher heat increment than concentrates.
4	d	**Compensatory growth** Compensatory growth is the accelerated rate of weight gain and improved feed efficiency observed when animals previously subjected to nutrient restriction are placed on an adequate or high plane of nutrition.

No.	Ans	Correct Answer & Explanation
5	b	**They are deaminated in the liver with the nitrogen excreted as urea and carbon skeletons used for energy** Because lysine is the first limiting amino acid in swine diets, protein synthesis halts once lysine is exhausted. Excess amino acids cannot be stored; they are deaminated in the liver, excreting nitrogen as urea while oxidizing the carbon skeletons for energy.
6	c	**80.0 percent** Crude protein intake = 1.20 kg × 0.15 = 0.180 kg. Fecal crude protein output = 0.40 kg × 0.09 = 0.036 kg. Apparent digestibility = [(0.180 − 0.036) ÷ 0.180] × 100 = (0.144 ÷ 0.180) × 100 = 80.0%.
7	a	**Fecal nitrogen includes metabolic fecal nitrogen from sloughed intestinal cells, digestive enzymes, and gut microbes** Apparent digestibility treats all fecal nitrogen as undigested feed protein. Because endogenous metabolic fecal nitrogen is included in feces, apparent digestibility always underestimates true protein digestibility.
8	d	**Adipose tissue deposition increases relative to lean muscle accretion** As pigs approach market weight, lean muscle accretion plateaus and excess dietary energy above maintenance and protein synthesis requirements is stored primarily as subcutaneous and intramuscular adipose tissue.
9	b	**45.0 percent** Most proteins contain an average of 16 percent nitrogen, giving a standard conversion factor of 100 ÷ 16 = 6.25. Thus, 7.2% N × 6.25 = 45.0% crude protein.
10	c	**The method measures total nitrogen including non-protein nitrogen compounds rather than exclusively peptide-bound amino acids** Kjeldahl analysis quantifies total elemental nitrogen regardless of chemical form. Urea contains roughly 46.7% nitrogen (equivalent to 292% crude protein), inflating crude protein values even though it supplies zero true amino acids.
11	a	**83.0 percent** On a dry matter basis, Nitrogen-Free Extract (NFE) = 100% − (% CP + % EE + % CF + % Ash) = 100% − (9.0 + 4.0 + 2.5 + 1.5) = 100% − 17.0% = 83.0%.
12	d	**12.0 percent** To convert from an as-fed basis to a dry matter basis, divide the nutrient percentage by the dry matter decimal: 2.4% ÷ 0.20 = 12.0% crude protein on a dry matter basis.
13	b	**Plant pigments such as chlorophyll, waxes, and sterols** Diethyl ether extracts all ether-soluble substances. In leafy forages such as alfalfa, non-triglyceride compounds like chlorophyll, cuticular waxes, and plant sterols inflate ether extract without providing fat-equivalent energy.
14	c	**Plants store energy primarily as carbohydrates whereas animal bodies consist predominantly of protein and lipid with negligible carbohydrate** Plants rely on structural and non-structural carbohydrates (cellulose, hemicellulose, starch) for support and energy storage, whereas animals contain less than 1 percent carbohydrate (glycogen and glucose) and store energy mainly as lipids.

No.	Ans	Correct Answer & Explanation
15	a	**The Weende method dissolves variable amounts of hemicellulose and lignin, causing them to be misclassified into the nitrogen-free extract fraction** Sequential boiling in dilute acid and alkali during Weende crude fiber analysis solubilizes substantial hemicellulose and alkali-soluble lignin, erroneously shifting indigestible cell wall components into the supposedly digestible NFE fraction.
16	d	**Hemicellulose** Neutral Detergent Fiber (NDF) isolates hemicellulose, cellulose, and lignin, whereas Acid Detergent Fiber (ADF) isolates cellulose and lignin. Therefore, NDF − ADF (62% − 38% = 24%) estimates the hemicellulose fraction.
17	b	**80 percent** Organic matter on an as-fed basis equals 100% − (% Moisture + % Ash) = 100% − (12% + 8%) = 80%.
18	c	**Lipids** Because lipids have a higher ratio of hydrogen to oxygen than carbohydrates or proteins, complete oxidation yields approximately 1.07 grams of metabolic water per gram of lipid, compared to 0.56 grams for starch and 0.40 grams for protein.
19	a	**Propionate proportion increases while acetate proportion decreases, improving energetic efficiency for weight gain** High-starch concentrate diets favor amylolytic bacteria that produce higher molar proportions of propionic acid, which is captured more efficiently for tissue synthesis and reduces ruminal methane energy losses.
20	d	**Reduced acetate-to-propionate ratio coupled with altered biohydrogenation intermediates that inhibit mammary fatty acid synthesis** Low effective fiber lowers rumen pH, narrowing the acetate-to-propionate ratio and generating trans-10, cis-12 conjugated linoleic acid intermediates that downregulate de novo milk fat synthesis in the mammary gland.
21	b	**Propionate** Propionate is the only major glucogenic volatile fatty acid produced in the rumen; it is absorbed into portal blood and converted to glucose in the liver via gluconeogenesis.
22	c	**Microbial biohydrogenation of unsaturated fatty acids in the rumen prior to intestinal absorption** Ruminal bacteria hydrolyze esterified plant lipids and saturate double bonds in unsaturated fatty acids (biohydrogenation), converting linoleic and linolenic acids primarily into saturated stearic acid prior to absorption.
23	a	**Pepsin in the stomach, followed by trypsin and chymotrypsin from the pancreas, and aminopeptidases at the intestinal brush border** Protein digestion begins in the acidic stomach with pepsin, continues in the small intestine via pancreatic endopeptidases (trypsin, chymotrypsin, elastase) and carboxypeptidases, and finishes at the brush border with aminopeptidases and dipeptidases.

No.	Ans	Correct Answer & Explanation
24	d	**Ammonia is released faster than rumen microbes can capture it for microbial protein synthesis, leading to ammonia toxicity** Ruminal urease rapidly hydrolyzes urea into ammonia. Without readily fermentable carbohydrates to provide carbon skeletons and ATP, excess ammonia crosses the rumen wall into portal blood, overwhelming hepatic urea synthesis and causing acute toxicity.
25	b	**Ruminal microbes require cobalt to synthesize vitamin B12, which is essential for propionate metabolism** Cobalt is the central mineral atom of vitamin B12 (cobalamin). Vitamin B12 acts as a cofactor for methylmalonyl-CoA mutase, a key enzyme required for ruminants to metabolize propionic acid into glucose.
26	c	**Insufficient dietary calcium forces the hens to mobilize medullary bone calcium to form eggshells** Laying hens require roughly 3.5 to 4.2 percent dietary calcium (an 8:1 to 10:1 Ca:P ratio) to deposit ~2 grams of calcium per eggshell. A 1:1 Ca:P diet forces severe depletion of structural and medullary bone.
27	a	**Vitamin E prevents lipid peroxidation in cell membranes while selenium functions as a cofactor for glutathione peroxidase to destroy peroxides** Vitamin E and selenium act synergistically: tocopherol scavenges free radicals within lipid membranes, while selenium-dependent glutathione peroxidase neutralizes hydrogen peroxide and lipid hydroperoxides in the cytosol, preventing mulberry heart disease.
28	d	**Monogastric animals lack sufficient endogenous intestinal phytase to hydrolyze phosphorus bound to myo-inositol in plant seeds** Roughly 60 to 80 percent of total phosphorus in cereal grains and oilseed meals is stored as phytate (myo-inositol hexakisphosphate), which requires microbial or exogenous phytase to cleave phosphate groups for absorption.
29	b	**Ruminal microorganisms synthesize adequate B-complex vitamins that are subsequently absorbed in the lower digestive tract** Functional rumen microbes synthesize all water-soluble B-complex vitamins and vitamin K in quantities sufficient to meet host maintenance and moderate production needs once microbial cells pass into the small intestine.
30	c	**Vitamins A, D, E, and K** Fat-soluble vitamins (A, D, E, and K) depend on bile salts and pancreatic lipase to form mixed micelles for intestinal absorption; hepatic biliary insufficiency directly impairs their uptake.
31	a	**Dry forages and roughages** Under the International Feed Nomenclature system, Class 1 (Dry forages and roughages) includes dry feeds containing more than 18 percent crude fiber or more than 35 percent cell wall on a dry matter basis.
32	d	**Protein supplements** Under the International Feed Nomenclature system, Class 5 (Protein supplements) encompasses feedstuffs containing 20 percent or more crude protein on a dry matter basis and less than 18 percent crude fiber.

No.	Ans	Correct Answer & Explanation
33	b	**Increase the inclusion of protein supplements and synthetic amino acids to compensate for the very low crude protein content of cassava** Dried cassava root meal is rich in digestible starch but contains only 2 to 3 percent crude protein (compared to ~8.5–9% in corn), requiring extra protein and amino acid supplementation to maintain dietary balance.
34	c	**Trypsin inhibitors** Raw soybeans contain protease inhibitors (Kunitz and Bowman-Birk trypsin inhibitors) that bind pancreatic trypsin and chymotrypsin, impairing protein digestion and triggering compensatory pancreatic hypertrophy; proper toasting inactivates them.
35	a	**Mimosine** Ipil-ipil (Leucaena leucocephala) contains the toxic non-protein amino acid mimosine, which inhibits cell division and disrupts hair follicle growth (alopecia), feed intake, and reproduction in non-ruminants.
36	d	**Free gossypol causes olive-green yolk discoloration in eggs and exhibits greater toxicity in monogastrics than in ruminants** Free gossypol in cottonseed meal binds iron in egg yolks to produce an unmarketable olive-green color and can cause cardiac and hepatic toxicity in monogastrics, whereas mature ruminants detoxify gossypol in the rumen by binding it to soluble proteins.
37	b	**Activation of endogenous lipase enzymes that rapidly hydrolyze unsaturated fats into free fatty acids, leading to rancidity** Milling ruptures oil cells in rice bran, bringing potent endogenous lipases into contact with unsaturated triglycerides. Under warm, humid conditions, rapid hydrolytic and oxidative rancidity spoils the feed.
38	c	**High crude fiber content, low digestible energy, and deficiency in lysine and methionine** Copra meal contains substantial non-starch polysaccharides (mannans and galactomannans), relatively high crude fiber (12–15%), low metabolizable energy for poultry/swine, and poor lysine and methionine profiles.
39	a	**Fish meal supplies highly digestible protein with an excellent balance of lysine and methionine, alongside bioavailable calcium and phosphorus** High-quality fish meal provides highly digestible animal protein rich in limiting amino acids (lysine, methionine, threonine), bioavailable minerals, and omega-3 fatty acids ideal for immature piglet digestive tracts.
40	d	**Promote anaerobic lactic acid bacteria to rapidly lower silage pH to around 3.8 to 4.2, inhibiting clostridial spoilage** Compacting and sealing exclude oxygen, halting plant respiration and aerobic mold growth while allowing anaerobic lactic acid bacteria to ferment sugars into lactic acid, dropping pH to 3.8–4.2 to preserve nutrients.
41	b	**Improves palatability, reduces dustiness, and supplies readily fermentable sugars to stimulate rumen microbial activity** Cane molasses acts as a natural dust binder, enhances ration palatability, and provides rapid-release sucrose to fuel ruminal microbial growth and fiber digestion.

No.	Ans	Correct Answer & Explanation
42	c	**Crude protein and digestibility decline sharply while cell wall lignin and crude fiber increase** As tropical grasses mature, the leaf-to-stem ratio drops and structural cell walls thicken with lignified cellulose and hemicellulose, markedly lowering crude protein concentration and dry matter digestibility.
43	a	**Selectively inhibits Gram-positive rumen bacteria, shifting fermentation toward greater propionate production and lower methane loss** Ionophores such as monensin disrupt transmembrane ion gradients in Gram-positive bacteria (including lactate and methane producers), enriching Gram-negative succinate/propionate producers and improving energy retention.
44	d	**20.0 percent** Using the Pearson Square with target 16% CP in the center: Corn parts = |44 − 16| = 28; Soybean meal parts = |9 − 16| = 7; Total parts = 28 + 7 = 35. Soybean meal percentage = (7 ÷ 35) × 100 = 20.0%.
45	b	**20.83 percent** The 20 kilograms of crude protein needed in the 100-kilogram ration must be supplied entirely by the remaining 96 kilograms of non-fixed ingredients: (20 ÷ 96) × 100 = 20.83% CP target for the Pearson Square.
46	c	**Linear programming simultaneously satisfies multiple nutrient constraints and ingredient limits while minimizing total ration cost** The Pearson Square balances only a single nutrient across two ingredients or premixes, whereas linear programming solves multi-ingredient, multi-nutrient equations with minimum/maximum bounds to achieve the least-cost formulation.
47	a	**25.0 kilograms** As-fed weight = Dry Matter weight ÷ Dry Matter fraction = 8.0 kg ÷ 0.32 = 25.0 kilograms of fresh corn silage.
48	d	**Source A at 80.00 pesos per kilogram of crude protein compared to 90.00 pesos for Source B** Cost per kg of CP = Price per kg feed ÷ CP fraction. Source A: 35.20 ÷ 0.44 = 80.00 pesos/kg CP. Source B: 18.00 ÷ 0.20 = 90.00 pesos/kg CP. Thus, Source A is more economical.
49	b	**Feed intake decreases, causing inadequate intake of protein and amino acids, which reduces lean growth and increases carcass fatness** Poultry regulate voluntary feed intake primarily to satisfy their metabolizable energy demand. Excessive dietary energy reduces total feed consumption, resulting in insufficient amino acid intake for lean growth and excess energy deposition as fat.
50	c	**1.20 kilograms** Daily dry matter intake = 400 kg × 0.025 = 10.0 kg DM/day. Daily crude protein intake = 10.0 kg DM × 0.12 = 1.20 kilograms of crude protein per day.