OCR
Oxford Cambridge and RSA

Cambridge Technicals
IT

Unit **2: Laboratory Techniques**

Level 3 Cambridge Technical in Science for Technicians

Mark Scheme for June 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Question			Answer	Marks	Guidance
1	(a)	(i)	**Hazard:** Pathogenic/disease causing / microorganisms/bacteria; **Risk:** infection (of laboratory worker); **Control measure:** aseptic technique/swabbing bench/good hygiene/washing hands after work;	3	**Ignore** food poisoning for risk **Allow** disinfectant/disinfecting **Ignore** gloves **Ignore** dispose of carefully mark independently
		(ii)	**Hazard:** Enzymes; **Risk:** Allergic reaction/ sensitising/ irritation/dermatitis; **Control measure:** Avoid contact with skin/exposure to washing powder/avoid breathing dust;	3	**Do not allow** answers related to bacteria **Allow** degradation of body tissue = risk **Allow** wear gloves = control **Ignore** dispose of carefully
		(iii)	**Hazard:** X-rays/**ionizing** radiation/irradiation; **Risk:** Damage to DNA/ carcinogenic/ teratogenic/ cell death/mutation; **Control measure:** Follow radiological guidelines/training / reduce (time/frequency/dose of) exposure/do not receive primary exposure/limit distance/monitor use from another room/use/shielding/wear lead apron/ check integrity of PPE;	3	**Allow** cells killed/cells become cancerous/cancer/radiation poisoning **Allow** wear protective clothing **Allow** radiographer stands outside room/behind screen **Ignore** dispose of carefully

Question			Answer	Marks	Guidance
	(b)		*Any three from:* Accepted measurement system in place; Evaluation of measurement system/assessment of uncertainty/comparison with standard measurement system; Use of accepted equipment; Traceability of reference solutions/buffer solutions (for calibration); Internal laboratory monitoring programme of measurement system/reference materials; Lab establishes unbroken chain of comparison with standards;	3	**Allow** calibrate with known pH solutions
	(c)		Enclose in biohazard/autoclaving bag/container; Sterilise/autoclave (at 121 °C for 15 minutes); Dispose of according to laboratory guidelines/in general waste.	3	**only allow** MP3 for in general waste if either MP 1 or 2 already awarded
			Total	**15**	

Question			Answer	Marks	Guidance
2	(a)	(i)	the paper	1	A solid or liquid supported on a solid **Reject** plate
		(ii)	*Any two from:* Silica gel; Alumina/aluminium oxide; Cellulose;	2	
		(iii)	**Answers related to advantages of TLC/ advantages of paper chromatography.** *Any three from:* TLC has a faster run; TLC gives better separation/greater resolution of spots; TLC plate easier to manipulate; TLC plate more durable than paper/TLC on glass or plastic plate; paper chromatography is cheaper; **Disadvantages of both techniques.** *Any one from:* (Neither) give positive identification; (Usually used as) qualitative technique/(usually) not quantitative;	4	**Allow** reverse arguments for either Must be a comparison
	(b)		Hexane = 90 (cm^3)	1	**All** correct = 1 mark.
	(c)		Fluorescence; (Under) ultraviolet light.	2	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>
<table>
<tr><th></th><th>Distance moved (mm)</th></tr>
<tr><td>Spot A</td><td>30</td></tr>
<tr><td>Spot B</td><td>39</td></tr>
<tr><td>Spot C</td><td>57</td></tr>
<tr><td>Spot D</td><td>76</td></tr>
<tr><td>Spot E</td><td>118</td></tr>
<tr><td>Solvent front</td><td>134</td></tr>
</table>
</td><td>1</td><td>All correct = 1 mark.

Allow measurements up to – 7mm of value given in answer table (due to the shape of the trace).</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th>Spot</th><th>R_f value</th><th>Suggested identification of class of lipid</th></tr>
<tr><td>A</td><td>0.22</td><td>monoglycerides</td></tr>
<tr><td>B</td><td>0.29</td><td>unknown</td></tr>
<tr><td>C</td><td>0.42</td><td>diglycerides</td></tr>
<tr><td>D</td><td>0.57</td><td>free fatty acids</td></tr>
<tr><td>E</td><td>0.88</td><td>triglycerides</td></tr>
</table>
</td><td>2</td><td>All R_f values correct (+/- 0.01) = 1 mark. Allow ecf.

All identifications correct = 1 mark.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Any two from:
Use a series of standards (A-F);
Individual lipids;
Compare distance travelled by spots;</td><td>2</td><td>Reject answers related to gas chromatography.
Ignore published Rf values</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

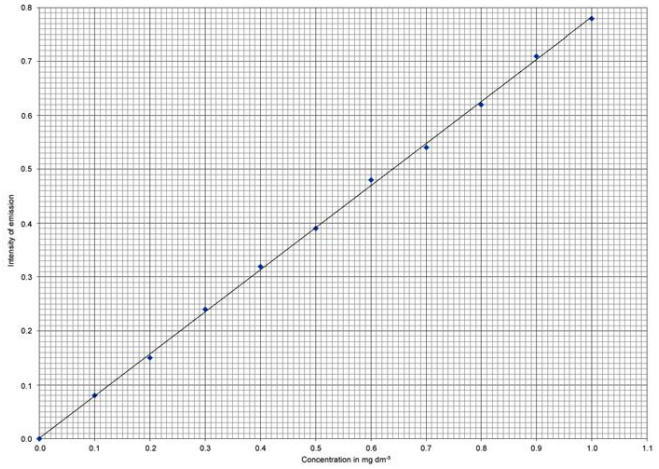
Question			Answer	Marks	Guidance
3	(a)		Phenolphthalein; Reaction is weak acid-strong base; Phenolphthalein changes colour at equivalence point.	3	ECF from first mark point.
	(b)		weak acid; buffer solution; equivalence point; weak alkali; sodium ethanoate and water; strong alkali;	6	Mark using the **sequence** provided in the answer column.
	(c)		**[Level 0]** Candidate includes **no** valid points. ***(0 marks)*** **[Level 1]** Candidate shows a basic understanding of how autotitrators work AND/OR why this method is preferred to using an indicator, with little or no explanation. ***(1 – 2 marks)*** **[Level 2]** Candidate shows an understanding of how autotitrators work AND why this method is preferred to using an indicator. ***(3 - 4 marks*** **[Level 3]** Candidate shows a high level of understanding and gives a good description of how autotitrators work AND why this method is preferred to using an indicator. ***(5 – 6 marks)***	6	**Valid points:** **Technique:** • Titrant addition / add reagent • In specific/small volumes • Increment size is determined by the nature of the titration • Reaction monitored using pH electrode/ potentiometer/constantly measures pH • Titration of unknowns will measure volume of the titrant • At the (predetermined) inflection point of curve/equivalence point/end point • Defined by pH/concentration-dependent potential • Concentration of unknown calculated **Why technique is preferred:** • Process is automated • Faster once calibrated • Not affected by coloured analytes

Question			Answer	Marks	Guidance
					Compensatory mark: award no human error/idea it is not subjective if no other mark awarded
			Total	**15**	

Question			Answer	Marks	Guidance
4	(a)	(i)	**Light** (microscope)	1	
		(ii)	100 µm on stage micrometer corresponds with 65 divisions on graticule. Therefore, 1 division ≡ 100/65 = 1.5 µm; Width of pollen grain = 28 divisions; Therefore, width of pollen grain = (28 x 1.5) µm = 42 µm;	3	**Allow** 43 µm Make allowances for differences in judgement based on the boundary of pollen grain. **ECF**
		(iii)	*Any three from:* Eyepiece graticule is placed in the eyepiece of microscope; Stage micrometer placed on stage of microscope Appropriate objective selected; Eyepiece graticule rotated to appropriate orientation; Graticule and micrometer lined up so that a suitable distance on the micrometer corresponds with divisions, beginning with whole division on the graticule scale; Reading made from scale on graticule against dimension/ 100 µm, on micrometer;	3	

Question			Answer	Marks	Guidance
		(iv)	Width of pollen grain (from light micrograph/calculation) is 42 µm and width of pollen grain from light micrograph is 14 mm/42 µm is represented by 14 mm on micrograph; Choice of suitable length of scale bar, e.g. equivalent to 50 µm/ 100 µm; Correct calculation of length of this scale bar (represented by $\frac{50}{42} \times 14$ mm Or $\frac{100}{42} \times 14$ mm, etc.); Accurately drawn and labelled scale bar;	4	**Accept** ecf using answer from (a) (ii).
	(b)	**(i)**	Scanning electron (microscope)/EM	1	**Allow** SEM
		(ii)	*Any three from:* Increased depth of field/3D image; Reveals surface detail; Reveals (triporate) shape of pollen grain; Improved/increased/greater resolution;	3	**Ignore** references to higher magnification. **Ignore** cleaner image
			Total	**15**	

Question			Answer	Marks	Guidance
5	(a)	(i)	White precipitate (of lead hydroxide) formed; Precipitate is soluble in excess sodium hydroxide solution; Gives a clear, colourless solution;	3	
		(ii)	Reaction of lead $Pb^{2+} + 2OH^- \rightarrow Pb(OH)_2$; With excess hydroxide $Pb(OH)_2 + 2OH^- \quad [Pb(OH)_4]^{2-}$;	2	
		(iii)	Aluminium;	1	**Allow** Al^{3+}
	(b)	(i)	Quantitative technique; Measures concentration to very low levels; All/almost all elements can be analysed at same time/no interference;	3	
		(ii)	*Any two from:* Concentration <u>has defined degree</u> (or wtte) of accuracy; Ensures that standards are the same degree of accuracy <u>each time;</u> Adds traceability to analyses;	2	**Ignore** answers related simply to accuracy. **Allow** reliable for same degree of accuracy each time
		(iii)	Correct axes and units; Points plotted correctly; Appropriate line of best fit;	1 2 1	**For the plotting of points:** correct to +/- ½ one small square 10 or 11 points plotted correctly = 2 marks 4 to 9 points plotted correctly = 1 mark 3 or fewer points plotted correctly = 0 marks Maximum 3 marks for plots if axes reversed.

Question			Answer	Marks	Guidance
					
			Total	**15**	

Question			Answer	Marks	Guidance
6	(a)	(i)	*Any two from:* Prevent contamination of culture; Erroneous results would be obtained/erroneous conclusions drawn; Prevent contamination of the environment with the bacterium; For safety (as culture may contain pathogenic bacteria);	2	**Allow** pathogens are harmful
		(ii)	*Any two from:* Sterile working area; Good personal hygiene; Sterile media and reagents; Sterile handling/glassware/equipment;	2	**Allow** disinfection of working area
	(b)	(i)	*Any four from:* Provides aseptic environment for culture work; Contains infectious splashes/aerosols; Protect culture from contamination; (Inward) airflow protects user; Exhaust air is filtered to protect user/laboratory workers;	4	
		(ii)	*Any three from:* Disrupts airflow/creates turbulence (compromising protection of culture and user); Causes heat build-up/affects metabolism of microorganisms; Damage (HEPA) air filter; Potential cause of fire;	3	**Accept** answers relating to affecting manufacturer warranties. **Ignore** alter results unqualified

Question		Answer	Marks	Guidance
(c)	(i)	*Any two from:* Wrap in aluminium foil; Sterilise in autoclave; Keep wrapped until required;	2	
	(ii)	(For media made up unsterile) Sterilise in autoclave;	1	
	(iii)	(Swabbed/wiped) with (70%) ethanol/autoclave;	1	
		Total	**15**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553