



**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:** June 2017

**Exam date:** 19 June 2017

**Exam time:** 13:30

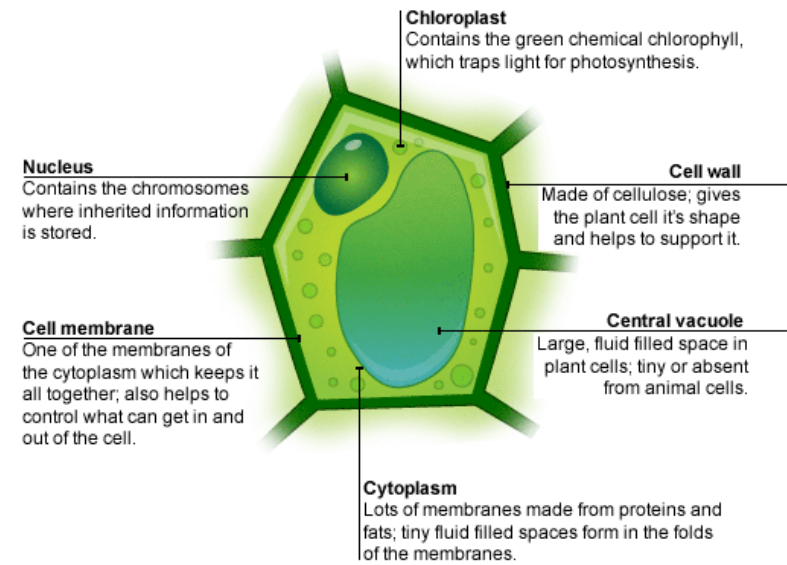
Base mark: 80

Question no.	Answer	Notes for marking examiners	Mark allocation
1	<ul style="list-style-type: none"> <li>• Habit (e.g. prostrate, horizontal, fastigiated, columnar, weeping, round, irregular)</li> <li>• Size (height, spread)</li> <li>• Leaf (shape, apex margin, colour, and arrangement)</li> <li>• Bud (shape, colour, size, arrangement)</li> <li>• Stem (colour and texture)</li> <li>• Bark</li> <li>• Stem and leaf modifications</li> <li>• Flowers and fruit (colour, shape, size, flower morphology, type of inflorescence, scent and fruit)</li> </ul>	One mark for each feature given	4
2 a)	<p>a) Frost pockets- particularly affect tender plants (1) as harmful frosts can occur at any time of year (1) which will freeze plant cells (1) resulting in necrosis and death of shoots and buds (1).</p> <p>b) Maritime exposure- salt laden winds can damage foliage through plasmolysis (1), drawing water from leaf cells to the atmosphere (1) causing necrotic patches (1).</p> <p>c) Slope- sloped ground is often free draining and plants may suffer from drought (1), they may also be in shade for long periods or in direct sunlight for long periods (1).</p>	One mark for each point within each explanation	4

Question no.	Answer	Notes for marking examiners	Mark allocation
	d) Wind Exposure- plants with soft leaves and thin cuticles can become wind burned (1) and unsightly due to rapid desiccation (1).		
3	<ul style="list-style-type: none"> <li>• International system of classification</li> <li>• Universal language</li> <li>• Avoids misunderstanding</li> <li>• Avoids confusion of 'common names', some plants have very many common names</li> <li>• Ensures specifications are correctly met</li> <li>• Demonstrates professionalism</li> <li>• Allows a more scientific approach to plant studies</li> </ul>	<p>One mark for each of the reasons given above as part of the explanation</p> <p>Plus one mark for any other acceptable explanation provided</p>	2
4	<ul style="list-style-type: none"> <li>• Texture</li> <li>• Compaction</li> <li>• pH</li> <li>• Nutrient status</li> <li>• Presence of soil organisms</li> <li>• Surface and sub surface drainage</li> <li>• Amount of traffic</li> <li>• Aeration</li> <li>• Surface vegetation depth of rooting</li> </ul>	One mark for each factor stated	4
5	<p>Advantages</p> <ul style="list-style-type: none"> <li>• Generally suitable for establishment in areas of poor soil/low nutrient status (1). Therefore a colourful and varied cover can be provided (1) for previously unkempt areas at minimal cost (1)</li> <li>• Wild flower seed mixes are initially expensive but when successfully managed re-seeding is seldom required (1) as plants will produce millions of viable seeds themselves</li> <li>• Increases the range of invertebrates per square metre (1) and improves foraging for honey bees and other important pollenating insects (1)</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Unless species mix is chosen carefully and matched to the site and soil conditions, aspect, rainfall etc. one or two species can take over at the expense of others (1) and you end up with a monoculture.</li> </ul>	<p>One mark for each point within each advantage or disadvantage provided.</p> <p>Maximum of 3 marks to be awarded for advantages</p> <p>Maximum of 3 marks to be awarded for disadvantages</p>	6

Question no.	Answer	Notes for marking examiners	Mark allocation
	<ul style="list-style-type: none"> <li>• Different management regimes are needed to produce rich flower swards (1) which can mean employing non-conventional methods in public spaces such as grazing animals, haymaking and less frequent mowing (1)</li> <li>• Some low maintenance swards can take a long time to establish (1) and require fencing off during the establishment phase (1) therefore effectively reducing available public space for a while.</li> </ul> <p><i>These points are not exhaustive</i></p>	Plus any other acceptable advantage or disadvantage	
6	<ul style="list-style-type: none"> <li>• Security of nuts, bolts and fittings</li> <li>• Fuel tank filled</li> <li>• Clean machine</li> <li>• Check guards</li> <li>• Check for damage</li> <li>• Remove ignition key</li> <li>• Report defects immediately and make a record (PUWER)</li> <li>• If damaged or unsafe take out of service and put a lockout or notice on machine</li> </ul>	One mark for each check provided	3
7	<ul style="list-style-type: none"> <li>• <b>Blocked air filter-</b> engines require a large quantity of clean air to run efficiently. When the filter is blocked the fuel air mix entering the engine is compromised and generally fuel rich which leads to incomplete combustion. This in turn leads to greater carbonisation and smoking of the engine and severely reduced power and fuel efficiency. So the machine goes slower and burns more fuel and lacks power to operate properly.</li> <li>• <b>Damaged or blunt cutting blades-</b> On cylinder mowers blades will not cut effectively leading to an unpredictable playing surface or unsightly lines on fine lawns. Grass will often not be cleanly severed and gets bent over and lays flat on the surface. With rotary mowers the blades will bruise and lay the grass over resulting in very ragged cuts or clogging of the mower mechanism. Blunt blades can also lead to damage to the drive train of the machine as they are forced into work. Either of these scenarios will result in a poor finish and may cause contract contraventions.</li> </ul>	2 marks for each common fault described. 1 mark for the effect on the machine, and 1 mark for the effect on the task completion	4

Question no.	Answer	Notes for marking examiners	Mark allocation										
8	<table border="1" data-bbox="275 167 1364 384"> <thead> <tr> <th data-bbox="275 167 819 209">Group</th> <th data-bbox="819 167 1364 209">Animal Pests</th> </tr> </thead> <tbody> <tr> <td data-bbox="275 209 819 250">a) Molluscs</td> <td data-bbox="819 209 1364 250">3) Slug</td> </tr> <tr> <td data-bbox="275 250 819 292">b) Nematodes</td> <td data-bbox="819 250 1364 292">1) Narcissus eelworm</td> </tr> <tr> <td data-bbox="275 292 819 333">c) Mites</td> <td data-bbox="819 292 1364 333">4) Glasshouse red-spider</td> </tr> <tr> <td data-bbox="275 333 819 384">d) Insects</td> <td data-bbox="819 333 1364 384">2) Cabbage white caterpillar</td> </tr> </tbody> </table>	Group	Animal Pests	a) Molluscs	3) Slug	b) Nematodes	1) Narcissus eelworm	c) Mites	4) Glasshouse red-spider	d) Insects	2) Cabbage white caterpillar	One mark for each correct pairing of Group and Animal Pests	4
Group	Animal Pests												
a) Molluscs	3) Slug												
b) Nematodes	1) Narcissus eelworm												
c) Mites	4) Glasshouse red-spider												
d) Insects	2) Cabbage white caterpillar												
9	<p>a)</p> <ul style="list-style-type: none"> <li>• <b>Vectors</b>-Diseases carried by insect vectors- sap-sucking insects such as aphids can be controlled by natural predators such as ladybird larvae or lacewings or by spraying. Aphid populations explode rapidly, related to available food supply, so early treatment is crucial. Destroy any plants with bacterial or viral diseases by burning, therefore removing the source of infection.</li> <li>• <b>Walking</b>- Fungal diseases are often spread by spores being carried on the feet of walkers or animals e.g. ash dieback (<i>Chalara spp.</i>) Encourage people to clean or wash footwear when leaving an infected area, provide disinfectant or fungicidal boot washing facilities. Restrict access to area until disease is controlled. Put up warning signs.</li> <li>• <b>Rain splash</b>- a problem with fungal diseases such as rust, leaf spot and phytophthora. Covering the plants can help as can individual shelters for young trees and shrubs, also spraying as a preventative measure to inoculate the plants. Restricting movement in affected areas.</li> </ul> <p>b)</p> <p>Plum Leaf-curling aphid Causes severe distortion and discoloration of foliage in spring coupled with copious amounts of honeydew and sooty mould/</p> <p>The aphid has a complex life cycle including parthenogenesis, nearly all infestations are entirely female and effectively the aphids can clone themselves many times over. This leads to huge population explosions when conditions are suitable. The key conditions are temperature, humidity and an adequate food supply. When the aphid numbers begin to out-strip food availability then the aphids develop wings and move onto other plants. However there are times in the lifecycle when controls can be more effective.</p>	<p>(a) One mark for describing the way (maximum of two marks) and one mark for describing the biosecurity method to be used (maximum two marks)</p> <p>(b) Any other acceptable explanation for a named example can be used. Marker to award 1 mark for each relevant point or reason for importance within the explanation, up to a max of 4</p>	8										

Question no.	Answer	Notes for marking examiners	Mark allocation
	<p>Overwintering eggs are laid in stem and leaf joints for protection and a treatment with an effective winter wash of products such as plant oil can kill the eggs which will significantly reduce populations the following year.</p> <p>Many insects such as ladybirds and their larvae and lacewings and earwigs eat aphids. However they are not usually present in sufficient numbers to control rapid increases in aphid populations but if extra predators are introduced early in the season before aphid numbers they can be effective.</p> <p>Timings of introductions and the use of plant protection products (pesticides) have to be applied at the right point in the lifecycle of the aphids if they are to be effective.</p>		
10	 <p><b>Nucleus</b> Contains the chromosomes where inherited information is stored.</p> <p><b>Chloroplast</b> Contains the green chemical chlorophyll, which traps light for photosynthesis.</p> <p><b>Cell wall</b> Made of cellulose; gives the plant cell its shape and helps to support it.</p> <p><b>Cell membrane</b> One of the membranes of the cytoplasm which keeps it all together; also helps to control what can get in and out of the cell.</p> <p><b>Central vacuole</b> Large, fluid filled space in plant cells; tiny or absent from animal cells.</p> <p><b>Cytoplasm</b> Lots of membranes made from proteins and fats; tiny fluid filled spaces form in the folds of the membranes.</p> <p>Images from <a href="http://www.bbc.co.uk">www,bbc.co.uk</a></p>	<p>One mark for correctly labelling the component; one mark for stating the function of the component</p>	6

Question no.	Answer	Notes for marking examiners	Mark allocation
11	<p>Factors affecting Photosynthesis</p> <ul style="list-style-type: none"> <li>• The availability of carbon dioxide will affect photosynthesis (1) if the immediate atmosphere can be enriched with additional CO<sub>2</sub> and other factors can be increased as well, then plants will photosynthesise more effectively (1), produce more carbohydrates and increase the growth rate.</li> <li>• Water availability will restrict or improve photo-synthetic rate (1). H<sub>2</sub>O is an ingredient for sugar; if a plant is suffering from drought then not enough water is available for conversion into sugar (1). The photosynthetic rate is lowered accordingly.</li> <li>• Temperature and the rate of evaporation and gaseous exchange will affect the photosynthetic rate (1). Plants are more likely to close stomata in warm dry windy conditions to prevent water loss. The reduction in water movement will directly affect the movement and conversion of water in the plant (1)</li> <li>• Lack of nutrients (1) will prevent the plant from successfully manufacturing chlorophyll (1). Shortages of iron and nitrogen along with potassium will cause the leaves to become pale (Chlorotic) (1) ie low in chlorophyll and that will significantly lower the photosynthetic. rate</li> </ul>	<p>Marker to award 1 mark for each relevant point within the explanation, up to a max of 2 marks for each factor</p>	6
12	<p><b>Improvement methods:</b></p> <ul style="list-style-type: none"> <li>• Addition of organic material</li> <li>• Addition of lime – if the soils pH is too low</li> <li>• Addition of Mycorrhizae</li> <li>• Cultivations</li> </ul> <p><b>Addition of organic material—</b></p> <ul style="list-style-type: none"> <li>• will improve the water holding capacity of the soil</li> <li>• will increase the numbers and activity of soil organisms (macro and micro)</li> <li>• will help to aerate the soil and the binding properties of poor soil structure, which will lead to improved rooting plant development</li> <li>• will add essential nutrients to the soil for exploitation by plants</li> </ul> <p><b>Addition of Lime:</b></p> <ul style="list-style-type: none"> <li>• added to heavy soils with a high clay content, lime will cause soil to flocculate, breaking down large dense structures in the soil into smaller ones making the soil easier to work and improving rooting</li> </ul>	<p>One mark for each improvement method given. Maximum of two marks per method describing how it improves the soil</p>	10

Question no.	Answer	Notes for marking examiners	Mark allocation
	<ul style="list-style-type: none"> <li>• the acidity levels of the soil will be reduced which will allow a wider range of plants to grow effectively releasing previously unavailable nutrients such as iron in the soil.</li> </ul> <p><b>Addition of Mycorrhizae</b></p> <ul style="list-style-type: none"> <li>• Mycorrhizae fungal spores in planting compost will improve the establishment of many newly planted trees and woody perennials. They form close associations with plant root systems and effectively extend plant roots and allow the uptake of nutrients that would otherwise be in short supply. The fungal threads (hyphae) will move through the soil like microscopic roots improving aeration and gaseous exchange in the soil and when they break down they will add nutrients and organic material into the soil.</li> </ul> <p><b>Cultivations:</b></p> <ul style="list-style-type: none"> <li>• Turning the soil over in the autumn will expose soil borne pests to low temperatures and frost which will kill them and reduce populations for the coming growing season</li> <li>• Turning the soil also exposes soils structures to the effect of frost which will freeze the soil water causing large structures to break up and become more friable resulting in better rooting of plants</li> <li>• It will also allow the break-up of surface and sub surface compaction layers (pans) improving drainage and root penetrations</li> </ul>		
13	<p>The acidity or alkalinity of a soil can be measured using the pH scale which runs from 0-14 with 7 being neutral. It can be measured using chemical test kits or electronic equipment. Observation of surrounding vegetation can also indicate whether soil is basically acid or alkaline e.g. <i>Rhododendron</i> indicates acid soil whilst <i>Buddleia</i> often indicates alkaline conditions.</p> <p>It may be necessary to adjust the levels to increase the range of plants that can be grown or to maintain plants in good health and colour e.g. <i>Hydrangea</i>, which are often blue but revert to pink on alkaline soils due to the unavailability of iron in the alkaline environment increasing the acidity by the addition of peat and iron sulphates will cause the plant to go back to blue flowers.</p> <p>It may also be necessary where acid loving plants are beginning to show nutrient deficiency due to alkaline conditions (lime induced chlorosis) the addition of acid fertilizers and more acidic composts and soil improvers can rectify the situation. Effects however tend to be short term and treatments generally have to be repeated.</p>	<p>Maximum of two marks describing how the acidity or alkalinity of soil can be determined</p> <p>Maximum of two marks in describing why it may be necessary to adjust the levels</p>	4

Question no.	Answer	Notes for marking examiners	Mark allocation
14	<p><b>Band 1: 1-5 marks</b>  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.</p> <p><b>Band 2: 6-10 marks</b>  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.</p> <p><b>Band 3: 11-15 marks</b>  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.  To access the higher marks in the band, a comprehensive range of potential impacts and detailed evaluations were given.</p> <p><b>Indicative content</b>  Selecting plants suitable for the site to enable low maintenance.  Plant selection:</p> <ul style="list-style-type: none"> <li>• site conditions</li> <li>• soil characteristics</li> <li>• plant requirements</li> <li>• maintenance requirements including inputs</li> </ul> <p>Pests, disorders and diseases.</p> <ul style="list-style-type: none"> <li>• correct plant selection to avoid occurrence</li> <li>• pollution of soil and water from chemicals</li> <li>• increase of resistance to chemicals by overuse</li> <li>• Integrated pest management programmes</li> </ul> <p>Wildlife encouragement</p> <ul style="list-style-type: none"> <li>• Encouraging biodiversity eg wildflower meadows.</li> </ul>		15



