

# Mark Scheme Summer 2009

GCSE

## GCSE 360Science

Science (2101)

Additional Science (2103)

Biology (2105)

Chemistry (2107)

Physics (2109)

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## Mark Schemes for Multiple Choice Papers

### Science 5005 / Biology 5025 (B1a)

Unit B1a - 5005/5025	
Topics 1 & 2	
1	D
2	C
3	C
4	C
5	D
6	C
7	B
8	A
9	A
10	C
11	D
12	C
13	D
14	B
15	B
16	D

Unit B1a - 5005/5025	
Topics 1 & 2	
17	A
18	D
19	B
20	C
21	B
22	D
23	B
24	C

Unit B1a - 5005/5025	
Topics 1 & 2	
25	C
26	A
27	B
28	C
29	C
30	B
31	D
32	D
33	A
34	B
35	C
36	D
37	C
38	D
39	B
40	C

### Science 5006 / Biology 5026 (B1b)

Unit B1b - 5006/5026	
Topics 3 & 4	
1	C
2	D
3	A
4	B
5	C
6	A
7	D
8	A
9	C
10	B
11	D
12	D
13	A
14	C
15	B
16	A

Unit B1b - 5006/5026	
Topics 3 & 4	
17	B
18	D
19	C
20	A
21	A
22	C
23	A
24	B

Unit B1b - 5006/5026	
Topics 3 & 4	
25	C
26	C
27	A
28	A
29	D
30	D
31	B
32	C
33	D
34	C
35	B
36	A
37	C
38	A
39	C
40	C

Science 5007 / Chemistry 5035 (C1a)

Unit C1a - 5007/5035	
Topics 5 & 6	
1	D
2	D
3	A
4	A
5	B
6	D
7	B
8	A
9	C
10	C
11	B
12	C
13	C
14	D
15	B
16	D

Unit C1a - 5007/5035	
Topics 5 & 6	
17	C
18	D
19	A
20	C
21	B
22	C
23	D
24	B

Unit C1a - 5007/5035	
Topics 5 & 6	
25	D
26	C
27	B
28	B
29	B
30	C
31	C
32	A
33	C
34	A
35	B
36	C
37	B
38	D
39	C
40	A

Science 5008 / Chemistry 5036 (C1b)

Unit C1b - 5008/5036	
Topics 7 & 8	
1	A
2	C
3	D
4	A
5	D
6	A
7	B
8	C
9	B
10	B
11	A
12	B
13	B
14	D
15	B
16	D

Unit C1b - 5008/5036	
Topics 7 & 8	
17	B
18	C
19	D
20	D
21	C
22	A
23	D
24	C

Unit C1b - 5008/5036	
Topics 7 & 8	
25	B
26	C
27	A
28	C
29	D
30	A
31	C
32	D
33	D
34	C
35	D
36	C
37	C
38	C
39	A
40	C

Science 5009 / Physics 5045 (P1a)

Unit P1a - 5009/5045	
Topics 9 & 10	
1	C
2	A
3	B
4	B
5	A
6	C
7	A
8	B
9	D
10	B
11	C
12	B
13	D
14	D
15	D
16	B

Unit P1a - 5009/5045	
Topics 9 & 10	
17	A
18	A
19	D
20	B
21	C
22	D
23	B
24	C

Unit P1a - 5009/5045	
Topics 9 & 10	
25	D
26	B
27	C
28	D
29	B
30	A
31	C
32	A
33	B
34	A
35	C
36	B
37	D
38	D
39	C
40	A

Science 5010 / Physics 5046 (P1b)

Unit P1b - 5010	
Topics 11 & 12	
1	A
2	D
3	B
4	B
5	B
6	A
7	A
8	C
9	D
10	D
11	C
12	A
13	B
14	C
15	C
16	D

Unit P1b - 5010	
Topics 11 & 12	
17	B
18	D
19	B
20	A
21	A
22	C
23	D
24	B

Unit P1b - 5010	
Topics 11 & 12	
25	A
26	C
27	D
28	B
29	D
30	A
31	C
32	B
33	B
34	C
35	A
36	A
37	C
38	D
39	B
40	D

Additional Science 5015 / Biology 5027 (B2)

Unit B2 - 5015 / 5027	
Topics 1, 2, 3 & 4	
1	C
2	A
3	D
4	C
5	C
6	A
7	B
8	D
9	C
10	C
11	B
12	C
13	D
14	C
15	A
16	C

Unit B2 - 5015 / 5027	
Topics 1, 2, 3 & 4	
17	B
18	C
19	D
20	C
21	A
22	C
23	B
24	D

Unit B2 - 5015 / 5027	
Topics 1, 2, 3 & 4	
25	A
26	B
27	B
28	C
29	C
30	C
31	A
32	B
33	D
34	C
35	D
36	B
37	B
38	C
39	D
40	B

Additional Science 5017 / Chemistry 5037 (C2)

Unit C2 - 5017/5037	
Topics 5, 6, 7 & 8	
1	D
2	C
3	A
4	B
5	D
6	C
7	A
8	B
9	C
10	A
11	C
12	B
13	B
14	A
15	B
16	B

Unit C2 - 5017/5037	
Topics 5, 6, 7 & 8	
17	C
18	A
19	C
20	B
21	A
22	D
23	C
24	B

Unit C2 - 5017/5037	
Topics 5, 6, 7 & 8	
25	C
26	B
27	C
28	D
29	C
30	B
31	C
32	D
33	A
34	D
35	B
36	B
37	D
38	C
39	C
40	D



Additional Science 5019 / Physics 5047 (P2)

Unit P2 - 5019/5047	
Topics 9, 10, 11 & 12	
1	A
2	D
3	B
4	C
5	C
6	A
7	B
8	C
9	A
10	A
11	B
12	B
13	A
14	B
15	C
16	D

Unit P2 - 5019/5047	
Topics 9, 10, 11 & 12	
17	C
18	C
19	D
20	D
21	D
22	B
23	A
24	C

Unit P2 - 5019/5047	
Topics 9, 10, 11 & 12	
25	A
26	D
27	B
28	B
29	B
30	D
31	C
32	B
33	A
34	C
35	A
36	A
37	B
38	A
39	B
40	C

## Using the Mark Scheme for Structured Papers

1. This mark scheme gives you;
  - \* an idea of the type of response expected
  - \* how individual marks are to be awarded
  - \* the total mark for each question
  - \* examples of responses that should not receive credit.
2. ; separates points for the award of each mark.
3. / means that the responses are alternatives and either answer should receive full credit.
4. ( ) means that a phrase/word is not essential for the award of the mark but helps the examiner to get the sense of the expected answer.
5. Phrases/words in bold indicate that the meaning of the phrase/word is essential to the answer.
6. OWTTE (or words to that effect) and eq (equivalent) indicate that valid alternative answers (which have not been specified) are acceptable.
7. 'Ignore' means that this answer is not worth a mark but does not negate an additional correct response.
8. 'Reject' means that the answer is wrong and negates any additional correct response for that specific mark.
9. ORA (or reverse argument) indicates that the complete reverse is also valid for the award of marks.
10. ecf (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

### Marking

1. Suggestion/explanation questions should be marked correct even when the suggestion is contained within the explanation.
2. Do not award marks for repetition of the stem of the question.
3. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct scientific context.

### Amplification

1. In calculations, full credit must be given for a bold, correct answer. If a numerical answer is incorrect, look at the working and award marks according to the mark scheme.
2. Consequential marking should be used in calculations. This is where a candidate's working is correct but is based upon a previous error. When consequential marks have been awarded write "ecf" next to the ticks.
3. If candidates use the mole in calculations they must be awarded full marks for a correct answer even though the term may not be on the syllabus at their level.
4. If candidates use chemical formulae instead of chemical names, credit can only be given if the formulae are correct.

Additional Science 5016F/1F  
 Biology 5028F/1F  
 B2 Mark Scheme

Question Number	Answer	Mark
1(a)	chloroplast	(1)

Question Number	Answer	Mark
1(b)	<p style="text-align: center;"><b>Part of cell</b>                      <b>function</b></p> <p style="text-align: center;">Given</p> <p>1 mark for each correct line. If two lines start from one 'part of cell' box award no mark for that box;;</p>	(3)

Question Number	Answer	Mark
2	1. faster ; 2. oxygen ; 3. red ;	(3)

Question Number	Answer	Mark
3(a)	1. (as the distance from the sea increases) the number of types/species of plants increase ; 2. Stays (roughly) constant number of species from 20m / (after 20m) the number of species goes down then up / decreases at 25m then increases again ;	(2)

Question Number	Answer	Mark
3(b)	less wave action / out of reach of tides / less salt / less spray; more humus; soil warmer; more soil / less sandy; more water; more minerals / nutrients / more fertile; soil more stable / less wind;  ORA (e.g. less plants near sea as too salty / salt damages plants / more wave action / not enough minerals)	(1)

Question Number	Answer	Mark
4(a)	respiration ;	(1)

Question Number	Answer	Mark
4(b)	Two of: Increase plant mass / number / more plants / more trees ; Increase light intensity / turn more lights on ; Increase day length ; Increase temperature ; Increase photosynthesis ; Decrease animal / microbial biomass / number / fewer animals / less people;	(2)

Question Number	Answer	Mark
4(c)	fungi / named decomposing fungi / mould /bacteria / named decomposing bacteria / microorganisms / microbes ;	(1)

Question Number	Answer	Additional guidance	Mark
5(a)	water ;	hops / barley / malt;	(1)

Question Number	Answer	Additional guidance	Mark
5(b)	fermentation ;	(Aerobic) respiration ;	(1)

Question Number	Answer	Mark
5(c)	Two of: fast growth; climate independent / can be produced anywhere in the world; easily handled; not sentient OWTTE re rights; (waste products) can be sold / used / reused;	(2)

Question Number	Answer	Mark
5(d)(i)	more (yeast) is produced than is needed by the brewery / they only need the alcohol not the yeast / yeast is not needed in the beer / because some yeast is left over after the process / yeast is not used in the final product / yeast is not needed and left over	(1)

Question Number	Answer	Additional guidance	Mark
5(d)(ii)	in brewing other alcohol fermentation / baking / bread / marmite / brewers yeast / animal feed / (human) food / fertiliser;	Accept: to make vitamin supplements / tablets; to supply / treat people with vitamin B deficiency / low levels of vitamin B;  Ignore: source of vitamin B (in stem of question)	(1)

Question Number	Answer	Additional guidance	Mark
6(a)	(sulphur dioxide emissions) fall / go down/decrease / show negative correlation;	references to variations e.g. goes up in 1978/1979 Accept: gradual/steady decrease	(1)

Question Number	Answer	Additional guidance	Mark
6(b)	burning fossil fuels / burning named fossil fuel e.g. burn coal / gas fired power station ;	Ignore just factories / just power stations (could be nuclear) / just cars  Accept compost heaps / car exhaust / driving cars / burning sulphur Reject deforestation	(1)

Question Number	Answer	Additional guidance	Mark
6(c)	<p>One from:</p> <ol style="list-style-type: none"> <li>1. Dissolves in /reacts with/ combines with/in rain / water (in the air) / moisture (in the air);</li> <li>2. correct chemical details e.g. makes sulphuric acid;</li> </ol> <p>Two from:</p> <ol style="list-style-type: none"> <li>3. reacts with minerals in soil so plants cannot use them ;</li> <li>4. decreases pH of lakes /rivers / makes lakes /rivers acidic;</li> <li>5. bad affect on / kills organisms in lakes / rivers ;</li> <li>6. reduces biodiversity ;</li> <li>7. removes cuticles from leaves /damages leaves / kills plants / trees;</li> <li>8. corrosion of buildings / statues / limestone / marble / chalk / calcium carbonate / eq ;</li> <li>9. MP6 makes CO<sub>2</sub> increases global warming;</li> </ol>	<p>Ignore: mixes / trapped / absorbed / contaminates the rain. Accept: clouds for rain</p> <p>Reject: increases pH Ignore: affects pH</p> <p>Accept: correct chemical / biological details of effects e.g. reduces mucus layer of fish / fish gills less able to absorb oxygen; Ignore: pollution</p> <p>Accept: dissolves Ignore: erodes / wears away / damages. Ignore other stones. Ignore: damages skin / cars</p>	<p>(1)</p> <p>(2)</p> <p>maximum (3)</p>

Question Number	Answer	Additional guidance	Mark
7(a)	(External source of) fertilisers (e.g. runoff from farmland) / sewage / animal waste / tap water / decay;	Ignore: eutrophication	(1)

Question Number	Answer	Additional guidance	Mark
7(b)	Two from: 1. reduces light ; 2. so less/no photosynthesis / less glucose made; 3. plants die / kills plants / less / no growth;	Ignore: less oxygen, make food	(2)

Question Number	Answer	Additional guidance	Mark
7(c)	Two from: 1. Increase in numbers of microorganisms /bacteria / fungi / increase in amount of decay; 2. using/reducing oxygen (content of water); 3. (this causes )animals to die/move away to another area;	Accept: references to streams and rivers even though pond in question	(2)



Additional Science 5016H/1H  
 Biology 5028H /1H  
 B2 Mark Scheme

Question Number	Answer	Additional guidance	Mark
1(a)	(sulphur dioxide emissions) fall / go down/decrease / show negative correlation;	Ignore: references to variations e.g. goes up in 1978/1979 Accept: gradual/steady decrease	(1)

Question Number	Answer	Additional guidance	Mark
1(b)	burning fossil fuels / burning named fossil fuel e.g. burn coal / gas fired power station ;	Ignore just factories / just power stations (could be nuclear) / just cars  Accept compost heaps / car exhaust / driving cars / burning sulphur Reject deforestation	(1)

Question Number	Answer	Additional guidance	Mark
1(c)	<p>One from:</p> <p>10. Dissolves in /reacts with/ combines with/in rain / water (in the air) / moisture (in the air);</p> <p>11. correct chemical details e.g. makes sulphuric acid;</p> <p>Two from:</p> <p>12. reacts with minerals in soil so plants cannot use them ;</p> <p>13. decreases pH of lakes /rivers / makes lakes /rivers acidic;</p> <p>14. bad affect on / kills organisms in lakes / rivers ;</p> <p>15. reduces biodiversity ;</p> <p>16. removes cuticles from leaves /damages leaves / kills plants / trees;</p> <p>17. corrosion of buildings / statues / limestone / marble / chalk / calcium carbonate / eq ;</p> <p>18. MP6 makes CO<sub>2</sub> increases global warming;</p>	<p>Ignore: mixes / trapped / absorbed / contaminates the rain. Accept: clouds for rain</p> <p>Reject: increases pH Ignore: affects pH</p> <p>Accept: correct chemical / biological details of effects e.g. reduces mucus layer of fish /fish gills less able to absorb oxygen; Ignore: pollution</p> <p>Accept: dissolves Ignore: erodes / wears away / damages. Ignore other stones. Ignore: damages skin / cars</p>	<p>(1)</p> <p>(2)</p> <p>maximum (3)</p>

Question Number	Answer	Additional guidance	Mark
2(a)	(External source of) fertilisers (e.g. runoff from farmland) / sewage / animal waste / tap water / decay;	Ignore: eutrophication	(1)

Question Number	Answer	Additional guidance	Mark
2(b)	Two from: 4. reduces light ; 5. so less/no photosynthesis / less glucose made; 6. plants die / kills plants / less / no growth;	Ignore: less oxygen, make food	(2)

Question Number	Answer	Additional guidance	Mark
2(c)	Two from: 4. Increase in numbers of microorganisms /bacteria / fungi / increase in amount of decay; 5. using/reducing oxygen (content of water); 6. (this causes )animals to die/move away to another area;	Accept: references to streams and rivers even though pond in question	(2)

Question Number	Answer	Additional guidance	Mark
3(a)(i)	increase muscle (growth) ;	Accept: Bigger /stronger muscles Ignore big/strong muscles Accept side-effects if correct and given here	(1)

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	enhances performance/ win (more medals)/be better at their sport /be faster/be stronger/increased stamina;	Accept: Muscle strength increased if not awarded in 3ai	(1)

Question Number	Answer	Additional guidance	Mark
3(b)	Two from:  <ol style="list-style-type: none"> <li>1. increased hormone/named hormone (e.g. oestrogen) production;</li> <li>2. impotence (in men)/erectile dysfunction/reduced testes size/reduced fertility (in men);</li> <li>3. development of breast in men;</li> <li>4. facial hair growth in women;</li> <li>5. deepening of voice in women;</li> <li>6. liver failure/damage;</li> <li>7. heart disease/attack</li> <li>8. kidney disease</li> <li>9. stunted growth</li> </ol> ignore aggression/addiction ignore muscle turns to fat when you stop using them	Ignore: heart problem	(2)

Question Number	Answer	Additional guidance	Mark
3(c)	gives an unfair advantage / causes harmful effects on athletes /causes side-effects on athletes/bad example for youths;	Accept: Its not fair/it is cheating	(1)

Question Number	Answer	Additional guidance	Mark
4(a)	stops contamination (of the product) / so no other (living) microorganisms present / stops (unwanted microorganisms) competing ;	Ignore: kill (all) microorganisms (as this is what the sterilisation process actually does) Ignore: clean/cleaning Accept: prevent other microorganisms entering  Reject: removes bacteria	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	to stop unwanted microorganisms /viruses/bacteria entering;	Ignore: Contamination/ pollution/ substances/germs/ clean	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	So (aerobic) respiration can take place / prevent anaerobic respiration / bubbles help mix contents / to ensure conditions throughout the fermenter are the same e.g. temperature/pH ;	Ignore: To breathe/to grow/ to supply oxygen/air	(1)

Question Number	Answer	Additional guidance	Mark
4(c)	(temperature / pH) probes /sensors/ exhaust gases examined / samples taken (from harvest outlet) ;	Ignore: computers	(1)

Question Number	Answer	Additional guidance	Mark
4(d)	to optimise growth / to control growth/ maximise yield / to switch on genes ORA - e.g. if temperature too high/low, the bacteria will not ferment the mixture ;	Accept 'best' for optimum  Ignore: to keep everything level/to keep the conditions the same	(1)

Question Number	Answer	Additional guidance	Mark
5(a)(i)	three/3;	Accept: Eastern Asia, Western Asia and Northern Africa; any order	(1)

Question Number	Answer	Mark
5(a)(ii)	South eastern Asia ;	(1)

Question Number	Answer	Additional guidance	Mark
5(b)	Three from: 1. loss of habitat /places to live;  2. atmosphere CO2 levels increase (from burning/rotting/reduced photosynthesis) / increased global warming/greenhouse effect  3. increases soil erosion/increased leaching of minerals/nutrients ;  4. increases desertification;  5. rivers get silted;  6. (increased) flooding;  7. reduces biodiversity/ species /animals / plants become extinct;	Ignore: homes  Ignore: references to oxygen      Ignore animals die	(3)

Question Number	Answer	Additional guidance	Mark
6(a)	nucleus removed (from egg cell)/ enucleated ;	Reject: fertilise it Ignore use of enzymes Ignore DNA, genes, chromosomes	(1)

Question Number	Answer	Additional guidance	Mark
6(b)	<ol style="list-style-type: none"> <li>1. body cell taken from a another sheep</li> <li>2. nucleus removed (from body cell)</li> <li>3. nucleus held on a pipette</li> <li>4. nucleus inserted into (enucleated) egg</li> <li>5. (egg cell) treated with chemicals / hormones / electric pulse</li> <li>6. Grown into ball of cells / mitosis occurs / cells divide</li> <li>7. implanted in (uterus of surrogate) mother / sheep</li> </ol> <p>If a point is clearly given in the wrong order e.g. electric shock after it is implanted then do not award the mark. However, credit remainder of response appropriately.</p>	<p>Ignore genes/DNA/chromosomes only once in part (b)</p> <p>Accept develop into an embryo</p> <p>If 'fertilise' or 'zygote' anywhere in part b) deduct 1 mark which then gives a maximum possible mark of 3</p>	(4)





Additional Science 5018F/1F  
Chemistry 5038F/1F  
C2 Mark Scheme

Question Number	Answer	Mark
1(a)(i)	metal ;	(1)

Question Number	Answer	Mark
1(a)(ii)	contains free electrons ;	(1)

Question Number	Answer	Mark
1(a)(iii)	the element that is the main part of steel ;	(1)

Question Number	Answer	Mark
1(b)	sodium ; [Reject Na] chlorine ; [Reject Cl, Cl <sub>2</sub> ]	(2)

Question Number	Answer	Mark
2(a)	alkanes ;	(1)

Question Number	Answer	Mark
2(b)	C <sub>2</sub> H <sub>6</sub> ;	(1)

Question Number	Answer	Mark
2(c)	each carbon atom forms four stable bonds ;	(1)

Question Number	Answer	Mark
2(d)	12 + 4; (= 16)	(1)

Question Number	Answer	Mark
2(e)(i)	yellow / orange / red / brown ; (any combinations of the above colours allowed, reject other combinations eg yellow-blue)	(1)

Question Number	Answer	Mark
2(e)(ii)	It is an alkane /it is not an alkene / no double bonds/ saturated/ no reaction ;	(1)

Question Number	Answer	Mark
3(a)	<p>Surface area mark: larger surface area / (powder has) smaller pieces / more marble exposed / more contact with acid / OWTTE;</p> <p>Collisions mark: more (frequent) collisions ;</p>	(2)

Question Number	Answer	Mark
3(b)	hotter acid / heat / raise temperature / use more concentrated acid (allow stronger) acid / (suitable) catalyst ;	(1)

Question Number	Answer	Mark
3(c)(i)	(biological) catalyst / speeds up reactions ; Ignore answers such as 'breaks up food' - this is a definition of digestion which is in the stem	(1)

Question Number	Answer	Mark
3(c)(ii)	<p>advantage: plants grow more or faster or better / (can be sold as) organic / cheaper (than man-made fertilisers) / no (man-made) chemicals added [however, ignore any idea that man made chemicals are harmful] / 'natural' / higher selling price (of produce) / improve soil structure ; Ignore 'healthier', does not cause pollution, or any idea that crops are better, tastier etc</p> <p>disadvantage: variable or unknown composition / 'less concentrated' in nutrients - must use more / can cause pollution in rivers etc ;</p>	(2)

Question Number	Answer	Mark
4(a)	P ; [Allow B, Boron]	(1)

Question Number	Answer	Mark
4(b)	S ; [Allow Ar, Argon] [Reject A, AR]	(1)

Question Number	Answer	Mark
4(c)	R ; [Allow K, Potassium]	(1)

Question Number	Answer	Mark
4(d)	Q ; [Allow F, Fluorine]	(1)

Question Number	Answer	Mark
5(a)(i)	<p>Need two points:</p> <ul style="list-style-type: none"> <li>-Idea of chain large molecule / chain / 'repeating' or 'joining' (unit of some sort)</li> <li>-Second idea made from (small) molecules / alkenes / monomers / hydrocarbons / small chain (molecules) ;</li> </ul> <p>[Ignore references to plastic]</p>	(1)

Question Number	Answer	Mark
5(a)(ii)	<p>only one type of (single) monomer / only one product / made from alkene;</p>	(1)

Question Number	Answer	Mark
5(b)	<p>allow</p> <p>(note: H<sub>3</sub> - C bond as shown above is allowed)</p> <p>Allow molecule with one C=C bond (carbons do not have to be tetravalent) for one mark (molecule can have any number of carbons); [Allow correct dot and cross diagram Molecules with no double bonds will score zero]</p>	(2)

Question Number	Answer	Mark
5(c)	<p>First mark:  <math>&gt;C=C&lt;</math> bond breaks / double bond(s) break / opens up / OWTTE ;</p> <p>Second mark - dependent on first being awarded:  then form new (covalent) bond / molecules then bond / join / form chain / link ;  [Ignore 'combine' here]</p>	(2)

Question Number	Answer	Mark
5(d)	<p>any two of:</p> <ul style="list-style-type: none"> <li>• melts or softens ;</li> <li>• molecules would slide or move or separate ;  [Ignore particles/ atoms]</li> <li>• no or weak cross-links or inter-molecular forces (between molecules) ;  [Allow 'bonds' ONLY if it is absolutely clear they are inter-molecular eg  - 'weak bonds' NO,  - 'weak bonds between molecules' YES  - 'no intermolecular bonds' YES]</li> </ul> <p>[Ignore idea of bonds/ forces breaking or weakening]  [Allow layers/ chains instead of molecules]</p>	(2)

Question Number	Answer	Mark
5(e)	<p>conserves resources / oil / energy / prevents waste or rubbish / cuts down landfill use / cuts down CO<sub>2</sub> release if they are burnt instead / new polymer articles can be made / slow degradation / non-biodegradable ;  [Ignore 'better for environment' 'prevents pollution' etc as too vague]</p>	(1)

Additional Science 5018H/1H  
 Chemistry 5038H/1H  
 C2 Mark Scheme

Question Number	Answer	Mark
1(a)(i)	<p>Need two points:</p> <ul style="list-style-type: none"> <li>-Idea of chain large molecule / chain / 'repeating' or 'joining' (unit of some sort)</li> <li>-Second idea made from (small) molecules / alkenes / monomers / hydrocarbons / small chain (molecules) ;</li> </ul> <p>[Ignore references to plastic]</p>	(1)

Question Number	Answer	Mark
1(a)(ii)	<p>only one type of (single) monomer / only one product / made from alkene;</p>	(1)

Question Number	Answer	Mark
1(b)	<p style="text-align: right;">;;</p> <p>allow</p> <p>(note: H<sub>3</sub> - C bond as shown above is allowed)</p> <p>Allow molecule with one C=C bond (carbons do not have to be tetravalent) for one mark (molecule can have any number of carbons);        [Allow correct dot and cross diagram        Molecules with no double bonds will score zero]</p>	(2)

Question Number	Answer	Mark
1(c)	<p>First mark:  <math>&gt;C=C&lt;</math> bond breaks / double bond(s) break / opens up / OWTTE ;</p> <p>Second mark - dependent on first being awarded:  then form new (covalent) bond / molecules then bond / join / form chain / link ;  [Ignore 'combine' here]</p>	(2)

Question Number	Answer	Mark
1(d)	<p>any two of:</p> <ul style="list-style-type: none"> <li>• melts or softens ;</li> <li>• molecules would slide or move or separate ;  [Ignore particles/ atoms]</li> <li>• no or weak cross-links or inter-molecular forces (between molecules) ;  [Allow 'bonds' ONLY if it is absolutely clear they are inter-molecular eg  - 'weak bonds' NO,  - 'weak bonds between molecules' YES  - 'no intermolecular bonds' YES]</li> </ul> <p>[Ignore idea of bonds/ forces breaking or weakening]  [Allow layers/ chains instead of molecules]</p>	(2)

Question Number	Answer	Mark
1(e)	<p>conserves resources / oil / energy / prevents waste or rubbish / cuts down landfill use / cuts down CO<sub>2</sub> release if they are burnt instead / new polymer articles can be made / slow degradation / non-biodegradable ;  [Ignore 'better for environment' 'prevents pollution' etc as too vague]</p>	(1)



Question Number	Answer	Mark
2(a)	11 (p) 12 (n) 11 (e) ;; Allow 2 correct for one mark;	(2)

Question Number	Answer	Mark
2(b)(i)	One electron (transferred); From Na to Cl / Na loses and Cl gains;	(2)

Question Number	Answer	Mark
2(b)(ii)	ionic / electrovalent ;	(1)

Question Number	Answer	Mark
2(c)	<p>Any two of</p> <ul style="list-style-type: none"> <li>• strong forces / bonds / electrostatic attraction / bonds hard to break ; [Reject strong intermolecular forces]</li> <li>• between ions / ionic bonding / ionic bonds; [Ignore atoms / molecules here]</li> <li>• a lot of heat / energy needed ; [Ignore 'high temperature needed']</li> </ul> <p>[Allow one mark maximum if covalent bonding or intermolecular forces mentioned eg 'strong covalent bonds' scores 1; 'strong covalent bonds need a lot of energy to break' also just 1 only]</p>	(2)

Question Number	Answer	Mark
3(a)(i)	2, 8, 8 ; [Allow 2 8 8 / 2-8-8 etc or correct diagram]	(1)

Question Number	Answer	Mark
3(a)(ii)	Any two from: unreactive (accept not very reactive) / stable ;  full outer shell / 8 electrons in outer shell ;  stops filament evaporating / reacting / burning / oxidising / replaces or excludes air or oxygen ;  Ignore references to conduction of electricity	(2)

Question Number	Answer	Mark
3(b)	20.2;; [Allow 20.182 for 1 mark]  working with incorrect final answer scores 1: $\frac{(20 \times 90.90) + (22 \times 9.10)}{100}$	(2)

Question Number	Answer	Mark
4(a)	<p>First mark for WEAK forces: Weak forces / bonds (between molecules); [Reject weak covalent, ionic or intramolecular bonds]</p> <p>Second mark dependant on first - for intermolecular or energy: between (N<sub>2</sub>)molecules / intermolecular / requires little energy to overcome;</p> <p>'Weak bonds' = 0, 'weak forces between atoms' = 0 as we assume these are N≡N bonds unless otherwise specified</p>	(2)

Question Number	Answer	Mark
4(b)	<p>3 x shared pair of electrons between N and H (3 covalent bonds); lone pair / remaining 2 electrons on N outer shell;</p> <p>[Notes: -as long as numbers of electrons correct, allow any combination of dots and crosses -element symbols not required -can only score 2 marks if fully correct -if inner shells shown incorrectly, penalise a 2 mark answer, but not a 1 mark answer]</p>	(2)

Question Number	Answer	Mark
4(c)	<p>Mark for yield: yield decreases / less ammonia / product; [Ignore references to reactant for this mark]</p> <p>Movement of equilibrium mark (does not depend on first mark): Equilibrium 'moves left' / gives more reactant / endothermic reaction favoured ; [Ignore 'reaction would reverse', 'reaction becomes endothermic']</p> <p>[Ignore rate arguments]</p>	(2)

Question Number	Answer	Mark
4(d)	increase rate (of attainment of equilibrium) /to speed up reaction /a lower temperature can be used / more (frequent) successful collisions; Allow lowers activation energy;	(1)

Question Number	Answer	Mark
4(e)	$\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$ ; [reactant formulae; product formula; If formulae correct but unbalanced scores maximum 1]	(2)

Additional Science 5020F/1F  
 Physics 5048F/1F  
 P2 Mark Scheme

Question Number	Answer	Mark												
1(a)	<p>one mark for each; if 4 ticks max mark =2, if all boxes ticked no marks can be awarded</p> <table border="1"> <thead> <tr> <th>condition</th> <th>Increases stopping distance?</th> </tr> </thead> <tbody> <tr> <td>car full of passengers</td> <td>✓</td> </tr> <tr> <td>driving slower</td> <td></td> </tr> <tr> <td>good brakes</td> <td></td> </tr> <tr> <td>icy roads</td> <td>✓</td> </tr> <tr> <td>worn tyres</td> <td>✓</td> </tr> </tbody> </table>	condition	Increases stopping distance?	car full of passengers	✓	driving slower		good brakes		icy roads	✓	worn tyres	✓	(3)
condition	Increases stopping distance?													
car full of passengers	✓													
driving slower														
good brakes														
icy roads	✓													
worn tyres	✓													

Question Number	Answer	Accept	Ignore	Reject	Mark
1(b)	(his reaction time) is increased;	<i>be careful that it is his reaction time that is increased and not his reaction speed,</i> hence allow 'longer' /OWTTE (his reactions are) slower/eq	References to stopping distances /car speed	decreases	(1)

Question Number	Answer	Accept	Reject	Mark
2(a)	bombarded ;			(1)

Question Number	Answer	Accept	Reject	Mark
2(b)	One mark for each correct line ; Any two lines to or from a box negates that mark fuel -----uranium ; energy-----heat ;			(2)

Question Number	Answer	Accept	Reject	Mark
2(c)	turbine and a generator ;			(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(d)	any sensible suggestion;	<ul style="list-style-type: none"> <li>• mention of previous incident e.g. Chernobyl</li> <li>• possible terrorist activity</li> <li>• idea of 'radioactivity' (radiation, waste) <i>possibly</i> dangerous</li> <li>• possible incident e.g. meltdown /going critical</li> </ul>	idea of nuclear power stations exploding 'dangerous substances'  Idea of radiation emission in normal use		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(e)	any sensible suggestion ;	<ul style="list-style-type: none"> <li>no greenhouse effect</li> <li>no CO<sub>2</sub> emitted</li> <li>no pollution of the <u>atmosphere</u> e.g. smoke, dangerous gases, acid rain, specified (correct) gas</li> <li>very energy dense</li> </ul>	ref to other pollution  fossil fuels natural resources environmentally friendly no waste		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(f)	any sensible suggestion;	<ul style="list-style-type: none"> <li>deep burial land /sea</li> <li>vitriification /eq</li> <li>sealed containers with security (both ideas necessary)</li> </ul>	landfill----- ---  security by itself is not enough	idea of local surface tip  burn it	(1)

Question Number	Answer	Accept	Reject	Mark
3(a)(i)	ionises the air ;			(1)

Question Number	Answer	Accept	Reject	Mark
3(a)(ii)	smaller;			(1)

Question Number	Answer	Accept	Reject	Mark
3(a)(iii)	alpha particles;			(1)

Question Number	Answer	Accept	ignore	Reject	Mark
3(b)	any ONE correct explanation/ statement about any one of ;  range  penetration /absorption	e.g. <ul style="list-style-type: none"> <li>• (highly ionising <i>and therefore</i>)small range</li> <li>• alpha can only travel few cm (max 20cm if a number given)</li> <li>• it can be stopped by paper/ shielding</li> </ul> also allow <ul style="list-style-type: none"> <li>• small <u>activity</u> level /eq</li> <li>• fitted in ceiling so no one can get near it</li> </ul>	beta  bald ‘highly ionising’  quickly  half-life  strength	incorrect physics, i.e. ionising ability is small	(1)



Question Number	Answer	Accept	ignore	Reject	Mark
4(a)	58 ;	allow +/- 0.5	Units		(1)

Question Number	Answer		Accept		Reject	Mark
4(b)	subst.; ans;	400/58 6.9	allow ecf from 4a Bald correct answer (6.9) scores both marks  allowed range 6.8-7.0 for both marks  For 1 mark $13/2 = 6.5$	Bald incorrect ans = 0  Ignore no of dp/ sig figs	units if seen must be correct in the ans	(2)

Question Number	Answer	Accept	Reject	Mark
4(c)	C ;	at the end of the race	A B	(1)

Question Number	Answer		Accept	Comments	Reject	Mark
4(d)	subst.;  answer ;	$0.5 \times 80 \times 13^2$  6760	<p><i>ensure that any substitution is dimensionally correct</i></p> <p><math>0.5 \times 80 \times 13 \times 13</math></p> <p>allow velocity range of 12.5-13.5</p> <p>Ans in the range 6250-7290</p> <p>For 1 mark</p> <ul style="list-style-type: none"> <li>• 520 (.5 X 80 X 13)</li> <li>• 13520 (80 X 13 X 13)</li> <li>• 1849 - 1961 (using 6.8-7.0 not 13)</li> </ul>	276 (.5 X 80 X 6.9) 2 mistakes =0	<p>incorrect units for one mark</p> <p>incorrect sub of 800 for mass for both marks</p>	(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
5(a)	any 2 from: causal mechanism  what moves  which direction;;	<p>e.g. (due to) friction/rubbing</p> <p>negative charge moves OR electrons</p> <p>onto hose OR from fuel</p>	repeat of stem	<p>Reject incorrect physics</p> <p>reject for the last two marking points ions or positive electrons</p>	(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
5(b)	consequence AND <i>some</i> explanation;  OR explanation AND <i>some</i> consequence;	both needed for the mark e.g. chance of explosion as fuel is flammable chance of explosion/ignition if spark  static build-up/it could ignite fuel static build-up/it could cause explosion spark/it could ignite fuel	Do not award repeat of stem...'it is dangerous'  (electric /static) shock	unqualified explosion	(1)

Question Number	Answer	Accept	Comments	Reject	Mark
5(c)	movement of charge (in wire);  effect of this movement;	electrons/charges move (along the wire) electrons/charges move (from hose to plane)  this discharges it/the static build-up this neutralises it this earths it/to earth this grounds it/to ground gives plane and hose the same potential / same charge  this prevents a build up of charge for both marks	Mark in either order  floor	ions or positive electrons for the first mark UNLESS mark has been deducted in 5a	(2)

Question Number	Answer	Accept		Reject	Mark
6(a)	any sensible <i>suggestion</i> ;	<ul style="list-style-type: none"> <li>• lack of perception of risk</li> <li>• to check for fit (with movement of feet)</li> <li>• children had scientific interest</li> <li>• to keep them happy/amused</li> </ul>			(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
6(b)	<p>any sensible concept and consequence based on physics;</p> <p>OR</p> <p>they can cause DNA mutation</p>	<p>both needed</p> <p>Any sensible suggestion e.g. X-rays are dangerous.... <u>and</u></p> <ul style="list-style-type: none"> <li>• need trained operator</li> <li>• need to limit dose of X-rays</li> <li>• in high doses</li> <li>• with long exposure</li> <li>• shielding is needed</li> </ul> <p><i>look for reversed answers such as ionising radiation and therefore dangerous</i></p> <p>they can cause cancer / cell mutation / cell damage</p>	<p>Confusion with gamma too expensive</p> <p>unqualified 'health risk'</p> <p>unqualified 'dangerous'</p>		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
6(c)(i)	any sensible <i>suggestion</i> ;	<ul style="list-style-type: none"> <li>doctors are trained</li> <li>doctors understand the risks /know what they are doing</li> <li>(they) closely monitor /control the dose</li> <li>(they)/doctors take suitable precautions during use</li> <li>idea of lesser of 2 risks--X-ray or illness</li> <li>will do more good than harm</li> <li>this use is sensible / eq / ORA</li> </ul>	<ul style="list-style-type: none"> <li>Can/ helps to diagnose illness unless qualified, e.g. barium x-ray</li> <li>Dose is less nowadays</li> <li>Used to treat illness</li> </ul>		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
6(c)(ii)	can 'see' what is happening in real time/eq	<ul style="list-style-type: none"> <li>ORA</li> <li>X-ray gives you one photo—fluoroscope gives continuous monitoring</li> <li>See it as it is done</li> <li>Moving/video images possible</li> </ul>	<ul style="list-style-type: none"> <li>'better (image)' is not enough</li> <li>portability</li> <li>cost</li> <li>smaller area</li> <li>can be in same room or converse</li> <li>clear(er) image</li> <li>bald 'quicker'</li> </ul>		(1)



Additional Science 5020H/1H  
 Physics 5048H/1H  
 P2 Mark Scheme

Question Number	Answer	Accept	Ignore	Reject	Mark
1(a)	any 2 from: causal mechanism  what moves  which direction;;	e.g. (due to) friction/rubbing  negative charge moves OR electrons  onto hose OR from fuel	repeat of stem	Reject incorrect physics  reject for the last two marking points ions or positive electrons	(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
1(b)	consequence AND <i>some</i> explanation;  OR explanation AND <i>some</i> consequence	both needed for the mark e.g. chance of explosion as fuel is flammable chance of explosion/ignition if spark  static build-up/it could ignite fuel static build-up/it could cause explosion spark/it could ignite fuel	Do not award repeat of stem...'it is dangerous'  (electric /static) shock	unqualified explosion	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
1(c)	<p>movement of charge (in wire);</p> <p>effect of this movement;</p>	<p>electrons/charges move (along the wire / from hose to plane)</p> <p>this discharges it/the static build-up this neutralises it this earths it / to earth this grounds it / to ground gives plane and hose the same potential/ same charge</p> <p>Prevents build-up of charge for both marks</p>	<p>floor</p>	<p>ions or positive electrons for the first mark UNLESS mark has been deducted in 5a</p>	(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(a)	any sensible <i>suggestion</i> ;	<ul style="list-style-type: none"> <li>• lack of perception of risk</li> <li>• to check for fit (with movement of feet)</li> <li>• children had scientific interest</li> <li>• to keep them happy/amused</li> </ul>			(1)



Question Number	Answer	Accept	Ignore	Reject	Mark
2(b)	<p>any sensible concept and consequence based on physics;</p> <p>OR</p> <p>they can cause DNA mutation</p>	<p>both needed</p> <p>Any sensible suggestion e.g. X-rays are dangerous... <u>and</u></p> <ul style="list-style-type: none"> <li>• need trained operator</li> <li>• need to limit dose of X-rays</li> <li>• in high doses</li> <li>• with long exposure</li> <li>• shielding is needed</li> </ul> <p>look for reversed answers such as ionising radiation and therefore dangerous</p> <p>they can cause cancer / cell mutation / cell damage</p>	<p>Confusion with gamma too expensive</p> <p>unqualified 'dangerous'</p> <p>unqualified health-risk</p>		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(c)(i)	any sensible <i>suggestion</i> ;	<ul style="list-style-type: none"> <li>doctors are trained</li> <li>doctors understand the risks /know what they are doing</li> <li>(they) closely monitor /control the dose</li> <li>(they)/doctors take suitable precautions during use</li> <li>idea of lesser of 2 risks--X-ray or illness</li> <li>will do more good than harm</li> <li>this use is sensible / eq / ORA</li> </ul>	<ul style="list-style-type: none"> <li>Can/ helps to diagnose illness unless qualified, e.g. barium x-ray</li> <li>Dose is less nowadays</li> <li>Used to treat illness</li> </ul>		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
2(c)(ii)	can 'see' what is happening in real time/eq	<ul style="list-style-type: none"> <li>ORA</li> <li>X-ray gives you one photo—fluoroscope gives continuous monitoring</li> <li>See it as it is done</li> <li>Moving/video images possible</li> </ul>	'better (image)' is not enough portability cost smaller area can be in same room or converse clear(er) image		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
3(a)(i)	<p>he/she should raise it ;</p> <p>bring it forwards;</p> <p><i>either order</i></p>	<ul style="list-style-type: none"> <li>• for either mark but only credit this once: move it so that it is in the good/ correct region</li> <li>• make the height equal to Y (Y in range +4cm to -6 cm) / reduce height difference / eq</li> <li>• make the backset equal to X (X in range 0-8cm) / reduce the backset / eq</li> <li>•</li> </ul>	<p>move it vertically increase the height difference</p> <p>change the backset</p>		(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
3(a)(ii)	reduction of chance of injury;	<ul style="list-style-type: none"> <li>• reduction of named relevant injury e.g. whiplash</li> <li>• to ensure (correct) support of head</li> <li>• (correct) protection of neck / head</li> <li>• to make sure its in the good region on the graph <i>if not given in 3ai</i></li> </ul>	bald 'its safer'		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
3(b)	any sensible suggestion;	<p>perception of improved safety e.g. he thinks he's safer with ABS brakes</p> <p>reduction in risk avoidance</p>			(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
3(c)	<p>decreases rate of change of momentum for both marks</p> <p>OR</p> <p>any two from</p> <p>longer time of impact</p> <p>momentum is reducing to zero</p> <p>force is reduced;;</p>	<p>reduces momentum more slowly for 2 marks</p> <p>Slower impact</p> <p>If no argument in terms of momentum/time/force then allow a maximum mark of 1 for an energy argument, e.g. absorbs some of the energy of the car</p>	<p>references to stopping distance of car</p> <p>bald 'reduces momentum' 'absorbs momentum'</p>		(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(a)(i)	(atom/nucleus with) same no of protons different numbers of neutrons;	allow same element /atomic no  different number of neutrons /atomic mass /mass number	Bald different mass	Same no of n different no of p	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(a)(ii)	alpha is 4 nucleons, tritium has (only) 3) /eq;	tritium has only 1p, 2p are in alpha tritium has not got enough mass tritium has not got enough nucleons tritium has not got enough p tritium has not got enough p+n	tritium is too small  tritium has not got enough neutrons		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(b)	any one from  energy explanation  absorption explanation  penetration explanation;	e.g.  <ul style="list-style-type: none"> <li>• beta particles have given up all their KE on impact</li> <li>• beta particles have hit phosphor therefore none can escape</li> <li>• beta can not penetrate thick glass</li> </ul>	beta particles have low ionisation /OWTTE    no gas can escape gas /beta can not leak		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(c)(i)	time for half of the atoms to decay  OR  time for the (radio)activity to drop to half (of original value);	accept isotope / element / nuclei / radioactive substance/radioactive material / tritium for atoms   must be clear and correct as to what has halved	mass particles matter	do not accept ion(s)/atom/reactivity  do not accept decompose/die/lose for decay	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(c)(ii)	method shown as maths or on graph;  13.5 years;                      +/- 0.5 years	Bald correct answer (in range) with unit, 2 marks, without unit 1 mark  check values from graph allow y or yrs for years			(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(d)	both must be seen <ul style="list-style-type: none"> <li>correct statement re time (at which the count is 400 or count at 20 years)</li> <li>correct judgement re claim</li> </ul>	description of fading/OWTTE <i>with</i> time  comparison of 440 to 400	random nature of decay  mention of half-life		(1)

Question Number	Answer	Accept	Comments	Reject	Mark
5(a)(i)	subst.; ans; unit;	$38 \times 1.2$ 45.6 kg m/s	unit is independent mark, allow Ns		(3)

Question Number	Answer	Accept	Accept	Reject	Mark
5(a)(ii)	subst.; ans;	$35 \times 6$ 210(J)	ignore missing unit	incorrect units for one mark	(2)

Question Number	Answer	Accept	Ignore	Reject	Mark
5(b)(i)	Frank continues in straight line;  no force acting on him to cause him to change direction;	<ul style="list-style-type: none"> <li>• He carries on straight</li> <li>• He slides to outside of sledge</li> <li>• He falls off outside of sledge</li> </ul> <p>Any of above mark points can be gained either in words or by unambiguous additions to diagram (eg arrow / clear sequence of blobs ) .</p> <ul style="list-style-type: none"> <li>• there is no force / friction to keep him going in a circle / hold him on the sledge</li> <li>• no change in direction of momentum</li> <li>• he has inertia</li> </ul>	References to trajectory of sledge		(2)



Question Number	Answer	Accept	Ignore	Reject	Mark
5(b)(ii)	he will hit the <u>far</u> side of the box;	<ul style="list-style-type: none"> <li>• hits outer edge of box</li> <li>• breaks through the side of the box</li> <li>• box tips over / Simon falls out (to the outside of the arc)</li> </ul>	Unqualified “Simon stays inside the box”	Box tips over /Simon falls out to inside of arc / backwards	(1)



Biology 5029/01  
B3 Mark Scheme

Question Number	Answer	Mark
1(a)	Two from: arched back / eye staring / eyes wide open / tail down / tucked in / tail curled / close to body / ears forward / ears up / making itself look big / hair standing on end / bristling fur;;  ignore: changed body language / changed facial expression	(2)

Question Number	Answer	Mark
1(b)	aggression / anger / feeling threatened / fear / stay away / go away;	(1)

Question Number	Answer	Mark
1(c)	Any two: <ol style="list-style-type: none"> <li>1. body language / examples of body language;</li> <li>2. facial expression / examples of facial expression;</li> <li>3. sign language / mime / hand signals;</li> <li>4. drawing / art / music / dance;</li> <li>5. morse code / semaphore ;</li> <li>6. pheromones / perfumes / do not accept just smell;</li> <li>7. video / movies;</li> </ol> ignore: personality moods / texting / emails	(2)

Question Number	Answer	Mark
2	<p>2. Draw <b>one</b> straight line from each product to the organism used in its production.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><b>product</b></p> <div style="border: 1px solid black; padding: 5px; width: 200px; margin-bottom: 10px;">citric acid (used in fizzy drinks)</div> <div style="border: 1px solid black; padding: 5px; width: 200px; margin-bottom: 10px;">carrageen extract (used as a gelling agent)</div> <div style="border: 1px solid black; padding: 5px; width: 200px; margin-bottom: 10px;">invertase (enzyme used in the manufacture of sweets)</div> <div style="border: 1px solid black; padding: 5px; width: 200px;">vitamin C</div> </div> <div style="text-align: center;"> <p><b>organism</b></p> <div style="border: 1px solid black; padding: 5px; width: 150px; margin-bottom: 10px;">seaweed</div> <div style="border: 1px solid black; padding: 5px; width: 150px; margin-bottom: 10px;"><i>Aspergillus</i></div> <div style="border: 1px solid black; padding: 5px; width: 150px; margin-bottom: 10px;"><i>Acetobacter</i></div> <div style="border: 1px solid black; padding: 5px; width: 150px;">Saccharomyces (yeast)</div> </div> </div> <p>3 or 4 correct = 3 marks  2 correct = 2 marks  1 correct = 1 mark  if two or more lines come from one product award no mark for that product</p>	(3)

Question Number	Answer	Mark
3	<ol style="list-style-type: none"> <li>1. thinking ;</li> <li>2. instinctive ;</li> <li>3. conditioning ;</li> <li>4. learned ;</li> </ol>	(4)

Question Number	Answer	Mark
4(a)(i)	<p>proteins / carbohydrates or named examples e.g. sucrose /starch / maltose;</p> <p>ignore: lactose, glucose, sugar</p>	(1)

Question Number	Answer	Mark
4(a)(ii)	<p>1. amino acid / (poly)peptides;</p> <p>2. sugar, glucose;</p> <p>ignore: lactose, sucrose, proteins</p>	(2)

Question Number	Answer	Mark
4(b)	<p>stops its action/ stops it secreting enzymes;</p> <p>ignore: kills it / breaks it down / digests it</p>	(1)

Question Number	Answer	Mark
4(c)	<p>to stop any further fermentation / destroys / kills microorganisms / kills bacteria / extends shelf life;</p> <p>ignore: germs /sterilise</p> <p>reject: remove / get rid of (bacteria)</p>	(1)

Question Number	Answer	Mark
5(a)	40 ;	(1)

Question Number	Answer	Mark
5(b)(i)	number of visits increased (from 11/12 to 54/55/56);	(1)

Question Number	Answer	Mark
5(b)(ii)	more food needed by young ;	(1)

Question Number	Answer	Mark
5(c)	Repeat test / compare to other people's results / take readings more often ;	(1)

Question Number	Answer	Mark
5(d)	less risk of disturbing the birds / reduces unnatural behaviour/ get to inaccessible areas / ability to record / store results / continuous / accurate record;	(1)

Question Number	Answer	Mark
6(a)	more predictable results / acceptable to vegetarians / animals not hurt / large scale production; ignore: safer / more hygienic / faster	(1)

Question Number	Answer	Mark
6(b)	the milk sets / forms (solid) curds / clots / lumps / coagulates / separates solid from liquids; ignore: thickens / speeds up fermentation / speeds up cheese making	(1)

Question Number	Answer	Mark
6(c)	the chymosin is not GM / the cheese does not contain the GM organism / yeast; ignore: references to not harming animals	(1)

Question Number	Answer	Mark
7(a)	<p>two from:</p> <ol style="list-style-type: none"> <li>1. separate the X &amp; Y sperms / use X or Y sperm; ignore: use X and Y sperm / IVF</li> <li>2. separate male and female embryos / embryo screening ;</li> <li>3. use ultrasound then terminate / retain;</li> <li>4. cloning;</li> </ol>	(2)

Question Number	Answer	Mark
7(b)	<p>Advantage (one of)  faulty genes can be eliminated / reduce risk of sex linked genetic disorders / named sex linked genetic disorder / fewer terminations / fewer girl killing in named country / family issues e.g. balance of previous children ; ignore social comments e.g. picking coloured clothes in advance</p> <p>Disadvantage (one of)  may skew gender balance / risk of designer babies / reduce gene pool / more terminations; ignore: unnatural / religious references</p>	(2)



Question Number	Answer	Mark
8(a)	to find areas of new food / used up food / overgrazed where they are; ignore: escape predators / find shelter	(1)

Question Number	Answer	Mark
8(b)	three from: <ol style="list-style-type: none"> <li>1. herbivores / wildebeest eat plants / grass ;</li> <li>2. plant material / herbivore food low in proteins / amino acids / nutrients / energy ;</li> <li>3. plant material / cellulose harder to digest (than meat) ;</li> <li>4. lions are carnivores/predators /eat meat ;</li> <li>5. so food rich in protein / amino acids / energy / nutrients ;</li> </ol>	(3)

Question Number	Answer	Mark
8(c)(i)	good eyesight / eyes at front of head / binocular vision / judge distance well / good night vision / large claws / sharp claws / good sprinters / powerful front limbs / powerful enough to overcome prey / hunt in groups / pointed teeth / large canines / powerful jaws / camouflage / ability to creep forward low / stay upwind when hunting;  ignore: sharp / long / large teeth /run fast / see in the dark	(1)

Question Number	Answer	Mark
8(c)(ii)	good sense of smell / eyes on side of head / all round vision / horns /quick to run away / good long distance runner / fast runner / idea of herd acts as many eyes / form protective circle;	(1)

Question Number	Answer	Mark
9(a)	omega 3 / stanol (esters)/statins; ignore benecol as trade name	(1)

Question Number	Answer	Mark
9(b)	two of: 1. reduces (cholesterol / fat) deposits in arteries / no (further) build up of deposits; ignore veins 2. reduces atheromas / arteriosclerosis / atherosclerosis; 3. improve blood flow / circulation; 4. heart has to work less hard / less chance of heart strain / attack / failure / disease / stroke; ignore heart problems / diabetes 5. Lowers high blood pressure;	(2)

Question Number	Answer	Mark
9(c)	(trial on ) lots of people ( if numbers quoted must be at least 10)/ over long period of time (if length of time must be 3 months minimum) / test on both males and females / test various ages / range of people / use placebo / double blind test / use control group / test (cholesterol) before and after;	(1)

Question Number	Answer	Mark
10(a)	Fit/healthy / parasite free / parasite load low / parasite resistant / has good genes / improve gene pool / improve offspring fitness/strength / more chance of chicks surviving; Ignore: attractive / more chicks (as ORA of stem)	(1)

Question Number	Answer	Mark
10(b)	wouldn't be able to fly /so hard to fly that predators will catch them (easily)/ can't catch food effectively / some long tailed swallows will mate with short tail swallows / there is a maximum length for tail length because the mutation for even longer tail length has not yet occurred; ignore: males will die / harder to fly	(1)

Question Number	Answer	Mark
10(c)(i)	more attractive to females /attract more females /more likely to breed with fit females;	(1)

Question Number	Answer	Mark
10(c)(ii)	Not enough food supplied to the chicks qualified / males not fit enough to catch/supply enough food for large numbers of chicks;	(1)

Question Number	Answer	Mark
11(a)	<p>One from: idea of:</p> <ol style="list-style-type: none"> <li>1. some people have different alleles / versions of genes (that produce a chemical) resulting in a reaction with penicillin ;</li> </ol> <p>reject: genes react with penicillin / ORA ignore: people have different genes</p> <ol style="list-style-type: none"> <li>2. some people produce different chemicals some of which may react with penicillin;</li> </ol>	(1)

Question Number	Answer	Mark
11(b)	<p>three from:</p> <ol style="list-style-type: none"> <li>1. reduced allergic responses / less side effects;</li> <li>2. named examples of allergic responses / side effects e.g. less damage to healthy tissues;</li> <li>3. better targeting particular diseases/variants of disease / symptoms;</li> <li>4. drug dosages / type of drug can be specific to patient;</li> </ol> <p>ignore: 'safer' as in question ignore: 'personalised medicine'</p>	(3)

Question Number	Answer	Mark
11(c)	<p>two from:</p> <ol style="list-style-type: none"> <li>1. technology not perfected yet / not widely available (to all doctors) yet;</li> <li>2. too expensive (for most);</li> <li>3. trials to see (long term) side effects;</li> <li>4. trials to see effectiveness required;</li> <li>5. all genomes not yet available / may be regarded as private / withheld;</li> </ol>	(2)

Question Number	Answer	Mark
12(a)	(a crop) that has had genes added / taken away ; ignore: genes altered	(1)

Question Number	Answer	Mark
12(b)	<p>four from (NB at least one advantage and one concern)</p> <p>Advantages:</p> <ol style="list-style-type: none"> <li>1. increased resistance to insects / pests ;</li> <li>2. disease resistance ;</li> <li>3. improved resistance to environmental stress / drought / extreme environments / salinity ;</li> <li>4. herbicide / pesticide tolerance / resistance; reject immunity</li> <li>5. reduced pesticide / fertiliser requirements - e.g. ability to fix nitrogen ;</li> <li>6. improved nutritional value ;</li> <li>7. biopharmaceuticals can be developed ;</li> <li>8. increased yield;</li> <li>9. increased shelf life;</li> </ol> <p>Concerns:</p> <ol style="list-style-type: none"> <li>10. effects on human health not fully understood ;</li> <li>11. reduced biodiversity / gene pool / long term effects on food chains ;</li> <li>12. gene transfer to other species;</li> <li>13. qualified 'not natural' arguments ;</li> <li>14. corporate control arguments / countries become dependent on GM companies;</li> <li>15. increased cost to farmers / consumers / countries;</li> </ol>	(4)

Question Number	Answer	Mark
13(a)	<ol style="list-style-type: none"> <li>1. nomadic / move from place to place / OWTTE ;</li> <li>2. collect /gather / find / hunt for food;</li> </ol>	(2)

Question Number	Answer	Mark
13(b)	<p>two of: bushmen have:</p> <ol style="list-style-type: none"> <li>1. better communication / use (sophisticated) language;</li> <li>2. keep tools / better technology / better tools /specific examples e.g. weapons, traps, bows, clothes, shelters; ignore - using / making tools</li> <li>3. fire / cook;</li> <li>4. meet other groups for larger (social) gatherings / OWTTE;</li> <li>5. travel larger distances;</li> </ol> <p>ignore - more intelligent / more evolved /easier to catch food</p>	(2)

Question Number	Answer	Mark
13(c)	<p>two from:</p> <ol style="list-style-type: none"> <li>1. hunter-gather until 10 500 years ago / farmer after 10 500 years ago; accept any date from 11 000 to 10 500 BP</li> <li>2. By/After 10 500 years ago (evidence suggests) they had domesticated sheep/goats / before 10 500 there are not many sheep and goat bones; accept any date from 11 000 to 10 500 BP</li> <li>3. Farming allowed settling/houses/towns to develop;</li> </ol>	(2)

Chemistry 5039/01  
C3 Mark Scheme

Question Number	Answer	Mark
1(a)(i)	two from:  preparation: use of (conc)(hydrochloric) acid to clean wire (loop)/ make wooden splint damp;  sample: use of flame test wire (loop) to collect sample/ dip splint into sample or solution;  flame: hold sample <i>in</i> (Bunsen) flame [NB: Ignore above or over flame];	(2)

Question Number	Answer	Mark
1(a)(ii)	sodium ions;	(1)

Question Number	Answer	Mark
1(b)(i)	iron(III) ions ;	(1)

Question Number	Answer	Mark
1(b)(ii)	white ;	(1)

Question Number	Answer	Mark
1(c)	barium chloride solution ;	(1)

Question Number	Answer	Mark
2(a)	any specified suitable use eg drinking/ cooking/ watering gardens/ flushing lavatory ;  Ignore vague ideas eg 'use in industry' / 'solvent' but allow specifics eg cooling water in power stations NB: Ignore answers regarding washing - humans or clothes, cars etc	(1)

Question Number	Answer	Mark
2(b)	(sodium) carbonate/ $\text{Na}_2\text{CO}_3$ ; Reject incorrect formula eg $\text{NaCO}_3$ / $\text{NA}_2\text{CO}_3$ / $\text{NAHCO}_3$	(1)

Question Number	Answer	Mark
2(c)	triglyceride / fat / oil / ester / fatty / carboxylic acid / suitable named substance; [Ignore glycerine/ glycerol]  alkali / suitable named alkali eg sodium hydroxide/ $\text{NaOH}$ / potassium hydroxide/ $\text{KOH}$ ; [Allow calcium hydroxide]	(2)

Question Number	Answer	Mark
2(d)(i)	soap mark: produce scum or precipitate/ use of washing soda /waste soap/ use of excess soap / soap reacts with calcium or magnesium ions;  detergent mark: detergents produce lather / no scum / not wasted ;	(2)

Question Number	Answer	Mark
2(d)(ii)	biological detergents contain enzymes/ other suitable difference /biological detergents remove blood stains/ biological may cause irritation in some people/ biological work at lower temps/ biological cannot be used at too high temp;	(1)



Question Number	Answer	Mark
3(a)	any suitable two <i>products</i> e.g. detergents [Ignore soap]/ paints / dyes/ fertiliser/ fibres/ explosives ;; Allow chemical names 'ammonium sulphate' = fertiliser/ copper sulphate etc; Ignore non-products eg battery acid/ cleaning metals Ignore plastics	(2)

Question Number	Answer	Mark
3(b)	only oxygen in air reacts / other gases do not react with sulphur/air is cheaper than pure oxygen / air can be obtained directly from surroundings; Ignore reactivity of oxygen ('too reactive in pure oxygen')	(1)

Question Number	Answer	Mark
3(c)(i)	vanadium(V) oxide /vanadium oxide/ $V_2O_5$ ; Reject other roman numerals eg vanadium(III) oxide or incorrect formulae eg $VO_5$ / $V_5O_5$	(1)
3(c)(ii)	$2 SO_2 + O_2 \rightleftharpoons 2 SO_3$ ;;; (in either direction)  or all three formulae ; balancing of correct formulae inc multiples; equilibrium sign or $\rightleftharpoons$ (stand alone in any equation); reject $\leftrightarrow$ symbol	(3)

Question Number	Answer	Mark
3(d)	passed into (concentrated /pure) sulphuric acid/ $H_2SO_4$ / make into oleum and dilute; Reject dilute sulphuric acid	(1)

Question Number	Answer	Mark
4(a)	<p>two feature of copper and/or compounds from variable valency ;  coloured compounds (allow blue compounds);  act as catalyst ;  good conductor of electricity ;  good conductor of heat ;  high density / dense;  malleable;  ductile;  hard;  sonorous;  [Ignore strong]  high melting point/ high boiling point ;  Note cannot score for both high m.p. and high b.p.</p>	(2)

Question Number	Answer	Mark
4(b)(i)	<p>copper sulphate / <math>\text{CuSO}_4</math> / copper chloride/ <math>\text{CuCl}_2</math> /  copper nitrate / <math>\text{Cu}(\text{NO}_3)_2</math> ;  Ignore sulphuric acid</p>	(1)

Question Number	Answer	Mark
4(b)(ii)	<p>it disappears / passes into solution / reduces in mass  / forms copper ions / copper loses electrons/ copper removed / unreactive material falls off/ copper is oxidised;</p>	(1)

Question Number	Answer	Mark
4(b)(iii)	<p>Either:  (Copper ions) gain electrons/ reduction;  forming copper (atoms) / copper deposited/ cathode increases in size/ red-brown solid forms;</p> <p>Or :  <math>\text{Cu}^{2+} + 2 \text{e}^- \rightarrow \text{Cu}</math>;;  (LHS = 1; RHS = 1;)</p>	(2)

Question Number	Answer	Mark
4(b)(iv)	<p>identity of impurities: gold/ silver/ any sensible metal (low in reactivity);</p> <p>use or value of impurities (Metals) can be sold/ specified use/ valuable/ expensive/ precious metals;</p>	(2)

Question Number	Answer	Mark
5(a)	<p>any two from: lead is in form of compound; other compounds present /not just lead(compounds); reasonable accuracy point eg volume of sample too low for low lead concentration / mass of residue would be very low / idea of repeat heating until constant mass obtained; lead compounds will decompose (when heated); allow experiment should be repeated / sample may not be representative of the water supply;</p>	(2)

Question Number	Answer	Mark
5(b)(i)	<p><math>\text{Pb}^{2+} + 2\text{I}^- \rightarrow \text{PbI}_2</math>;;;</p> <p>Reactants inc. charges; product; balancing correct formulae;</p> <p>Or <math>\text{Pb}^{2+} + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{K}^+</math>;;;</p> <p>Reactants inc. charges; products inc. charges; balancing correct formulae;</p>	(3)

Question Number	Answer	Mark
5(b)(ii)	<p>so that test is unique/ other ions would give positive result/ OWTTE;</p>	(1)

Question Number	Answer	Mark
5(b)(iii)	<p>ion test (Qualitative) mark: Correct reference to ion test being qualitative / only shows presence / no measurements taken / amounts of substance not known / OWTTE;</p> <p>titration (Quantitative) mark: Correct reference to titration being quantitative / determines amount/ volumes measured / calculations carried out on results of titration / OWTTE; [Ignore 'titration determines concentration' as in stem]</p>	(2)

Question Number	Answer	Mark
5(c)	<p>any four from: clean burette and/ or pipette; use of pipette to transfer NaOH; use of burette for acid; (the solutions used could be reversed) white tile; add (named)indicator [Reject universal indicator]; add one liquid to another and swirl; drop wise at end; correct colour change for named indicator; repeat (to ensure concordancy / repeatable results)</p> <p>nb: first four marks count, no need to continue after these are awarded</p>	(4)

Question Number	Answer	Mark
6(a)(i)	solvent / reduce concentration of other substances / evaporate (in perfumes) / preservative ;	(1)

Question Number	Answer	Mark
6(a)(ii)	pleasant odour / solvent;	(1)

Question Number	Answer	Mark
6(b)	$C_2H_5OH + CH_3COOH \rightarrow CH_3COOCH_2CH_3 + H_2O$ ;; or Reactant formulae; product formulae; For $C_2H_5OH$ allow $CH_3CH_2OH$ or $C_2H_6O$ or displayed formula For $CH_3COOH$ allow $CH_3CO_2H$ or $C_2H_4O_2$ or displayed formula For ester allow $-CO_2-$ as ester linkage or $-C_2H_5$ as ethyl group or $C_4H_8O_2$ or displayed formula  An unbalanced equation cannot score 2 Ignore word equations and state symbols	(2)

Question Number	Answer	Mark
6(c)(i)	[600(kg) will score 3]  RFM methanol = 32 and ester = 60;  Then either moles methanol = $320000 / 32 = 10\ 000$ ; answer = $60 \times 10\ 000 / 1000 = 600$ (kg);  or scaling factor: $320 / 32 = 10$ ; therefore 320 kg methanol gives 600 kg;  Note : $320 \times (32 / 60) = 171$ kg scores 2 marks	(3)

Question Number	Answer	Mark
6(c)(ii)	to work out amount of raw material to buy/ to calculate efficiency of process/ to work out how much to react to make product ordered / prevent waste of raw materials/ OWTTE;	(1)

Question Number	Answer	Mark
6(c)(iii)	Reaction with	product
	Metal eg magnesium	Hydrogen/ named salt
	Alkali/ named alkali	Salt/ named salt (+ water)
	Carbonate/ named carbonate	Salt/ $CO_2$
	Named alcohol other than methanol	Named ester and water
		(2)

Question Number	Answer	Mark
7(a)	low melting point / reaction is exothermic ;	(1)

Question Number	Answer	Mark
7(b)	hydrogen/ H <sub>2</sub> ; [Reject H]	(1)

Question Number	Answer	Mark
7(c)	K <sup>+</sup> / potassium ions/ potassium salt / electrons changing energy level etc;	(1)

Question Number	Answer	Mark
7(d)	blue; Reject colour combinations eg blue-green, blue-purple etc	(1)

Question Number	Answer	Mark
7(e)(i)	aq, l, aq, g, g ;	(1)

Question Number	Answer	Mark
7(e)(ii)	products have MANY uses / specified use of one product eg NaOH used to make soap;	(1)

Question Number	Answer	Mark
7(e)(iii)	loss of electrons;	(1)

Question Number	Answer	Mark
7(e)(iv)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ / $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$ correct species (inc charge on Cl <sup>-</sup> ) but unbalanced scores 1 Allow $\text{Cl}^- \rightarrow \text{Cl} + \text{e}^-$ / $\text{Cl}^- - \text{e}^- \rightarrow \text{Cl}$ ; for one mark nb electron can be e or e <sup>-</sup>	(2)

Physics 5049/01  
P3 Mark Scheme

Question Number	Answer	Mark												
1(a)	<p>one mark for each; if 4 ticks :3 correct and 1 wrong = 2 marks: 2 correct and 2 wrong = 1 mark ,if all boxes ticked no marks can be awarded</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>statement</th> <th>True?</th> </tr> </thead> <tbody> <tr> <td>as the temperature increases the volume increases</td> <td>✓</td> </tr> <tr> <td>as the temperature increases the pressure increases</td> <td></td> </tr> <tr> <td>the mass of the gas is constant</td> <td>✓</td> </tr> <tr> <td>the pressure of the gas is constant</td> <td>✓</td> </tr> <tr> <td>when the temperature in °C doubles the volume doubles</td> <td></td> </tr> </tbody> </table>	statement	True?	as the temperature increases the volume increases	✓	as the temperature increases the pressure increases		the mass of the gas is constant	✓	the pressure of the gas is constant	✓	when the temperature in °C doubles the volume doubles		(3)
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as the temperature increases the volume increases	✓													
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the mass of the gas is constant	✓													
the pressure of the gas is constant	✓													
when the temperature in °C doubles the volume doubles														

Question Number	Answer	Accept	Mark
1(b)(i)	speed up ;		(1)

Question Number	Answer	Accept	Mark
1(b)(ii)	more frequently ;		(1)

Question Number	Answer	Accept	Mark
1(b)(iii)	the temperature in K;		(1)

Question Number	Answer	Accept	Mark
1(c)	373 (K)	allow degrees sign allow additional K 373.14 or 373.15	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
1(d)	movement ceases;	<ul style="list-style-type: none"> <li>the particles stop moving /OWTTE</li> <li>no KE</li> <li>particles at their lowest (vibrational) speed</li> <li>particles are still</li> <li>idea of smallest possible movement</li> </ul>	particles slow down completely frozen	don't have much E or movement	(1)

Question Number	Answer	Mark																
2	<p>all correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark</p> <table border="1"> <thead> <tr> <th>action</th> <th>Number?</th> </tr> </thead> <tbody> <tr> <td>two gamma rays are produced</td> <td>4</td> </tr> <tr> <td>the radioactive isotope emits positrons</td> <td>2 given</td> </tr> <tr> <td>gamma rays are detected</td> <td>5</td> </tr> <tr> <td>a computer puts the images together</td> <td>6</td> </tr> <tr> <td>positrons annihilate electrons</td> <td>3 given</td> </tr> <tr> <td>a 3-D image is produced</td> <td>7 given</td> </tr> <tr> <td>the patient is injected with a radioactive isotope</td> <td>1</td> </tr> </tbody> </table>	action	Number?	two gamma rays are produced	4	the radioactive isotope emits positrons	2 given	gamma rays are detected	5	a computer puts the images together	6	positrons annihilate electrons	3 given	a 3-D image is produced	7 given	the patient is injected with a radioactive isotope	1	(3)
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Question Number	Answer	Accept	Ignore	Reject	Mark
3(a)	One from <ul style="list-style-type: none"> <li>• action potential (caused by heart muscle)</li> <li>• p.d. / voltage (of the heart) with respect to time</li> <li>• electrical activity (of the heart);</li> </ul>	<ul style="list-style-type: none"> <li>• p.d. / voltage across the skin caused by heart activity</li> <li>• heart rate / pulse rate</li> <li>• heart activity</li> </ul>	heart beat pulse  ignore heart action		(1)

Question Number	Answer	Accept	Reject	Mark									
3(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">P</td> <td style="width: 33%; text-align: center;">QRS</td> <td style="width: 33%; text-align: center;">T</td> </tr> <tr> <td style="height: 40px;"></td> <td style="text-align: center;">↙ ↘</td> <td style="text-align: center;">↙ ↘</td> </tr> <tr> <td style="text-align: center;">atria contract</td> <td style="text-align: center;">recovery wave</td> <td style="text-align: center;">ventricles contract</td> </tr> </table> <p>P = atria contract;            QRS = ventricles contract;            T = recovery wave;</p>	P	QRS	T		↙ ↘	↙ ↘	atria contract	recovery wave	ventricles contract	all three correct = 2 marks any one correct = 1 mark		(2)
P	QRS	T											
	↙ ↘	↙ ↘											
atria contract	recovery wave	ventricles contract											

Question Number	Answer	Accept	Ignore	Reject	Mark
3(c)	<p>in order</p> <p>heart beats too slow/eq;</p> <p>heart beats too fast/eq;</p> <p>heart beat is irregular/eq;</p>	<p>allow descriptions in terms of</p> <ul style="list-style-type: none"> <li>the frequency or period of the heart beats</li> <li>specific section of the wave being too long/short</li> </ul> <p>for 3<sup>rd</sup> mark accept abnormal or (fast but) missing a beat</p>	random		(3)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(a)	<p>A shown to the right of Z=82;</p> <p>B shown above the curve;</p> <p>P shown below the curve;</p>	<p>correct symbols instead of the letters</p> <p><math>\alpha</math> for A no part of letter A to go below Z=70</p> <p><math>\beta</math> or <math>\beta^-</math> or <math>B^-</math> or <math>e^-</math> for B</p> <p><math>P^+</math> or <math>e^+</math> or <math>\beta^+</math> for P</p> <p>if in doubt, check the symbol vertically against the stability belt for P or B, and horizontally for A</p> <p>mark according to the specification</p>		$\beta^+$ or $B^+$ above the line	(3)

Question Number	Answer	Mark																																	
4(b)	<p>top line correct; lower line correct; accept for 1 mark any two of the 'particles' completely correct</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>38</td> <td></td> <td></td> <td>38</td> <td></td> <td></td> <td>0</td> <td></td> <td></td> <td>0</td> <td></td> </tr> <tr> <td></td> <td>S</td> <td>→</td> <td></td> <td>Cl</td> <td>+</td> <td></td> <td>B</td> <td>+</td> <td></td> <td>γ</td> </tr> <tr> <td>16</td> <td></td> <td></td> <td>17</td> <td></td> <td></td> <td>-1</td> <td></td> <td></td> <td>0</td> <td></td> </tr> </table>	38			38			0			0			S	→		Cl	+		B	+		γ	16			17			-1			0		(2)
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	S	→		Cl	+		B	+		γ																									
16			17			-1			0																										

Question Number	Answer	Accept	Ignore	Reject	Mark
4(c)(i)	(Excess) energy emitted OR nuclear rearrangement (leading to emission of energy);	<p>photon for energy</p> <p>change from metastable /excited to stable state/eq</p>	repeat of stem e.g. emits $\gamma$		(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(c)(ii)	neutron changes into proton (with emission of electron/ beta minus);	description in terms of nucleon/mass and proton no.s	repeat of stem e.g. emits beta or electron	Beta plus decay	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
4(c)(iii)	a down quark → an up quark;	2 down and 1 up → 2 up and 1 down $2D + 1U \rightarrow 2u + 1D$  <i>MARK CORRECT ANSWERS WHERE-EVER SEEN IN (I), (II), (III)</i>	quarks will become opposites ignore charges on quarks	implication of turning around or direction change	(1)

Question Number	Answer	Accept	Reject	Mark
4(d)	electron;	quark ( any flavour) antineutrino	positron neutrons protons	(1)

Question Number	Answer		Accept	Comments	Reject	Mark																																				
5	<p>calc. of distance (in m or in cm);</p> <p>substitution;</p> <p>answer in correct units;</p>	<p>3.3(m) 330(cm)</p> <p><math>3.3 \times 805</math></p> <p>2 660 J 2656.5(J) 2.656 kJ</p>	<p>No alternatives</p> <p>Acceptable Substitutions:</p> <table border="1"> <thead> <tr> <th>Distance (m)</th> <th>Ans</th> <th>Distance (cm)</th> <th>Ans</th> </tr> </thead> <tbody> <tr> <td>3.3 (or ecf)</td> <td>2656</td> <td>330 (or ecf)</td> <td>265650</td> </tr> <tr> <td>0.9</td> <td>725</td> <td>90</td> <td>72450</td> </tr> <tr> <td>1.4</td> <td>1127</td> <td>140</td> <td>112700</td> </tr> <tr> <td>1.8</td> <td>1449</td> <td>180</td> <td>144900</td> </tr> <tr> <td>1.9</td> <td>1530</td> <td>190</td> <td>152950</td> </tr> <tr> <td>2.4</td> <td>1932</td> <td>240</td> <td>193200</td> </tr> <tr> <td>2.8</td> <td>2254</td> <td>280</td> <td>225400</td> </tr> <tr> <td>Unit:</td> <td><b>J or Nm</b></td> <td></td> <td><i>Ncm</i></td> </tr> </tbody> </table> <p>(Allow ecf into answers for 3.3m or 330cm)</p> <p>ecf from substitution, as shown in above table. Answer plus correct unit.</p>	Distance (m)	Ans	Distance (cm)	Ans	3.3 (or ecf)	2656	330 (or ecf)	265650	0.9	725	90	72450	1.4	1127	140	112700	1.8	1449	180	144900	1.9	1530	190	152950	2.4	1932	240	193200	2.8	2254	280	225400	Unit:	<b>J or Nm</b>		<i>Ncm</i>	<p>check the diagram for the calc of distance method</p>	<p>incorrect units for one mark e.g. N/m</p>	(3)
Distance (m)	Ans	Distance (cm)	Ans																																							
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Unit:	<b>J or Nm</b>		<i>Ncm</i>																																							

Question Number	Answer	Accept	Ignore	Reject	Mark
6(a)(i)	very high frequency/pitch sound (or longitudinal) radiation;	<ul style="list-style-type: none"> <li>high frequency sound radiation</li> <li>correct description in terms of stated frequency or wavelength</li> <li>sound above the threshold of human hearing</li> </ul>	<p>Inaudible wave (could be infrasound)</p> <p>high sound</p> <p>description in terms of its mode of use</p>	<p>lack of precision leading to confusion of frequency and intensity</p> <p>electromagnetic wave</p> <p>transverse wave</p>	(1)

Question Number	Answer	Accept	Ignore	Reject	Mark
6(a)(ii)	<p>Cameron = non-ionising radiation /reduction in (healthy) cell damage;</p> <p>consultant = real-time image/soft tissue image;</p>	<p>Credit 'safety' or 'cell damage' or 'harmful radiation' idea only once</p> <ul style="list-style-type: none"> <li>ultrasound does not cause (healthy) cell damage /ORA;</li> <li>reduction in radiation that can damage (healthy) cells</li> <li>idea of 'can see what he is doing at the time'</li> <li>does not make his patient worse</li> <li>safer for consultant</li> <li>cheaper if qualified (comparison made on running or set-up costs)</li> <li>ultrasound (machines) are more portable</li> <li>3D image</li> </ul>	<p>waffle statements such as 'safer' unless qualified</p> <p>ultrasound can target the area</p> <p>ultrasound not as penetrating</p> <p>easier to find tumour</p>		(2)

Question Number	Answer	Mark												
6(b)(i)	<p>one mark for either alpha or beta or both; ticks in any other boxes then no marks</p> <p>;;</p> <table border="1"> <tr> <td>source type</td> <td>suitable for the 'seeds'?</td> </tr> <tr> <td>alpha</td> <td>✓</td> </tr> <tr> <td>beta</td> <td>✓</td> </tr> <tr> <td>gamma</td> <td></td> </tr> <tr> <td>neutron</td> <td></td> </tr> <tr> <td>photon</td> <td></td> </tr> </table>	source type	suitable for the 'seeds'?	alpha	✓	beta	✓	gamma		neutron		photon		(1)
source type	suitable for the 'seeds'?													
alpha	✓													
beta	✓													
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neutron														
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Question Number	Answer	Accept	Ignore	Mark
6(b)(ii)	<p>any one explanation in terms of</p> <p>EITHER range OR ionisation</p>	<p>Consequential marking....only sources allowed are alpha, beta or both look for reverse arguments → therefore only alpha and beta suitable</p> <p>correct description of</p> <ul style="list-style-type: none"> <li>• range/ penetration of particle</li> <li>• required range needed for treatment</li> <li>• ionisation ability of particle</li> <li>• ionisation required needed for treatment</li> </ul>	Photon in the list of sources	(1)

Question Number	Answer	Accept	Further guidance	Mark
6(b)(iii)	any 2 from <ul style="list-style-type: none"> <li>• half life</li> <li>• toxicity/side effects</li> <li>• decay product</li> <li>• energy emitted/damage done to healthy cells</li> <li>• activity level</li> <li>• range</li> <li>• ionisation</li> <li>• elimination of isotope;</li> </ul> <ul style="list-style-type: none"> <li>• any two correct reasons/ explanations or consequences re the above list;;</li> </ul>	All marks independent of answers to bi and bii allow cost, emission of other particles/radiation,  MUST have statement and reasons/ explanations or consequences to be awarded second and/or third mark e.g. <ul style="list-style-type: none"> <li>• (half life=) long enough to have an effect/does not want to stay radioactive for too long;</li> <li>• (toxicity =) should not be toxic/make patient more unwell</li> <li>• (consideration of energy =) should not be too high as this may cause damage to healthy cells</li> <li>• (activity level=)should not be too high as this may cause damage to healthy cells</li> </ul>	So for 1 mark can have EITHER 2 stated properties without reasons OR 1 property with a reason plus nothing else  For 2 marks 1 property with reason plus 1 other property  For 3 marks 2 properties with reasons	(3)



Question Number	Answer	Accept		Mark
6(b)(iv)	any three from: 1. getting the highest dose at the tumour/concentrating radiation on the tumour 2. <u>idea</u> of intensity $\propto 1/\text{distance}$ 3. not dosing other regions 4. slow at tumour to increase time there 5. longer it is there the bigger the dose;;;	not necessary to have intensity $\propto 1/\text{distance}^2$  <ul style="list-style-type: none"> <li>reduction in damage to other cells/body parts</li> <li>dose proportionate to time</li> <li>repeat to allow normal cells to recover</li> </ul>		(3)

Question Number	Answer	Accept	Ignore	Mark
6(c)	any suitable advantage;  any suitable disadvantage;	NOTE this is about ANY newer treatment, not just methods above <ul style="list-style-type: none"> <li>idea of newer is <u>possibly</u> better/safer</li> <li>may give increased chance of cure</li> <li>more likely to get highly skilled/qualified consultant</li> <li>mention of specific example relating to the question above e.g. radioactive source not left inside the patient</li> <li>it can go wrong/maybe not as reliable</li> <li>they don't know what they are doing</li> <li>possible side effects</li> <li>mention of specific example relating to the question above e.g. radioactive source is left inside the patient in older method</li> </ul> <p>only credit the source inside/outside the patient once</p>	Cost unless well reasoned, (can be either for or against), only credit once  Bald newer technology	(2)

Question Number	Answer		Accept	Comments	Mark
7	Conversion C into K;  subst.;  rearrangement;  ans;	$27C = 300K$  $\frac{1.01 \times 10^5 \times 14}{300} = \frac{23.8 \times 10^5 \times 2}{T}$ $T = \frac{23.8 \times 10^5 \times 2 \times 300}{1.01 \times 10^5 \times 14}$  $T = 1010 \text{ K ( 737 C)}$	<ul style="list-style-type: none"> <li>if temps in C used, max of 3 marks</li> <li>rearrangement and subst. in either order</li> <li>can use <math>T_2</math> or <math>T_1</math> instead of T</li> <li>allow for earlier cancelling e.g. <math>10^5</math> or <math>2/14 = 1/7</math></li> <li>if bald correct ans seen award all marks</li> <li>not necessary to change back into C</li> </ul>	91 (90.0 /90.89) is worth 3  $4713.3 = \frac{1.01 \times 10^5 \times 14}{300}$  If you see 476/4713 allow three marks  Ans= 0.000990196 K is worth 2 (=1/T)	(4)

Question Number	Answer	Accept	Ignore /Comments	Reject	Mark
8(a)	a correct <i>explanation</i> about one of the following gamma properties <ul style="list-style-type: none"> <li>• range</li> <li>• ionisation</li> <li>• deviation of radiation</li> <li>• energy emitted</li> <li>• decay chain</li> </ul>	Examples <ul style="list-style-type: none"> <li>• range must be long to <i>exit</i> body or range long so can be detected</li> <li>• small ionisation (weak interaction with matter) so no damage to cells</li> <li>• gamma rays do not have deviation in their path (less scattered than alpha or beta), so exit the body</li> <li>• no localised heating in body cells so less damage</li> <li>• does not produce daughter nuclei so does not make the patient radioactive/ill;</li> </ul> <i>look for ORA for alpha or beta sources</i>	<ul style="list-style-type: none"> <li>• half-life by itself</li> <li>• penetration by itself</li> <li>• ease of detection</li> </ul> The emphasis is on an explanation, bald statements are not enough at this level.	<ul style="list-style-type: none"> <li>• incorrect physics</li> <li>• ans where the radiation is going the wrong way (i.e. into the patient)</li> </ul>	(1)

Question Number	Answer	Accept	Ignore/ Comments		Mark
8(b)	<p><i>no mark for bald isotope choice</i></p> <p>each must have reason / explanation of the consequences of the properties</p> <ul style="list-style-type: none"> <li>• Short half-life /OWTTE;</li> <li>• Low(ish) energy emitted;</li> <li>• Ionisation produced</li> </ul>	<p>conditional marking</p> <p>only allow if barium or technetium e.g. must not stay active in body for long as would damage healthy cells, allow a goldilocks answer 'not too short not too long'</p> <p>only allow if iodine or technetium e.g. low energy to reduce damage to healthy cells</p> <p>for any source e.g. (gamma emitter, so) low ionisation so little damage to patient/ radiation exits to detector</p>	<p>The emphasis is on an explanation, bald statements are not enough at this level; the candidates must write more than 'short half life' 'low energy' or quote data from table</p>		(2)

Question Number	Answer	Accept	Ignore		Mark
8(c)(i)	Idea of reduction of discomfort for the patient;	<p>treatment given to reduce pain but not cure /OWTTE</p> <p>improve quality of life</p> <p>treating the symptoms without curing</p>	<p>to cure cancer</p> <p>to reduce spread of cancer</p>		(1)

Question Number	Answer	Mark
8(c)(ii)	any row or column correct; all four correct;;  <div style="display: flex; align-items: center; justify-content: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px;">88</div> <div style="border: 1px solid black; padding: 2px;">Sr</div> <div style="border: 1px solid black; padding: 2px;">+</div> <div style="border: 1px solid black; padding: 2px;">1</div> <div style="border: 1px solid black; padding: 2px;">n</div> <div style="border: 1px solid black; padding: 2px;">→</div> <div style="border: 1px solid black; padding: 2px;">89</div> <div style="border: 1px solid black; padding: 2px;">Sr</div> </div> <div style="display: flex; align-items: center; justify-content: center; gap: 10px; margin-top: 5px;"> <div style="border: 1px solid black; padding: 2px;">38</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">38</div> </div> NOT the two numbers in the corners	(2)

Question Number	Answer	Accept	Mark
9(a)	<u>thermionic emission</u> ;	incorrect but recognisable spellings e.g. emition or emision for emission	Thermionic decay  (1)

Question Number	Answer	Accept	Ignore	Reject	Mark
9(b)(i)	Idea of increase in (K)E / speed PLUS direction of attraction / movement	they are attracted towards the anode;	bald 'moves (quickly)towards the anode'	Increase in thermal energy	(1)

Question Number	Answer	Accept	Mark
9(b)(ii)	subst.;; ans; unit;	$10\,000 \times 1.6 \times 10^{-19}$ $1.6 \times 10^{-15}$ J (VC)	j or Joules  (3)

Question Number	Answer	Accept	Comments/ Allow	Reject	Mark
9(c)	<p>statement that current is rate of flow of charge (<math>I=Q/t</math>);</p> <p>subst. or rearrangement;</p> <p>ans;</p> <p>OR for last 2 marks</p>	<p>allow equation instead of statement</p> $I = \frac{N \times e}{T}$ $20 \times 10^{-3} = \frac{N \times 1.6 \times 10^{-19}}{10}$ $N = \frac{20 \times 10^{-3}}{1.6 \times 10^{-19}}$ $N = 1.25 \times 10^{18}$ <p>OR</p> $I = \frac{1.22 \times 10^{18} \times 1.6 \times 10^{-19}}{10} ;$ $I = 1.952 \times 10^{-2} \text{ A}$ $= 19.52 \text{ mA};$	<p>For 1 mark, correct use of time (division by 10)</p> <p>subst. and rearrangement in any order</p> <p>BEWARE of fudging!!!!</p> <p>alternative method for the calculation</p>		(3)



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