OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Mark Schemes for the Units

January 2007

H175/H375/MS/R/07J

Oxford Cambridge and RSA Examinations

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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.

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MARK SCHEMES FOR THE UNITS

Mark Scheme G622
January 2007

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mk</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>
<table>
<tr><th>physiological indicator</th><th>‘normal’ value</th><th>unit</th></tr>
<tr><td>blood pressure, 18 year old male</td><td>120/80</td><td>mm Hg</td></tr>
<tr><td>breathing rate</td><td>15 - 18</td><td>breaths per min</td></tr>
<tr><td>tidal volume at rest</td><td>0.4 to 0.5</td><td>dm^3</td></tr>
<tr><td>peak flow</td><td>400 – 600</td><td>$dm^3\ min^{-1}$</td></tr>
<tr><td>body temperature, range</td><td>36.5 to 37.2</td><td>°C</td></tr>
</table>
</td><td>5</td><td>both values for b.pressure must be as stated for the mark.

for Tidal Volume, peak flow and B.Temp ranges ACCEPT single values on or between the limits.</td></tr>
<tr><td></td><td>b</td><td></td><td>sphygmomanometer;</td><td>1</td><td></td></tr>
<tr><td></td><td>c</td><td>i</td><td>three from:
ensure sitting down/relaxed (breathing at start);
ensure marker on the scale is set to zero;
sterile mouthpiece/sterilise mouth piece;
after full breath in, breath out with a rapid forced maximal expiratory puff through the mouth and on into the meter/OWTTE;
ensure lips sealed around mouth piece;
repeat to give three readings;
taking best as result;</td><td>3</td><td>mark first three instructions then stop marking.</td></tr>
<tr><td></td><td></td><td>ii</td><td>four from:
increased peak flow rate;
data ;
ACCEPT levels to normal after day 10;
data ;
difference between morning and evening readings less ;
data ;</td><td>4</td><td></td></tr>
<tr><td></td><td>d</td><td>i</td><td>time period x = 60 seconds;
12;</td><td>2</td><td>if correct answer only, award 2 marks</td></tr>
<tr><td></td><td></td><td>ii</td><td>vital capacity;</td><td>1</td><td></td></tr>
<tr><td></td><td>e</td><td>i</td><td>electrocardiogram/ECG;</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>frequency/distance between similar peaks/SAW;</td><td>1</td><td>REJECT ‘irregular’ (in stem of question).</td></tr>
<tr><td></td><td></td><td>iii</td><td>arrhythmia;</td><td>1</td><td></td></tr>
<tr><td colspan="4">Total</td><td>19</td><td></td></tr>
</table>

Question			Expected Answers	Mk	Additional Guidance
2	a		adenosine triphosphate/ATP; oxygen; carbon dioxide; water; lactic; 38; 2;	7	
	b	i	both processes require fuel; both processes require oxygen; both processes produce waste products; both processes release energy from fuel;	4	if candidate describes rather than compares ACCEPT a <u>pair</u> of statements for each feature. e.g. 'Glucose is a fuel used in respiration. Coal is a fuel used in burning'. ✓ one mark
		ii	energy made available to enable change/to keep cells alive/OWTTE; *two from four:* nerve cell communication/transmission; muscle cell contraction/movement qualified with reference to cell; active transport; A.V.P;	1 2	 e.g. movement of sperm cell ciliated cell activity
			Total	14	

Question			Expected Answers	Mk	Additional Guidance
3	a		to prevent (100%) reflection of ultrasound/improve contact/lubricate probe/exclude air;	1	
	b		ultrasound does not pass through bone;	1	
	c		*six from:* uses sound waves; frequencies used 1 to 15 MHz; short pulses/about 1μs sent into body; at boundary between two different materials; eg bone and soft tissue; sound waves partly reflected; partly transmitted; time for reflected wave to come back indicates depth of interface; transmitted waves will be reflected at deeper interfaces; provides series of echoes; 'real time'; 'echoes' are converted into images; images on screen/photos; *organising information; using specialist vocabulary;*	6 2	QWC spec.vocab.: any two from: waves pulses reflection/reflected etc. echo transmission/transmitted etc. interface image frequency
	d		*two from* to monitor foetal development/to locate the placenta ; physiologist use; to look for: cysts/stones/tumours/abnormalities (in liver/kidney/pancreas); to guide surgeons when carrying out keyhole surgery;	2	
	e		*two from:* quick/cheaper/readily available; non-invasive; safe/no known undesirable side-effects; effective in producing images of soft tissue/some kinds of cancer;	2	IGNORE 3D effect
	f		(ionising) radiation ; and cancer risk/change cell (mutation); OR high voltage supplies ; and electrical hazards;	2	
			Total	16	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mk</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>a</td><td>i</td><td>20 x 3.16 [correct substitution];

63.2;</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>description of change in one of the factors;

use of data;</td><td>2</td><td>answer must refer/imply link to increase in walking speed</td></tr>
<tr><td></td><td>b</td><td></td><td>hazards: health;
environment;
equipment;
time;
minimise risk: supervision;
check fitness/medical records;
equipment certification;
health and safety regulations;

spelling;
punctuation and grammar;</td><td>8

2</td><td>read, award QWC
re-read looking for ‘hazards’ ✓H max 4
then re-read looking for linked ways to minimise risks max 4

ALLOW 1 spelling error and 1 punctuation and grammar error</td></tr>
<tr><td></td><td>c</td><td></td><td>
<table>
<tr><th></th><th colspan="4">feature</th></tr>
<tr><th>structure</th><th>cartilage</th><th>mucus secreting cell</th><th>smooth muscle</th><th>cilia</th></tr>
<tr><td>trachea</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>bronchus</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>large bronchiole</td><td>✗</td><td>✗</td><td>✓</td><td>✓</td></tr>
<tr><td>alveolus</td><td>✗</td><td>✗</td><td>✗</td><td>✗</td></tr>
</table>
</td><td>1

1

1</td><td>award one mark for each completely correct line</td></tr>
<tr><td colspan="5">Total</td><td>17</td><td></td></tr>
</table>

Question			Expected Answers	Mk	Additional Guidance
5	a		86.0 - 55.9/30.1; 30.1 x 100/35; 86.0	2	correct answer only award 2 marks
	b		glycogen: decreases/30.1; used as an energy store/provides respiratory substrate/for respiration; ATP: decreases/1.4; used as a source of energy/for muscle contraction/suitable alternative use; lactate: increases/30.4; produced during anaerobic; respiration/glycolysis;	6	glycogen: emphasis on storage, reject direct use in respiration
			Total	8	

Question			Expected Answers	Mk	Additional Guidance
6	a		statement about change in blood glucose concentration qualified by time; data value(s) in support; statement about change in blood glucose concentration qualified by time; data value(s) in support;	4	focus on Andrew. Ignore ref. to Joe/Joe data eg increases from time 0 to time 30 ; glucose max 138 ; decreases from time 30 until time 120 ; glucose minimum 72 ;
	b		*three from:* glucose absorbed into blood stream; increase in blood glucose causes release of insulin; from pancreas; glucose converted to glycogen; in liver; falls below threshold ; glucagon released; glucose released from glycogen in liver; AVP;	3	
	c		Two pairs: difference qualified by time or glucose concentration reference; comparative data; eg: blood glucose increases for longer; 0–60 compared to 0–30 (for Andrew); maximum glucose (concentration) greater; 210 as compared to 138 (for Andrew); still above starting glucose (concentration) during 150 minutes; whereas Andrew below starting concentration 60 to 150;	4	look for two of the pairs listed or valid equivalents: [1 mark for difference + 1 mark for data] assume first reference is Joe if not named
	d		Joe is diabetic; Joe's insulin not lowering blood glucose concentration/insufficient insulin/liver does not respond to insulin produced;	2	
	e		**1 A** **2 B** **3 D** **4 C**	3	4 ✓ = 3 3 ✓ = 2 2 ✓ = 1 1 ✓ = 0
			Total	**16**	

Mark Scheme G623
January 2007

Planning Exercise
Comparison of the water potentials of the swollen root of *Beta vulgaris* (sugar beet) and *Solanum tuberosum* (potato) tubers.

Marking of the plan:

1 Read the material presented.
2 Then *award 1 mark* if *scientific terminology* has been used appropriately. Record using the letter Y.
3 Then re-read, this time point marking up to 24, by placing letters A to X in the margin where you see evidence of the marking criteria.
4 The same piece of evidence can be used to award one criterion only.

Marking point	Marking criteria	Mark	Additional notes
A	easily recognised safety procedures highlighted;	**1**	evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan – reject anything 'over the top'
B	prediction made;	**1**	prediction related to comparison in task
C	with justification;	**1**	use evidence from text. '...sugar beet two thirds sea water...' etc.
D	description of preliminary work;	**1**	at least one from: range of [saline], mass/length of 'chip', time to get reasonable change, volume of saline to use, surface area of tissue used, AVP
E	clear and in detail;	**1**	explain how to do it.
F	reason (for doing it) explained;	**1**	explain why it's necessary for completion of the whole investigation
G	clear and in detail;	**1**	extra information/suitable extension
H	at least two secondary sources of information identified;	**1**	state at least 2 references. full website address needed. full description of named text (title, author, publisher)
I	relevance explained;	**1**	brief explanation as to how references helped in the planning
J	basic practical skills and accuracy;	**1**	simple method/list of instructions. basic. 'is it a feasible approach?'
K	sound practical skills and accuracy; (may also look for evidence of 'P' here)	**1**	could someone follow the instructions unaided? are quantities shown? is it repeatable to appropriate degree of accuracy?

main investigation starts here.

L	range of appropriate equipment listed;	**1**	list of names of main items of equipment and materials needed for the investigation generic terms: beakers, flasks etc are OK here
M	full range of appropriate equipment listed;	**1**	qualifications noted. indication of number of each, specific sizes, eg 250 cm^3 beaker, 1dm^3 flask. If any major item is missing do not award
N	appropriate number of measurements stated;	**1**	mentions replicates/repeats
O	need for range of measurements stated;	**1**	statement: eg 'range of saline solutions in order to find point of isotonicity (OWTTE)'
P	appropriate range stated;	**1**	minimum 5 concentrations
Q	relevant variables are identified (stated); controlled variables	**1**	at least 2 from: source of tissue, age of tissue, temperature, volume of saline used, surface area of tissue, time of immersion
R	how variables to be controlled explained;	**1**	explanation for at least 2 of the variables
S	one suitable method to display data;	**1**	one display of results eg table with appropriate column headings
T	additional method to display data;	**1**	any <u>different</u> display eg graph. [salinity] on horizontal axis, +/- change on vertical axis]
U	simple data handling;	**1**	mean/use of graph data eg where curve crosses x-axis, calculations
V	possible conclusions;	**1**	statements of expectations or observations to confirm or reject prediction made in **B**. 'what would the results need to show to confirm or reject the prediction?'
W	recognises sources of error;	**1**	at least two examples: equipment/materials/specific human error
X	suggests methods for improving accuracy and or validity;	**1**	accuracy: relate to '**W**' or use of alternative technique(s). AND/OR validity: state aspect of collected data to be compared with secondary sources
Marks	Maximum for plan = **25**	**24** + ***1*** *(scientific terminology)*	

[saline solution], initial mass/vol, final mass/vol, average change, percent' change.

e.g. how do you know the age of the tissue, guarantee the source of the tissue, measure the effect of evaporation, get consistent degree of dryness before measuring mass?

'floating' samples; expand critical [salinity] range around initial water potential values;

Mark Scheme G623
Planning Exercise
January 2007

Question			Expected Answers	Mk	Additional Guidance
1	a		*two from:* magnifies objects (over 500 000 times)/higher magnification/can see cell ultra-structure; has a higher resolving power; possible to investigate greater depth of field; *two from:* cost; special accommodation; needs skilled operative; preparation of specimens lengthy/complex; material may be distorted/produces artefacts/distorts image; high vacuum required; living material cannot be viewed/ORA;	**4**	
	b	**i**	correctly placed label line and letter; ; ; ;	**4**	
		ii	aerobic respiration/release of ATP/release of energy/Kreb cycle/TCA cycle/oxidative phosphorylation/electron transport chain;	**1**	
		iii	correct measurement between arrows; correct conversion from mm to µm/proportionality process; answer range 6.6 to 6.9; correct unit;	**4**	look for 35 /3.5 OR 60/6.0

		iv 1	identical/all from the same clone/hybridoma/single/pure antibody; which combines with only one specific antigen only;	**2**	
		iv 2	*two from:* genetic disorder produces a specific antigen; monoclonal targets specific antigen; enabling recognition of a specific genetic disorder; AVP;	**2**	
		v	*five from:* possibility of error arising during testing; human rights issues including employment; insurance; mortgage facilities; the mother may need to know because of possible problems with her long term care of the child; she may need to consider termination; she may need to consider how serious a defect has to be before selective abortion is considered; the disease is incurable so does she want to know; she/the child could have many years of normal life before symptoms show; if she is positive should she tell her close genetic relatives; cost-effectiveness of screening; AVP ; appropriate use of English; spelling, punctuation and grammar;	**5** **2**	QWC approp. use of English look for 'flow' ALLOW 1 error for each of spelling, punct and grammar
			Total	**24**	

2	**a**	**i**	disaccharide: (sugar) formed from (condensation) two monosaccharide; hexose: 6 carbon sugar;	**1** **1**	
		ii 1	both condensation reactions/water 'displaced'/AW;	**1**	
		ii 2	correct **structural** formulae for: $CH_3CHNH_2CONHCH_2COOH$; H_2O;	**2**	ALLOW answers that show correct symbols, single and double bonds of the peptide linkage ie of –CONH- IGNORE the rest
	b		maximum 6 marks from: iodine (in KI solution) ; blue/black indicates starch; boil with dil. acid ; neutralise ; heat with Benedict's reagent; orange – red (after hydrolysis) indicates sucrose; Biuret reagent ; goes lilac;	**6**	
			Total	**11**	

3	**a**		11;	**1**	
	b		area of central square = 0.2 x 0.2 mm^2; volume = 0.2 x 0.2 x 0.1 ;	**2**	look for the use of dimensions in area calculation for the 1st mark and the inclusion of 0.1 for volume for the 2nd.
	c		11 cells in 0.004 mm^3; in 1 mm^3 $\frac{1 \times 11}{0.004}$; in 1 cm^3 $\frac{1 \times 11 \times 1000}{0.004}$; 2 750 000;	**4**	ECF from (a) for number of cells
	d	**i**	*two from*: only one square counted; culture may not be uniformly sampled; some of the cells likely to be dead/AW ; human error; AVP;	**2**	e.g. for AVP 'new cells continuously produced'
		ii	count more squares/determine average values/change dilution used/use Coulter Counter ;	**1**	
			Total	**10**	

Mark Scheme G628
January 2007

Question			Expected Answers	Marks
1	a	i	$\frac{20 \times 31}{100}$ = 6.2 million;	1
		ii	$\frac{1 \times 6.2}{5}$ = 1.2(4) million (allow ecf);	1
	b		one of the hormones that controls cells which replace bone	1
	c		the body is designed to adjust to gradually falling hormone levels as we get older;	1
	d		P–O–P group;	1
	e	i	a compound that has no effect on the body/a compound that does not contain the active ingredient;	1
		ii	even if they knew, it could not have a (psychological) effect on bone mineral density;	1
		iii	any **two** from: greater number of participants; longer period of time; arrange patients in groups of severity;	2
		iv	the long term effects on the body are not known;	1
	f		any **four** from cost; side effects; toxicity; will it work; dose needed; method of administration; how often; for how long does the course need to be taken; for how long is the treatment effective; is the effect of the treatment age specific; are/will the treatment be easily obtainable; is the treatment specific for osteoporosis;	4
	g	i	side effects may be a serious problem/toxic;	1
		ii	it increases bone mineral density; reaches a plateau after three years;	1 1
		iii	the two rates become equal;	1

1 cont.	**h**		find out how the antibiotic works; modify its structure in an appropriate way; test to see if it works (not clinical trials);	**2**
	i	**i**	$\frac{120 \times 15 \times 7}{100}$ = 126 (mg);	**1**
		ii	conc. of calcium = $\frac{30.0}{0.063}$ = 476 (mg dm^{-3}); mass of calcium in tablet = $\frac{476 \times 250}{1000}$ = 119 mg;	**1** **1**
		iii	poor absorption into the body/there is no suggestion that they prevent (or cure) osteoporosis;	**1**
			Total	**24**

Question			Expected Answers	Marks
2	**a**	**i**	the % of bitumen varies/to get an average bitumen content;	**1**
		ii	where (s)he is going; how long for;	**2**
		iii	equidistant (horizontally); different heights; so that a representative sample is collected;	**3**
		iv	any **one** from overhanging rocks; dangers of collecting from a height; loose rocks;	**1**
		v	where they were from;	**1**
		vi	bigger surface area from finer particles;	**1**
		vii	data books/electronic means;	**1**

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th></tr>
<tr><td>2 cont.</td><td></td><td>viii</td><td></td><td></td></tr>
<tr><td></td><td></td><td>1</td><td>suitable description of crushing eg pestle and mortar;
weighed material will be left in the mortar;</td><td>1</td></tr>
<tr><td></td><td></td><td>2</td><td>to ensure (all) soluble material in the bitumen dissolved;</td><td>1</td></tr>
<tr><td></td><td></td><td>3</td><td>to ensure that no traces of bitumen solution were left on the rock particles;</td><td>1</td></tr>
<tr><td></td><td></td><td>4</td><td>drawing/writing shows method of heating involving no flames;</td><td>1</td></tr>
<tr><td></td><td></td><td>5</td><td>safe/acceptable method of evaporation;
use of a fume cupboard;</td><td>1
1
1</td></tr>
<tr><td></td><td></td><td>ix</td><td><table><tr><th></th><th>mass of sample/g</th><th>mass of bitumen/g</th><th>% of bitumen</th></tr><tr><td>1</td><td>12.50</td><td>1.00</td><td>8.00</td></tr><tr><td>2</td><td>10.58</td><td>0.82</td><td>7.75</td></tr><tr><td>3</td><td>11.54</td><td>0.90</td><td>7.80</td></tr></table></td><td>2</td></tr>
<tr><td></td><td></td><td>x</td><td>mean % = 8.00 + 7.75 + 7.80 = 7.85</td><td>1</td></tr>
<tr><td></td><td>b</td><td>i</td><td>so that the results can be compared;</td><td>1</td></tr>
<tr><td></td><td></td><td>ii</td><td>it would increase;
since the bitumen becomes softer/less viscous;</td><td>2</td></tr>
<tr><td></td><td>c</td><td></td><td>4 mm, flow rate is slower, therefore more accurate;</td><td>1</td></tr>
<tr><td></td><td>d</td><td></td><td>greater than the boiling point of decane;
but less than the ‘boiling point’ of bitumen;</td><td>2</td></tr>
<tr><td></td><td>e</td><td></td><td>errors reduced/more accurate;</td><td>1</td></tr>
<tr><td></td><td>f</td><td>i</td><td>risk assessment;</td><td>1</td></tr>
</table>

Question			Expected Answers	Marks
2 cont	f	ii	any **four** from add carbon disulphide/methylbenzene; stir; filter; into weighed filter paper; dry; reweigh; two marks for quality of written communication: select and use a form and style of writing appropriate to purpose and to complex subject matter; ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear;	4 2
	g	i	a (colloidal) system of one liquid dispersed in another liquid;	1
		ii	not/non/less flammable/ecologically 'safer';	1
		iii	bitumen is too viscous (for liquid injection);	1
		iv	during winter time the 'orimulsion' will be below its minimum storage temperature;	1
		v	advantage: relatively more heat generated; disadvantage contains more sulphur (greater pollution problems)/cannot be stored in the open air;	2
			Total	**40**

Question			Expected Answers	Marks
3	a		(consult the literature) for an alternative chemical/supplier/make it themselves;	1
	b		any **five** from crush it using e.g. a pestle and mortar; transfer it to a large crucible/tray; heat (strongly); for a suitable time interval; in a fume cupboard; allow the solid to cool;	5

Question			Expected Answers	Marks
3 cont	c		any **two** from heat mixture/stir; filter; crush to a finer powder; use 'stronger' sulphuric acid;	2
	d		any **three** from the diagram shows; stirring; filtration; washing of precipitate; drying of precipitate;	3
	e		warning sign on label;	1
	f	i	diagram shows a suitable method for oxygen collection; over the correct electrode;	2
		ii	weigh the aluminium electrode before use; wash it after the experiment/dry; reweigh the electrode;	3
	g	i	sulphur dioxide is a toxic/valuable gas;	1
		ii	sealing prevents acid 'spray'/vented for oxygen removal;	1
		iii	less labour intensive, therefore more economical;	1
	h	i	correct plots; line of best fit;	2
		ii	8.40 (g cm^{-3});	1
		iii	line drawn correctly on graph; correct value obtained from drawn line;	2
		iv	the volume has been measured to two significant figures therefore the density cannot be used to three significant figures/the volume has not been measured accurately enough;	1
			Total	**26**

Mark Scheme G635
January 2007

Question			Expected Answers	Mks
1	a	i 1	the number of cycles/waves/crests per sec/unit time; passing a point/determines colour/hertz/Hz;	2
		i 2	the distance between two peaks/troughs/points of max/min electric/magnetic field/equivalent points (on successive waves); at a given time/determines colour/metres/m; (NOT length wave)	2
		ii	2:3 [NOT 3:2]/X is 1.5 times that of Y	1
	b	i	fibres parallel/arrangement of fibres is same at both ends/throughout;	1
		ii	the image/elements of the image would be mixed up; ACCEPT image distorted	1
	c		illumination; OR (single) TV/computer link OR other appropriate alternative	1
	d	i	less	1
		ii 1	any two from: different path lengths; different times to travel down fibre; depending on angle light enters fibre; depending on number of internal reflections;	2
		ii 2	any two from: refractive index changes gradually; path lengths similar; refractive index decrease from the centre; ray with longer path/path further from centre travels faster;	2
	e		any four from: very large information capacity; low material costs; lasts longer; small cable size; negligible crosstalk; high immunity to interference; complete electrical isolation; large repeater spacing/longer distances/less attenuation/degradation in same distance; more secure;	4

Question			Expected Answers	Mks
1	f	i	reflected ray shown with direction arrow; reflected ray with angle of reflection = b (by eye); refracted ray shown with direction arrow [ACCEPT emerging along surface of block] refracted ray with angle of refraction > b	4
		ii	reflected ray marked	1
		iii	1 sin 90 = refractive index x sin **q**; or refractive index = 1/sin **q**; or refractive index = sin 90/sin **q**; 2 velocity in glass ~ 2/3 velocity in air/velocity of light less in glass than air;; 3 refractive index = ratio of light velocities OWTTE 4 critical angle; 5 disappears/TIR takes place/all energy transferred to reflected ray; 6 increases/all energy transferred to reflected ray; 7 total internal reflection/TIR;	7
	g		n = 1/sin C/1/sin 48/1/0.743 [ACCEPT any sf];	1
			Total	30

Question			Expected Answers	Mks
2	a	i	in the nucleus; any ONE of the following as a way of releasing excess energy; following β decay; energy released from an excited/unstable nucleus; nucleus returns to its ground state/accompanying α emission;	2
		ii	penetration of metal/more penetrating; ACCEPT X-ray set would not fit inside pipe;	1
		iii	any appropriate devices, eg: photographic film; Geiger counter;	2
	b	i	travel through a vacuum; same speed as light (in a vacuum); changing electric field/magnetic field;	3
		ii	greater (than both);	1
		iii	smaller (than both);	1
	c		any indication of direction perpendicular to the wave direction;	1
	d		any indication of direction at along the wave direction;	1
	e	i	sound waves cannot be polarised and light waves can be polarised;	1
		ii	any 4 from: light waves are transverse; sound waves are not transverse; transverse waves can be; polarised; longitudinal waves cannot be polarised; for longitudinal/sound there is only one possible displacement direction; transverse/electromagnetic/there are many/infinite/more than one possible displacement directions; polarised waves select/have only one of these directions;	4
			Total	**17**

Question			Expected Answers	Marks
3	a	i	white; contains all colours/frequencies/wavelengths of the visible spectrum/light; plus infrared radiation; reference to variation in intensity at different frequencies; [ALLOW credit for alternative correct points] [ACCEPT graphs] [ALLOW 1 mark only for yellow]	4
		ii	any 5 appropriate points eg: becomes red; then visible emission fades; total intensity decreases/less radiation emitted; intensity at all frequencies/wavelengths decreases; contributions from blue end of spectrum disappear completely/becomes yellow; contributions disappear progressively from blue to red end of spectrum/becomes red/orange; then higher infra red contributions disappear; only infra red remains when cold; [ACCEPT graphs] QWC scientific terminology	5 1
	b	i	any appropriate answer eg: looking for disturbed ground; seeing people in the dark; seeing engines in the dark; finding hot spot in engines; seeing liquid level in tanks;	1
		ii	false colours used to represent different temperatures; all objects emit infra-red radiation; statement about variation of temperature of object (eg disturbed ground/people warmer than surroundings;	3
			Total	14

Question			Expected Answers	Mks
4	**a**	**i**	divisions of geographical areas;	**1**
		ii	any value 0.5 – 20 miles/1-32 km or equivalent;	**1**
		iii	any two from: a (fixed) transmitter; and receiver; aerial/antenna;	**2**
		iv	any two of: to make the most of the limited frequency ranges; increases the number of users a network can carry; increases the range over which an individual user can communicate; frequency re-use; avoids cross-talk;	**2**
		v	up-link:- the signals transmitted by mobile phones/received by base station (ACCEPT satellite); down-link:- the signals received by mobile phones/sent by base station (ACCEPT satellite);	**2**
	b	**i**	signals where the loudness of the sound encoded as a number; OR signals that can only have certain values (0 or 1); OR continuously variable	**1**
		ii	signals where the size/amplitude/frequency is proportional to the loudness of the sound/signals that can have an infinite number of values (including negative ones);	**1**
		iii	any four of the points below: PCM works by: measuring the amplitude of the analogue signal at regular intervals; known as sampling; amplitude becomes a voltage; this is compared with a fixed set of voltages; the number of the voltage nearest to the sampled value is then stored as a digital number;	**4**

4	**c**		*letters characters correctly encoded (ALLOW numeral 0 or letter O);* *full stops correctly encoded;* *? correctly encoded;* O 1001111 or numeral 0 0110000 . 0101110 K 1001011 . 0101110 ? 0111111	**3**
				Total **17**

Question			Expected Answers	Mks
5	**a**	**i**	any three appropriate points eg damage cells: through ionisation; cause cancer/uncontrolled cell growth/other examples; cause sterilisation; cause genetic defects; short and long term effects; affect DNA QWC	**3** **1**
		ii	any appropriate point eg benefits outweigh hazards; dose is kept to a minimum/example of how this is done; patient only exposed once/a few times staff are working with radiation every day;	**1**
	b	**i**	any two appropriate points eg: X-rays harmful; cause cancers/kill cells/cause cells to mutate; reducing dose rate reduces dose (if time unchanged); the bigger the dose the more harm/more likely to harm; some patients (have to have) many X-rays;	**2**
		ii	any three appropriate points eg screen emits visible light/brightens image; when X-rays hit/excite it; called phosphors/phosphorescence/fluorescence; light exposes film; more than X-rays (alone); second sheet behind film; produces second batch of visible light;	**3**
		iii	any two appropriate points eg minimise time exposed; keep distance; ACCEPT: monitor dose received; wear lead apron OR stand behind a lead screen;	**2**
				Total **12**

Advanced GCE Applied Science AS (H175, H375)
January 2007 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G620	Raw	50	40	35	30	25	20	0	377
	UMS	100	80	70	60	50	40	0	
G621	Raw	50	40	34	29	24	19	0	279
	UMS	100	80	70	60	50	40	0	
G622	Raw	90	70	61	52	44	36	0	751
	UMS	100	80	70	60	50	40	0	
G623	Raw	90	70	61	52	44	36	0	177
	UMS	100	80	70	60	50	40	0	
G624	Raw	50	40	35	30	25	20	0	106
	UMS	100	80	70	60	50	40	0	
G625	Raw	50	40	35	30	25	20	0	52
	UMS	100	80	70	60	50	40	0	
G626	Raw	50	40	35	30	25	20	0	101
	UMS	100	80	70	60	50	40	0	

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H175	300	240	210	180	150	120	0

	Maximum mark	AA	AB	BB	BC	CC	CD	DD	DE	EE	U
H375	600	480	450	420	390	360	330	300	270	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total nos of candidates
H175	0.0	408	19.0	57.1	85.7	100.0	26

	AA	AB	BB	BC	CC	CD	DD	DE	EE	U	Total nos of candidates
H375	0.0	0.0	0.0	3.1	12.5	31.3	53.1	81.3	93.8	100.0	32

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: helpdesk@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553