Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate 2020

Marking Scheme

Agricultural Science

Ordinary Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

SECTION ONE Six questions to be answered Each question carries 20 marks

Q 1

(a) *Soil texture:*
The % sand, silt and clay (in a soil) **4**

(b) *Finding soil texture:* **4(3)**
Sieve method:
Dry soil/ crush soil/ weigh soil sample/ arrange sieves so that sieve with largest mesh size is on top/ place soil in top sieve and cover/ shake sieves/ weigh amount of soil in each sieve/ refer to soil textural triangle ***Any four***

or

Feel method:
Rub or feel (dry) soil (between thumb and finger)/ note grittiness or smoothness/ repeat with wet soil/ roll wet soil into a ball or a thread or bend into rings if possible/ compare (observations) to flow chart ***Any four***

or

Sedimentation method:
Place soil sample in beaker of water and stir/ add soil- water mixture to a graduated cylinder and add more water/ shake the soil- water mixture vigorously/ allow soil to settle/ measure the depth of each soil component/ refer to soil textural triangle ***Any four***

(c) *Reason for any **one** step above:* **4**
Sieve method:

Step	Reason
Dry soil	Allows soil to pass through sieves
Crush soil	Breaks up lumps of soil
Weigh soil	To find the mass of soil **or** to allow calculation of % of each soil component
Sieves in correct order	To facilitate separation of soil particles
Shake sieves	To move soil particles through sieves
Weigh soil in each sieve	To calculate mass of each soil component
Refer to soil textural triangle	To determine texture of soil

or

Feel method:

Step	Reason
Rub soil between fingers	To determine feel of soil
Note grittiness of soil	To assess sand content in soil
Wet soil	To allow soil to be rolled into a ball or thread
Roll soil into a ball or thread	To assess clay and/or silt content in soil
Compare to flow chart	To determine texture of soil

or

Sedimentation method:

Step	Reason
Stir soil and water in beaker	To break up lumps of soil
Soil and water in a graduated cylinder	To allow soil- water mixture to be shaken **or** to allow layers of each particle type to be measured
Shake soil-water mixture vigorously	To separate soil into its different components
Allow soil to settle	To allow sand, silt and clay particles to settle into different layers.
Measure depth of each layer	To calculate % sand, silt and clay
Refer to soil textural triangle	To determine texture of soil

Q 2

(a)

Animal	Length of gestation (pregnancy)	Birth weight of offspring (kg)
Pig	3 months, 3weeks, 3 days (**or** 110 – 120 days)	1 – 1.5 kg
Sheep	5 months (**or** 145 – 155 days)	3 – 5 kg
Cow	9.5months (**or** 280 – 290 days)	35 – 45 kg

4 + 8(2)

(b)

(i) *What colostrum is:*

First milk a young mammal (or named mammal) gets from its mother

(ii) ***W****hy colostrum is important:*

Rich in nutrients (or named nutrient)/ highly digestible/ rich in antibodies/ provides immunity/ warming effect/ laxative effect ***Any two***

Q 3

(a)	Stomata are pores found on the leaves of plants	**T**	**10(2)**
(b)	Pigs have a ruminant stomach	**F**	
(c)	Malting barley is used in the production of alcohol	**T**	
(d)	Brucellosis in cattle is caused by bacteria	**T**	
(e)	Clover plants can fix nitrogen	**T**	
(f)	Golden Wonder potatoes are a first early potato variety	**F**	
(g)	Sandstone is an igneous rock type	**F**	
(h)	L.W.G. stands for lower weight gain	**F**	
(i)	The right ventricle of the heart pumps blood around the body	**F**	
(j)	The crane fly larva is called a leatherjacket	**T**	

Q 4

Item/Machine	Name	Function
B	Slurry agitator	To break hard crust **or** to mix the solids and liquids **or** to allow gases to escape **or** easier to spread
C	Bale grabber	To transport bales (of hay) **or** to stack bales
D	(Reversible) plough	To turn the soil **or** to bury stubble **or** to bury weeds
E	Round feeder	Feeding fodder to livestock
F	Muck (or dung) spreader	To spread farmyard manure

5(2 + 2)

Q 5

(a) ***S**ources of pollution:*

Slurry/ silage effluent/ plastic/ pesticides/ herbicides/ waste oil/ lead paint/ smoke (e.g. gorse fires)/ parlour washings/ fertiliser run-off ***Any two***

(b) *Harmful effects of given pollution sources:*

Source	**Harmful effect**	***Source***	**Harmful effect**
Slurry	Water pollution	*Waste oil*	Water pollution
Silage effluent	Water pollution	*Lead paint*	Toxic to livestock
Plastic	Choking of livestock	*Smoke*	Air pollution
Pesticides	Can kill non-target species	*Parlour washings*	Water pollution
Herbicides	Can kill non-target species	*Fertiliser run-off*	Water pollution

Any two

(c) ***F**arming practices to reduce CO_2 in atmosphere:*

Plant trees (or hedgerows)/ more efficient farm machinery or proper maintenance of farm machinery/ solar panels/ minimum till/ wind generated electricity/ reduction in number of livestock on farm/ organic farming ***Any two***

4(4) + 2(2)

Q 6

(a) *Parts of stomach:*

B: Rumen
C: Reticulum
D: Omasum
E: Abomasum

2(4) + 6(2)

(b) *Which part has which function:*

Function	**Part (letter only in each case)**
Squeezes, and absorbs water	D
Pushes food back up into the mouth	C
Completes digestion of food	E
Contains bacteria and protozoans which digest cellulose	B

Q 7

***One** reason for **each** farm practice:* **5(4)**

(a) *Vaccination of farm animals:*
Prevents disease (or named disease) **or** stimulates antibody production **or** provides immunity

(b) *Using footbaths:*
To prevent foot rot **or** to prevent foot infection **or** to prevent lameness

(c) *Growing certified seed potatoes:*
Free from diseases (or named disease) **or** free from viruses **or** true-to-type **or** higher yields **or** seed graded to uniform tuber size

(d) *Subsoiling:*
To break up pans **or** improves drainage **or** loosens compacted soils **or** improves root penetration **or** improves aeration

(e) *Maintaining hedgerows:*
Habitat for wildlife **or** natural boundaries **or** natural amenity **or** improved crop growth (on sheltered side) **or** reduce soil erosion **or** to keep animals warm **or** to protect crops **or** to increase soil temperature **or** sound barrier **or** replenish oxygen **or** reduce carbon dioxide **or** encourages biodiversity **or** for biosecurity

SECTION TWO Three questions to be answered Each question carries 60 marks

Q 8

(a) (i) *Paddock grazing system:*

Drawing to show:

Means of access to paddock (e.g. roadway or pathway) and at least 10 paddocks **5, 3, 0**

Labels:

(Permanent) roadway/ water(supply)/ fencing/paddocks showing re-growth or recovery/ indication of direction of movement of livestock/ number of paddocks labelled (e.g. 20-25 paddocks) ***Any two*** **2(2)**

(ii) *Advantages:*

Fresh grass each day/ controlled grazing/ 21-day rotation/ time for grass to recover/ reduced incidence of parasitic worms/ paddocks can be fertilised when animals move/ more efficient use of grass (or less wastage or less trampling of grass)/ livestock spend less time walking/ palatable grass always available/ grass more digestible/ maximum production from animals (or higher milk yields or increased weight gain)/ some paddocks can be closed off for silage (or hay)/ low labour input (or easy to manage) ***Any two*** **2(3)**

Disadvantages :

Expensive to set up/paddock must have permanent water supply/fencing for each paddock/can be difficult to cut silage (or hay) if paddocks are small/poaching damage is possible (in certain weather conditions) ***Any two*** **2(3)**

(b) (i) *Steps in making good quality hay and a reason for any **one** step:*

Steps taken	**Reason**
Close field in time (or for 10 weeks)	Adequate time for grass to grow **or** higher yield of hay
Adequate fertiliser	Promotes good growth **or** higher yield of hay
Use good quality grass varieties (or named grass variety e.g. PRG)	Hay of better quality **or** more digestible **or** easier to dry
Control weeds	Hay of better quality **or** prevents poisoning (of livestock)
Cut or mow grass in dry weather	Easier drying **or** lowers risk of weather damage
Allow grass to wilt or dry	Lowers moisture content
Ted (or turn or shake) grass	Faster drying **or** lets air through grass
Rake (or gather) into rows	Easier to bale
Allow hay to dry before baling	Prevents rotting of hay
Bale hay	Easier to handle (or transport) **or** easier to store
Store hay in (leak-proof) shed or undercover	Keeps hay dry **or** prevents rotting

4(3) steps + 3 for one reason

(ii) *A reason for **each** listed step in silage making:*

Listed steps	Reason
1. *Cutting the grass on a sunny day*	Higher concentration of sugars (or carbohydrates)
2. *Allowing the cut grass to wilt*	Increases dry matter content **or** less effluent
3. *Rolling or baling the cut grass*	Creates anaerobic conditions (or eliminates oxygen)
4. *Covering the grass in plastic*	Creates anaerobic conditions **or** prevents rotting

4(3)

(c) *Simple on-site silage test:*

Test	Result and conclusion
Colour of silage	Yellow-green indicates high quality **or** dark green (or brown) indicates poor quality
Smell of silage	Sharp (or acidic) smell indicates high quality **or** putrid smell indicates poor quality
Squeeze silage (or dry matter or DM test)	Small amount of liquid produced from silage indicates high quality **or** large amount of liquid produced indicates poor quality
pH of silage	pH < 5 indicates high quality **o**r pH > 5 indicates poor quality
Taste of silage	Sharp (or acidic) taste indicates high quality **or** sweet **or** sour taste indicates poor quality
Feel of silage	A firm texture indicates high quality **or** a slimy feel indicates poor quality

4
Test
+
4
Result
+
4
Conclusion

Q 9		
(a)	(i) *Element in ground limestone:* Calcium *[Accept symbol]*	**3**
	(ii) *How a soil becomes acidic:* Crop removal/ leaching/(acid) rain/ animal urine/ addition of certain fertilisers/ plant vegetation (e.g. pine needles)/ addition of slurry or of farmyard manure ***Any two***	**3 + 2**
	(iii) *Finding pH of a soil sample*: Add soil to beaker (or suitable container)/ add distilled water (or deionised water)/ stir soil and water/ filter mixture/ add universal indicator solution (or indicator paper) to filtrate/ compare colour with pH chart ***Any four*** **or** Add soil to beaker (or suitable container)/ add distilled water (or deionised water)/ stir soil and water/ pH meter/ insert electrode (of meter) into distilled water to check if meter reading accurately/ insert electrode into soil-water mixture/ read the pH ***Any four***	**4(3)**
(b)	(i) *The three principal elements in 10-10-20:* Nitrogen Phosphorus Potassium *[Allow symbols]*	**3(4)**
	(ii) *Function of one of the nutrient elements in 10-10-20:* *Nitrogen:* Formation of chlorophyll (or of green colour) **or** prevents chlorosis (or prevents yellowing) **or** protein formation **or** increases yield **or** promotes leafy growth **or** *Phosphorus:* Cell division **or** energy transfer in cells **or** seed germination **or** promotes root growth **or** enhances seed formation **or** *Potassium:* Protein formation **or** disease prevention **or** promotes healthy growth **or** promotes early ripening **or** enhances fruit quality	**4**

(c) (i) *How FYM and slurry stored:*

Farmyard manure:
In a dungstead **or** on concrete **or** on in the open **4**

Slurry:
In an underground slurry tank **or** in a (covered) over-ground slurry tank **4**

(ii) *Differences between composition of FYM and of slurry:*

FYM		Slurry
Less water	**or**	More water
Contains straw	**or**	No straw
Less nitrogen	**or**	More nitrogen
More phosphorus	**or**	Less phosphorus
Solid	**or**	Liquid
Rich in organic matter	**or**	Low in organic matter

Any two **2(4)**

(iii) *Precautions when agitating slurry:*
Wear a mask/ do not work alone/ remove livestock from shed/ open shed doors/ agitate on windy day/ agitate from outside ***Any two*** **2(4)**

Q 10

(a)	(i) *How many chromosomes in cattle gametes:* 30 (ii) *Organ in which female games produced:* Ovary (iii) *Type of cell division that produces gametes:* Meiosis	**4** **4** **4**
(b)	*Cross 1:* *Gametes:* (G) × (g) *Offspring genotype:* (Gg) *Offspring phenotype:* <u>Green</u>	**2(4)** **4** **4**
(c)	*Cross 2:* *Parents' genotypes:* (Gg) × (Gg) *Possible gametes:* (G) (g) × (G) (g) *Offspring genotypes:* (GG) (Gg) (gg) *Offspring phenotypes:* <u>Green</u> <u>Albino</u>	**2(3)** **4(2)** **3(2)** **2(2)**
(d)	(i) *Cross breeding:* The mating of two different breeds of the same species **or** crossing two different varieties of plants (ii) *An advantage of cross breeding:* Hybrid vigour **or** increased prolificacy **or** increased milk yield **or** better quality milk **or** increased disease resistance **or** increased yields	**4** **4**

Q 11

(a) (i) *Dairy breeds:*

Holstein (Friesian)/ Jersey/Ayrshire/ Montbeliarde/ Norwegian Red/ (British) Friesian/ Kerry [*Allow Shorthorn*] ***Any two*** **2(4)**

(ii) *Why suitable for dairy:*

Breed	Suitability
Holstein (Friesian)	High milk yields
Jersey	High milk solids **or** low maintenance **or** easy calving
Ayrshire	High milk solids **or** easy calving **or** longevity
Montbeliarde	Milk suitable for cheese making **or** good fertility **or** longevity **or** good resistance to mastitis
Norwegian Red	Easy calving **or** high fertility **or** good (udder) health
(British) Friesian	Dual-purpose **or** high milk yields
Shorthorn	Dual-purpose **or** high milk yields
Kerry	Hardy **or** easy calving **or** docile

Any one **4**

(iii) *Why dairy cows culled:*

Injury (or lameness or bad feet)/ low milk yield/ poor milk quality (or explained)/ disease (or named disease)/ fertility problems/ calving difficulties/ bad temperament/ grading up/ old age/ poor conformation/ poor BCS ***Any two*** **2(4)**

(b) (i) *Characteristics of replacement heifers:*

Good conformation/ healthy udder or good teat placement/ good feet/ clean shiny coat/ disease-free or healthy (or one sign of good health explained)/ good BCS (or in good condition)/ bred from cow with high % milk solids/ good temperament/ bred from a sire with a high EBI ***Any two*** **2(4)**

(ii) *Heifer age at first calving:*

22 - 26 months **4**

(iii) *Target weight at first calving:*

500 – 550 kg **4**

(iv) S*igns that indicate calving imminent*:

Restlessness/ isolates herself/ swollen vulva/ mucus discharge from vulva/ swollen udder/ milk leaking from udder/ pelvic ligaments not visible (or pins drop) ***Any two*** **2(4)**

(c)	(i) *Body condition scoring:* A measure of the fat reserves on an animal's body **or** the fat reserves measured on a scale of 1-5 for cattle **or** the fat reserves measured on a scale of 1-9 for pigs (ii) *How BCS assessed in cows:* Hand pressure applied to (specific areas of)backbone/to assess body fatness or thinness/scale of 1-5 in cattle/1 indicates overly thin/4 indicates overly fat ***Any two*** (iii) *Cause of low BCS in cows*: Poor feeding **or** disease **or** old age **or** injury **or** not steaming up (iv) *Target BCS at calving:* 3 – 3.5	**4** **+** **4(3)**

Q 12

(a) (i) *Leaf adaptations for photosynthesis:*
Large surface area (or broad)/ thin/ stomata/ large air spaces/ most chloroplasts towards top of leaf (or in palisade layer)/ good supply of veins (or of vascular tissue or of xylem or of phloem) ***Any two***

(ii) *Reasons for the given procedures:*

Procedure	**Reason**
Place leaf in boiling water	To kill the leaf **or** to destroy the enzymes
Boil the leaf in alcohol or methylated spirits	To remove the chlorophyll (or green colour)
Rinse the leaf in warm water	To remove the alcohol **or** to soften the leaf
Pour iodine solution on the leaf	To test the leaf for starch

(iii) *Positive colour?* Blue-black

3(4) + 4(2)

(b) (i) *Excretion:*
Removing waste products of metabolism from body **or** removing waste products from the blood

(ii) *Parts:*
A = Kidney
B = Ureter
C = Bladder

(iii) *Substances removed from blood in kidney:*
Water/ urea/ salt/ hormones/ water-soluble vitamins/ potassium ions ***Any two***

(iv) *Other organs of excretion:*
Skin
Lungs

2(4) + 6(2)

(c) (i) *Parts of flower:*
A = Petal; B = Anther *[Allow stamen]*; C = Ovule; D = Stigma *[Allow carpel]*

(ii) *Wind or insect pollinated:* Insect

Reasons for choice:
Large petals/petals brightly coloured/ scented petals/small anthers/anthers inside petals (or flower)/ stigma inside petals (or flower) ***Any two***

(iii) *E develops into:* Fruit

(iv) *C develops into:* Seed

(v) *Conditions essential for germination:*
Moisture (or water) **and** Oxygen (or air) **and** Suitable temperature (or warmth)

2(4) + 2(2) + 8(1)

Q 13 **Any two of (a), (b), (c), (d) to be answered** **(30, 30)**

(a)

(i) *Factors affecting soil temperature:*
Soil type/ water content/ colour/ humus or organic matter content/ aspect/ altitude/ drainage ***Any two***

(ii) *Loam soil:*
A soil with roughly equal amounts of sand, silt and clay **or** a soil with 40% sand, 40% silt and 20% clay.

(iii) *Advantages of loam:*
Good drainage/ good aeration/ fertile/ warm/ early/ easy to till/ good water holding capacity ***Any two***

(iv) *How earthworms improve soil:*
Improve drainage/ improve aeration/ decompose organic matter into humus or add humus/ improve soil fertility/ mix soil/ improve soil structure ***Any two***

(v) *Factor causing decrease in earthworm population:*
Low pH **or** water-logging or drought **or** lack of oxygen **or** soil cultivation **or** predators **or** low organic matter content

2(6) + 6(3)

(b)

(i) *Barley:*

	Winter barley	**or**	**Spring barley**
1. Time of sowing	September - November		February - April
2. Time of harvesting	July - August		August - October
3. Expected yield	7–9 tonne/ha		5–8 tonne/ha

(ii) *Disease:*
Rhynchosporium (or leaf blotch) **or** powdery mildew **or** leaf rust **or** barley yellow dwarf virus **or** eyespot

(iii) *Pest:*
Wireworms **or** leatherjackets **or** aphids **or** birds **or** slugs

(iv) *Safe winter grain storage:*
Dry (or correct moisture content or 14-18% moisture content)/ treated with acid/ sealed/ correct temperature/ good hygiene/ free from vermin/ good ventilation ***Any two***

2(5) + 5(4)

(c) *Management of lowland lambs:*

(i) *Care at birth:*

Remove mucus/ dry lamb (or rub with straw) or make sure ewe licks lamb/ dip navel in iodine/ make sure lamb(s) suck or feed colostrum/ dry bed/ straw bedding/ good hygiene/ adequate supervision/ good shelter or lamb indoors/ remove to lambing pen/ encourage good bond between ewe and lamb(s) ***Any two***

(ii) *Changes in diet:*

Colostrum/ ewe's milk/ meals (or concentrates or ration)/ hay/ silage/ grass ***Any two***

(iii) *Housing:*

Dry/ straw bedding/ good ventilation/ draught free/ good hygiene (or clean)/ clean water supply/ individual lambing pens for first 2-3 days/ group pens for 2-3 days before turn-out ***Any two*** **2(6) +**

(iv) *Disease control:* **6(3)**

Colostrum **or** good hygiene **or** vaccinate **or** adequate ventilation **or** antibiotics **or** isolate sick lamb(s) **or** steaming up of ewe(s) in late pregnancy **or** dosing

(v) *Age at weaning*: 12 – 16 weeks

(d) (i) *Functions of dietary protein:*

Growth/ repair of damaged tissue/ enzyme production/ hormone production/ antibodies / development of muscle tissue or meat production/ hair or skin formation/ improved milk quality ***Any two*** **2(2)**

(ii) *Protein test:*

Food sample (or named food sample) in test-tube (or any suitable container)/ control/ add biuret solution (or add $CuSO_4$ and NaOH)/ shake to mix/ note colour change/ purple (or lilac or violet) colour indicates presence of protein/ no change (or blue colour) in control ***Any four*** **4(3)**

[all these points may be obtained from labelled diagram]

(iii) *Bulky feeds v concentrates:*

Bulky feeds		**Concentrates**
High water content	**or**	Low water content
High fibre content	**or**	Low fibre content
Low in energy	**or**	High in energy
Low dry matter content	**or**	High dry matter content

Any one **4**

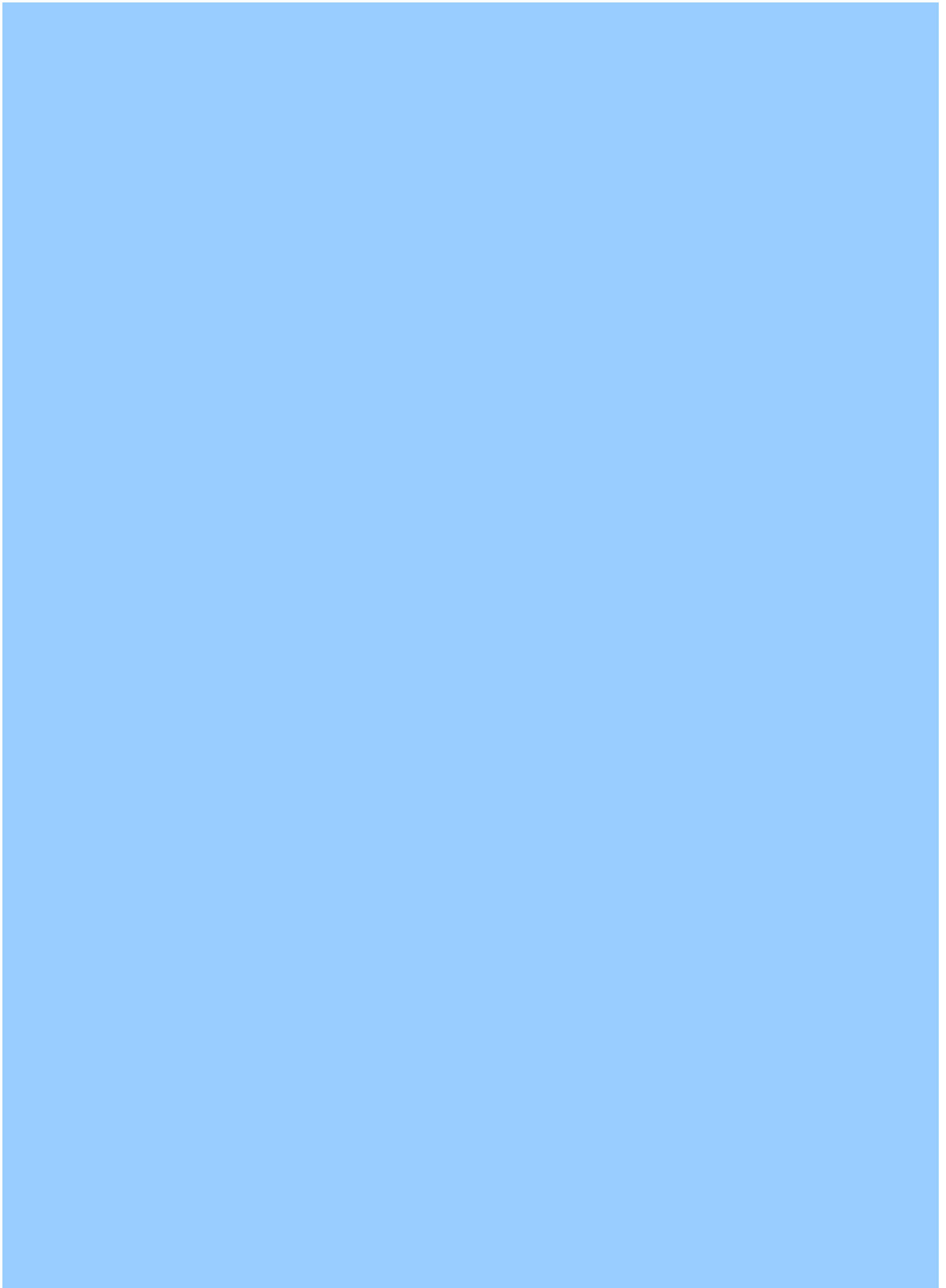
An example of each:

Bulky feeds: grass **or** silage **or** hay **or** haylage **or** root crops (or named root crop) **or** forage crop (or named forage crop) **2**

Concentrates: cereals (or named cereal) **or** molasses **or** beet pulp **or** soya bean meal **2**

(iv) *Maintenance ration:*

The amount of feed needed by an animal to maintain a constant body weight **or** the amount of feed needed to keep an animal healthy **3**

(v) *Production ration:*

The extra amount of feed needed by an animal to produce: 1 kg of LWG **or** 1 litre of milk **or** 1 kg wool **or** a calf **or** a lamb **3**