Question Number	Answer	Additional Guidance	Mark
1(a)(i)	(area or zone) where { no bacteria / bacteria not growing / bacteria killed } ;	ACCEPT bacteria not dividing / replicating / multiplying	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. the larger the size of zone of inhibition the { more bacteria killed / fewer bacteria grow / fewer bacteria multiply } / eq 2. idea of comparability between { species / plant extracts } ;	1. ACCE converse	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	1. clove has the greatest antimicrobial properties /most bacteria are sensitive to clove / eq ; 2. sage has no antimicrobial properties / no bacteria are sensitive to sage / eq ; 3. flower buds are more effective than leaves and stems ; 4. no difference between basil and rosemary AND between lemon balm and thyme ;	1. ACCE clove is the most effective 2. ACCE sage is ineffective against bacteria or is the least effective	(3)

Number			
1(c)	1. epeats for each type of plant extract ; 2. to all { mean / average } to be calculated / to increase reliability of results ; OR 3. u the same part of the plant for each extract ; 4. control variables / to allow comparisons / to make { method / conclusions } valid ;	2. ACCE identify anomalies 4. IG RE valid results	(2)

Question Number	Answer	Additional Guidance	Mark
1(d)	1. i a of incubating at { temperatures below 37 ºC / a lower temperature } ; 2. p vents growth of pathogenic bacteria ; OR 3. i a of using non-pathogenic bacteria ; 4. p vent risk of infection to humans ;	2. ACCE idea that 37 ºC encourages growth of pathogens	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	1. reference to aseptic technique ; 2. using sterilised { containers / agar / growth medium / equipment / eq } / eq ; 3. idea of sealing the container ;	2. IGNORE clean the bench ACCEPT tweezers, loops 3. ACCEPT use clingfilm, cotton wool, put lid on, foil	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	1. idea of contaminants causing {infection / disease / eq} of plant (tissue) ; 2. idea of contaminants compete (for nutrients) ; 3. idea of contaminants causing { poor growth / decay / death } / eq ;	1. ACCEPT pathogen of plant 2.NOT for light	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. light ; 2. temperature ; 3. humidity ; 4. sugar / glucose / sucrose ; 5. minerals / mineral ion(s) / named mineral ion ;	1. ACCEPT sunlight, wavelength 3. IGNORE water, moisture 5. e.g. nitrate	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. increase in number of shoots per explant { between pH 4.5 and 6.0 / up to pH 6.0 } ; 2. pH 6 is {optimum / highest number of shoots} / lowest number of shoots at pH 4.5 ; 3. idea of effect of pH on protein or enzyme ; 4. description of the consequence of this change on {metabolism / uptake of nutrients / eq} ;	1. ACCEPT positive correlation up to 6.0 2. IGNORE goes up and then down ACCEPT pH 6 is best 4. ACCEPT effect on named cell process	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. idea that the temperature of the {body / core} changes (with time after death) ; 2. idea that (core) temperature depends upon the {ambient / eq} temperature ; 3. idea that {other post-death changes / muscle contraction / insect life cycles / decomposition / eq} depend on (ambient / body) temperature ;	**1 ACCEPT** cooling	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	Correct answer gains all 3 marks 1. line drawn between 25°C (core) and 15°C (ambient) ; 2. line drawn from centre of circle through the intersect of line 1 with diagonal ; 3. time of death = {23 - 24} ;	**1 ACCEPT** within the next scale line **2 CE** applies **3 CE** applies	**(3)**

Question Number	Answer	Additional Guidance	Mark
***3(b)(ii)**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** **Clothing** 1. for the clothed body the {estimate was too short / eq } ; 2. because the clothing would {reduce heat loss / body would cool more slowly / temperature would drop slower / eq} ; 3. idea that clothing would {insulate / trap the heat / eq} ; **Position** 4. for the body curled up the {estimate was too short / eq } ; 5. because {heat loss is reduced / body would cool more slowly / temperature would drop slower / eq} ; 6. as the (exposed) surface area was smaller/ eq ; **Air movement** 7. for the moving air {the estimate was too long / eq } ; 8. as moving air {speeds up heat loss / body would cool faster / temperature would drop faster / eq } ;	**QWC emphasis is clarity of expression** **ACCEPT** converse arguments for Mps other than 1, 4 and 7 **1 ACCEPT** time of death was earlier / died longer ago **4 ACCEPT** time of death was earlier / died longer ago **7 ACCEPT** time of death was more recent / died later **IGNORE** submersion in water	**(6)**

Question Number	Answer	Additional Comments	Mark
4(a)	1. idea of using part of the seedling ; 2. idea of using agar ; 3. (agar contains) growth substances / hormones / eq ; 4. Idea of using aseptic technique ; 5. Idea of covering the top of the container to prevent contamination OR loss of water ; 6. Idea of supplying light ; 7. allow a suitable length of time for growth e.g. 1 to 6 weeks ; 8. look for { roots / leaves / (complete) plant } forming ;	1. CCEPT cuttings, explants IGNORE cells unqualified 3. CCEPT named plant growth substance	**(4)**

Question Number	Answer	Additional Comments	Mark
4(b)(i)	1. percentage of seedlings (showing totipotency) decreases as age increases up to 21 days / negative correlation up to 21 days / eq ; 2. as age increases { after 21 / from 21-28 / at 28} days percentage of seedlings showing totipotency increases / eq ; 3. 28 days is an anomalous result ; 4. credit correct manipulation of the data ;	4. Some examples ar shown below Days | Difference (%) 7-28 | (76-16 7-14 | (76-20 *7-21 mp1* | (76-40) 36 14-21 | (56-40) 16 *21-2 mp2* | (40-60) (+) 20 IGNORE calculated percentage of percentage	**(2)**

Question Number	Answer	Additional Comments	Mark
4(b) (ii)	1. { repeats / larger number of seedlings } { at each age / in each group } / eq ; 2. more ages of seedlings used / use seedlings older than 28 days / test 35 day old seedlings / eq ; 3. repeat 28-day group / repeat any anomalous results / eq ;	1. CEPT repeated the whole experiment	(2)

Question Number	Answer	Additional Comments	Mark
4(c) (i)	as phenol concentration increases from { 7 to 21 / 7 to 14 / 14 to 21 } days, percentage of seedlings showing totipotency decreases / negative correlation up to 21 days / eq ;		(1)

Question Number	Answer	Additional Comments	Mark
4(c) (ii)	(as phenol concentration increases) at 28 days percentage of seedlings showing totipotency increases / eq ;	ACCEPT reference to after 21 days	(1)

Question Number	Answer	Additional Comments	Mark
4(d)	1. totipotent cells can { give rise to / differentiate to become } { any cell / extra embryonic tissues / eq } ; 2. pluripotent cannot { give rise to / differentiate to become } { all cells in the body / extra embryonic tissues / eq } ; 3. idea that only totipotent cells can give rise to other totipotent cells ; 4. idea that totipotent cells can give rise to an entire human being, pluripotent cells cannot ;	NOT 'turns into', 'becomes', 'develops into' but penalise once only 1. CCEPT specialised for differentiated 1 & 2 IGNORE reference to embryonic cells/tissues unless it makes the response incorrect, ACCEPT placental cells/tissues 2. CCEPT can give rise to most cells	(2)