Qualification title: Level 3 Advanced Technical Diploma in Horticulture (540)
Level 3 Advanced Technical Extended Diploma in Horticulture (1080)

Exam: 0174-004/504 Level 3 Horticulture – Theory Exam

Version: April 2017

Exam date: 28 April 2017 **Exam time:** 13:30

Base mark: 80

Question no.	Answer	Mark allocation
1	Initial capital for genus Lower case for species X in front of Bi-generic hybrid X between genus and species for inter-specific hybrid Cultivars in single inverted commas with an initial capital or capitals if a name like 'Nelly Moser' Written in italics or underlined E.g. *Geranium clarkei 'Kashmir White'* E.g. *Aster* X *frikartii 'Mönch'*	4
2	a) **Weed control** around the root zone is important to reduce competition for water and nutrients as well as the problems caused by climbing weed species such as *Clematis or Lonicera* which cause strangulation and growth distortion in plants. b) **Mulching** with bulky organic material or synthetic material can reduce weed competition, reduce irrigation frequency, and improve soil temperatures. Organic materials may also add additional nutrients and micro-organisms to the soil around the root zone.	6

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	c) **Irrigation.** Studies have shown that frequent irrigation application is far more beneficial than occasional heavy drenching. The installation of an irrigation system such as perforated pipe surrounding the root zone at planting is beneficial. During times of drought the frequency should be increased as symptoms of drought such as wilting or twig dieback are slow to manifest themselves in woody perennials like trees.	
3	a) Close mowing, scarification, slitting, spiking, hollow tining, bulky top dressing. b) I. **Close mowing** removal of nearly all of the leaf and basal sheath of grass plants to allow adequate thatch removal and better penetration of aeration tools and equipment. Also to reduce resistance and friction when later working in bulky top dressings. All old growth is removed allowing for fresh new growth to take its place in improved conditions II. **Scarification** to cut and remove lengthy stolons, weed species, dead grasses and basal sheath material, moss etc. (thatch), to improve surface aeration and drainage and to encourage tillering of grasses. With improved tillering and better surface aeration and water penetration the surface condition of the sward will be more even and resilient. III. **Slitting** To improve surface soil aeration/drainage and to sever stolons and rhizomes, increasing the tillering of grasses. Also cutting through compacted thatch. With improved tillering and better surface aeration and water penetration the surface condition of the sward will be more even and resilient. IV. **Spiking** To improve surface aeration and drainage, also relieve localised compaction. With improved aeration and drainage grass plants will thrive and produce a more even and resilient surface. V. **Hollow tining** To improve surface aeration and drainage and to prepare soil for the incorporation of bulky top dressings. This process will encourage deeper rooting and increase in fibrous root formation providing a firm base for the sward which will increase its durability and recovery after wear. VI. **Bulky top dressings** The addition of top dressings is done to improve soil conditions and rooting. Soil improvement is key to increasing the strength and durability of the grass sward so that it is better able to withstand the use to which it is put. It will allow for better penetration of water, increase nutrient uptake, prevent water logging and can over time considerably alter the soil structure.	4 4
4	Lists not exhaustive: **Advantages:** • Mix of species will encourage greater diversity of invertebrates particularly pollinators. • Fewer maintenance cuts during the growing season resulting in lower costs. • Species mix will allow display over a long time period.	2

Question no.	Answer	Mark allocation
	• Opportunity to introduce locally under represented species. **Disadvantages** • Some species may take over at the expense of others. • Establishment can be difficult. • Fewer cuts or one end of season cut may give rise to problems of vegetation clearance. • Height and density of plants may obscure traffic sight lines leading to accidents.	
5	a) • Fuel and oil levels satisfactory • Clean windows • Stop switch working correctly • Parking and service brakes functioning correctly • Coolant levels satisfactory • Safety guards fitted and secure • Seat belts functioning • Tyre pressures correct • Tyre condition (tread, sidewalls) • Lights, horn, number plates if road working, flashing beacon all functioning b) • Health and safety risks to operator (eg. hand arm vibration syndrome (HAVS) and whole body vibration (WBV), other physical injury) • Health and safety risks to public (fumes, collision, injury from ejected objects etc.) • Poor performance of machine (uneven cut, poor cultivation, machine blockages) • Possible further damage to machine (increased wear, abrasion, friction leading to excessive noise, overheating, fire) • Possible damage to surface resulting in costly repairs (burning, scarring, rutting, smearing, compaction) • Works specification not maintained leading to contract default (penalties imposed, timings interrupted, machine down time leading to non completion) • Increased operating costs due to excessive fuel or oil consumption. • Risk of accident on the highway (Roads Traffic Act applies, operator can be prosecuted, points on licence)	3 4

<table>
<tr><th>Question no.</th><th>Answer</th><th>Mark allocation</th></tr>
<tr><td>6</td><td>A. Fusarium nivale (snow mould), Laetisaria fuciformis (Corticium group, red thread) Botrytis cinerea (grey mould), Doplocarpon rosae (rose black spot)
B. Tobacco mosaic virus, Camelia yellow mottle virus, Canna viruses, Cucumber mosaic virus.
C. Pseudomonas syringae (many cankers on ornamental trees and shrubs)
Erwina amylovora (Fire blight),
D. Bark lesions through drought, lighting damage, fertiliser or herbicide scorch, salt damage, wind damage (marginal leaf necrosis),nutrient deficiency (lime induced chlorosis)</td><td>4</td></tr>
<tr><td>7</td><td>
<table>
<tr><th>Annual weeds</th><th>Control factors</th></tr>
<tr><td>Short lifecycle - within one growing season</td><td>Soft plants easily damaged by hoeing etc.</td></tr>
<tr><td>Can set seed shortly after germinating</td><td>Physical removal can spread more seeds and actually increase the numbers of weeds</td></tr>
<tr><td>Mainly shallow fibrous root system</td><td>Do not survive drought or cold conditions well, easy to remove and root dies off in the soil</td></tr>
<tr><td>No woody stems</td><td>Generally more susceptible to herbicides</td></tr>
<tr><td>Tender</td><td>Will die off with first frosts</td></tr>
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<tr><th>Perennial weeds</th><th>Control factors</th></tr>
<tr><td>Long lifecycle, often many years, more than 2</td><td>Will continue to grow year after year, even if herbaceous tops die off root systems survives</td></tr>
<tr><td>Storage root system, tuber or taproot or woody roots</td><td>Enables survival through winter months and can enable plant to re-grow when top part is removed or sprayed with contact herbicide</td></tr>
<tr><td>Can take years before setting seed.</td><td>Opportunity to remove before full establishment eg ash seedlings</td></tr>
<tr><td>Often have woody stems</td><td>Woody stems are also storage organs and may be resistant to herbicides</td></tr>
<tr><td>Roots or small sections of root left in the soil can re-grow</td><td>Difficult to remove all of the root system effectively therefore re-growth takes place eg. dandelion</td></tr>
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</td><td>8</td></tr>
<tr><td>8</td><td>$6CO_2 + 6H_2O$ ---light energy and chlorophyll $=C_6H_{12}O_6 + 6O_2 + 6H_2O$

Carbon dioxide from the atmosphere and water from the soil via the roots are split into atoms using light energy from the sun and re-combined to form glucose, the remaining water and oxygen molecules are returned to the atmosphere.</td><td>2</td></tr>
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Question no.	Answer	Mark allocation
9	**Temperature**- In high temperatures the rate of evaporation is increased and the plant loses water faster, this in turn increases the rate of water uptake and movement through the plant to the stomata. **Humidity**- humidity is the amount of water in the atmosphere relative to the amount of water in the air in the plant. If the exterior humidity is the same as or higher than that of the plant there will be no net movement of water from the stomata and plant membranes. **Air movement**- air movement speeds up the rate of evaporation, the more rapid the air movement and the drier the air the more accelerated the rate of water loss from the plant surfaces becomes. This can reach a point where the loss is more than the gain to the plant and the plant begins to wilt or leaf cells dehydrate rapidly and collapse causing leaf scorch. **Water supply**- transpiration relies on an adequate supply of water from the root system to function. When the water supply becomes restricted the plant begins to react to water stress by closing many of the stomata to reduce the loss. If the plant loses more water than it can replace wilting becomes evident. If the drought situation continues for a prolonged period then the plant reaches permanent wilting point from which it will not recover as physical cell damage has occurred. **Light**- Light intensity and quality affects the rate of photosynthesis as it is closely linked to water movement in the plant as water is a key ingredient for the photosynthetic process and as it is converted to sugar more water is required to continue the process and the transpirational effort of the plant is key in getting water to the leaves and other green parts. **Stomata**- The opening and closing of the stomata control the movement of water vapour and atmospheric gases of oxygen and carbon dioxide in and out of the leaf. When water availability is good both the transpiration rate and the photosynthetic rate are increased, when the plant is stressed by drought many of the stomata are closed down, many stomata close during the hours of darkness although not all as transpiration and respiration still take place, but as there is no photosynthesis taking place the water requirement of the plant is reduced.	9
10	• Podzol • Rendzina • Brown Earth • Ranker • Gley	3

Question no.	Answer	Mark allocation
11	Sand- large particles 0.02-2.0mm diameter. Low aggregated surface area, large air spaces, less surface area per cubic metre for water to adhere to. Water can flow freely through the large pore spaces (macropores). Therefore, sandy soils are generally free draining and lower in nutrients due to leaching. Silt- medium to small particles 0.002 -0.02mm diameter. Much smaller particles which collectively have a much greater surface area per cubic metre and the pore spaces are much smaller. This will mean greater retention of water due to the greater attraction of water molecules to the surfaces of soil particles and in the capillary spaces (micropores) in between soil particles. Drainage is generally moderate on silty soils and nutrient holding capability is good. Clay- very small particle size <0.002mm diameter and often overlapping. Each clay particle holds onto water molecules very tightly through surface tension. Pore spaces are very small indeed resulting in poor drainage but good nutrient holding capabilities	6
12	A. Cuticle- Waterproofing and protection from animals and harmful rays. B. Upper Epidermis- to provide the outer structure strength and support the leaf. C. Pallisade Mesophyll- contain the largest number of chloroplasts for photosynthesis. D. Spongy Mesophyll- moist thin walled cells with air gaps to allow for gaseous diffusion. E. Stoma- to allow diffusion of water vapour, oxygen and carbon di-oxide to reach the mesophyll.	6
13	**Band 1: 1-5 marks** Basic understanding of potential environmental impacts of plant selection with limited examples. Limited discussion with little evaluation given. To access the higher marks in the band, a range of potential impacts given. **Band 2: 6-10 marks** Detailed discussion of the potential environmental impacts of plant selection with a range of examples used to support the discussion. Good understanding of the topic with positive and negative impacts considered. Evaluations were given. To access the higher marks in the band, a wide range of potential impacts given and evaluated. **Band 3: 11-15 marks** Thorough understanding of potential environmental impacts of plant selection with a range of specific and appropriate examples used to fully support the discussion. Clear and fully developed evaluations were made.	15

Question no.	Answer	Mark allocation
	To access the higher marks in the band, a comprehensive range of potential impacts and detailed evaluations were given. **Indicative content** Selecting plants suitable for the site to enable low maintenance. Plant selection: • site conditions • soil characteristics • plant requirements • maintenance requirements including inputs Pests, disorders and diseases. • correct plant selection to avoid occurrence • pollution of soil and water from chemicals • increase of resistance to chemicals by overuse • Integrated pest management programmes Wildlife encouragement • Encouraging biodiversity eg wildflower meadows.	