OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Mark Schemes for the Units

June 2009

H175/H375/MS/R/09

Oxford Cambridge and RSA Examinations

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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

G622 Monitoring the activity of the human body

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	fuel [and] oxygen **;** carbon dioxide [and] water **;**	2	both substrates both products **allow** correct formulae
		(ii)	*any **two** from:* heat / kinetic **;** light **;** sound **;**	2	
		(iii)	ATP / adenosine triphosphate **;**	1	
		(iv)	oxidation / redox **;**	1	
	(b)		*any **six** from:* blood is the transport medium **;** [blood] carries glucose to a (respiring) cell / tissue / muscles**;** heart pumps blood around the body **;** air breathed into lungs contains oxygen **;** oxygen diffuses from alveoli into blood **;** oxygen combines with haemoglobin (in red blood cells) **;** red blood cells carry oxygen to (respiring) cells / tissues / muscles **;** carbon dioxide from respiration / cells / tissues carried in blood to lungs **;** detail of diffusion into alveoli **;** AVP **;**	6	read the whole passage. look for each listed word. consider context.
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	right atrium ;	1	
		(ii)	collects / stores / receives blood ; pumps / forces / pushes blood ; to ventricle ;	3	**do not accept** send / transport / passes blood **reject** left ventricle
		(iii)	*any **four** from*: B and C are ventricles ; C pumps blood to lungs ; B pumps blood to all parts of the body ; difference in distance / overcome resistance of systemic system ; necessary to generate more pressure / force / power in B ; B has more muscle / thicker wall ; AVP ;	4	**reject** under more pressure e.g. to stop damage to alveoli and capillaries in lungs
	(b)		*any **four** from*: cardiovascular centre / medulla (oblongata) involved ; accelerator centre involved ; more impulses ; along accelerator nerve / sympathetic nerve (system) ; to SAN ; iIncreases the rate of cardiac / heart contraction ; increase strength of heart beat / AW ; arterioles ; muscles in walls contract ; vasoconstriction ; increase vascular resistance ; increases blood pressure ; AVP – correct reference to hormonal release ;	4	
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		15 – 18 ; 0.4 – 0.5 ; dm^3 ; 4.25 ; dm^3 ;	5	
	(b)	(i)	3 in 15 seconds ; 12 ;	2	answer only award 2 marks e.c.f.
		(ii)	0.5 – 0.6 ; 5.25 ;	2	value needed here not range
		(iii)	*any **two** from*: tidal volume higher than normal ; vital capacity higher than normal ; very fit ;	2	no need for comparator – in stem of question e.c.f.from 3a
		(iv)	*any **four** from:* ***period A*** faster ; shallower breathing ; ***period B*** taking a deep breath ; very slowly ; data values ; ;	4	IRV = 3.25 dm^3 ERV = 1.50 dm^3 TV = 0.50 dm^3 data values can be awarded for A and/or B
		(v)	1.25 $\underline{dm^3}$;	1	

Question			Expected Answers	Marks	Additional Guidance
3	(c)	(i)	***Recreational*** nicotine / ketamine / cannabinoids / cannabis / amphetamines / cocaine / caffeine / methadone / morphine / diamorphine (heroin) / ecstasy **;**	1	
			Performance En caffeine / (anabolic) steroids / anabolic androgenic steroids / e.g. nandrolone / e.g. stanozolol / beta-blockers / erythropoietin / EPO / ketamine **;**	1	
		(ii)	*any **three** from:* divided into two **;** keep one sample **;** analyse or test one sample **;** analytical techniques **;** AVP **;**	3	e.g. chromatography / spectroscopy / ELISA test **reject** references to blood doping. AVP e.g. – compared to standard / quantified / identified
		(iii)	*any **four** from:* 2 examples of a contaminated material and their appropriate disposal procedure **; ; ; ;** specialist waste disposal companies **;** AVP **;**	4	**example 1** Petri dishes / Culture flasks **;** *procedure:* Autoclaving **;** **example 2** Syringes / lancets **;** *procedure:* Special containers for sharps **;** AVP e.g. – correct mention of alcohol use
			appropriate use of English **;** SPG **;**	2	
			Total	**27**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i 1)	B before G G before A A before H H before E	3	4 correct = 3 marks 3 = 2 2 = 1 1 = 0
		(i 2)	to avoid gravity affecting reading / OWTTE **;**	1	**do not accept** to keep pointer at zero
		(i 3)	to ensure **highest / maximum** reading obtained / SAW **;**	1	**reject** average / reliability
		(ii 1)	260 + 240 + 310 + 260 or 1070 **;** 1070/4 **;** 267.5 / 268(dm^3 min^{-1}) **;**	3	**allow** ecf for total **allow** 3 marks for answer only
		(ii 2)	SUN week 8 **;**	1	
		(ii 3)	<u>am/morning and pm/evening values</u> higher than average **;**	1	
		(ii 4)	*any **six** marks from* peak flow rates consistently higher (week 9 cf week 8) **;** related data **;** difference between am and pm values consistently less (week 9) **;** related data **;** am readings always less than pm readings **;** related data **;** AVP **;** related data **;**	6	AVP - **accept** a description of correct and correctly related data for 2 marks

Question			Expected Answers	Marks	Additional Guidance
4	**(b)**	**(i)**	sphygmomanometer **;**	1	
		(ii)	120 mmHg is measure of systolic pressure / owtte **;** 80 mmHg is measure of diastolic pressure / owtte **;**	2	
			Total	**19**	

Question			Expected Answers	Marks	Additional Guidance
5	**(a)**	**(i)**	*any **six** from :* correct reference to generation of x-rays **;** X-ray / radiation through body to film **;** (radiation) produces an image on the film **;** bones / denser material absorbs more radiation **;** soft tissue absorbs less **;** different tissues absorb different amounts of x-rays **;** idea of image dark where most gets through / shadow image / bones white or light grey / bones give better resolution **;** X-ray film as record **;**	6	**ignore** reference to Barium meal
			QWC organising relevant information **;** use of specialist vocabulary **;**	2	any 2 of, image, absorb, dense, radiation, tissue

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(ii)	*any **six** from :* age and survival rate ; the need to obtain informed consent and patient not able to give it ; why prolong a life of little quality ; identify need for palliative care / additional support without treatment ; need for pain management ; is imaging necessary if surgery is not going to occur / or be successful ; if cancer early stage patient could die before seriously affected ; would patient be able to cooperate during imaging ; cost effectiveness ; availability of imaging equipment ; priority of use of equipment ; AVP ; ;	6	treatment / survival affected by age

Question			Expected Answers	Marks	Additional Guidance
5	(b)		**CAT** high levels of (ionising) radiation involved with CAT **;** cell or tissue or DNA damage / cancer / accumulation effect over time in workplace **;** wear badges to register radiation / leave vicinity of scanner when operating / wearing lead aprons **;**	3	
			MRI noise / magnetism / metal / staples / earrings / implants / enclosed space **;** deafness / ear damage / panic / MRI banned therefore incomplete diagnosis / metal sucked into machine / out of patient / damage to machine / damage to patient / claustrophobia **;** ear plugs / music / interview / remove 'metals' / counsel / warn / sedate **;**	3	risk should link to hazard safety precaution should link to risk
			Total	**20**	

G623/01 Cells and molecules – Plan

Planning Exercise

Does the activity of papain increase as the fruit ripens?

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 task.
C	with justification;	1	Use evidence
D	description of preliminary work;	1	At least one from:
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?

Preliminary work here

Main investigation starts here.

2 types of hazard related to task, assoc risk and safety precautions: sharps eg during maceration /processor/ blender; electrical incl above,devices or water bath or centrifuge; biohazard ;

How to extract enzyme ; buffering ; how to avoid decay of tissue ;dilution factors, how to set up dilution series; range of dilution to consider; type of film; size of film sample

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, e.g. 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: reason for range chosen
P	appropriate range stated;	1	5 values to provide a sensible range
Q	relevant variables are identified (stated); controlled variables	1	At least 2 from:
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 e.g. Table with appropriate column headings
T	additional method to display data;	1	Any <u>different</u> display e.g. graph. NB the dependent variable must be on the vertical axis
U	simple data handling;	1	mean / use of graph data
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)*	

5 time intervals / degrees of

VARIABLES age of sample; volumes of extract solution / etc ; temperature ; source of fruit; type of film

Accuracy: precision of water bath

Validity: comparison with secondary source

G623/02 Cells and molecules

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mk</th><th>Additional Guidance</th></tr>
<tr><td rowspan="8">1</td><td rowspan="8">(a)</td><td rowspan="8">(i)</td><td rowspan="8">
<table>
<tr><th>feature</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td>.....cloudy white emulsion</td><td></td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>.... is a lilac/mauve colour</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>test reagent for lipids</td><td></td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>test reagent for proteins</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>test reagent for sugars</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>test reagent for starch</td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>.....non-reducing sugars</td><td></td><td></td><td></td><td>√</td><td></td></tr>
</table>
</td><td>7</td><td>reject each line if more than 1 tick</td></tr>
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<tr><td></td><td>(ii1)</td><td>peptide / covalent ;</td><td>1</td><td>accept ‘dipeptide’</td></tr>
<tr><td></td><td>(ii2)</td><td>sequence/order of amino acids ;</td><td>1</td><td></td></tr>
<tr><td></td><td>(ii3)</td><td>α-helix ;
β-sheet ;</td><td>2</td><td>NB 2 marks for this part</td></tr>
<tr><td></td><td>(ii4)</td><td>irregular folding (into globular protein / owtte) / ref to 3D shape / particular shape ;</td><td>1</td><td></td></tr>
<tr><td></td><td rowspan="3">(b)</td><td>(i)</td><td>condensation ;</td><td>1</td><td></td></tr>
<tr><td></td><td>(ii)</td><td>glycosidic ;</td><td>1</td><td></td></tr>
<tr><td></td><td>(iii)</td><td>maltose ;
water ;</td><td>2</td><td></td></tr>
</table>

Question			Expected Answers	Mk	Additional Guidance
	(c)		*any **five** from :* double layer ; phospholipid molecules ; hydrophilic / lipophobic 'phospho heads' / 'glycoheads' ; lipophillic / hydrophobic 'lipid tails' / 'glycolipid tails' ; proteins ; some extrinsic / owtte ; some intrinsic / owtte ; some proteins function as enzymes ; some proteins function as carrier molecules ; glycoproteins ; glycolipids ; cholesterol ; molecules can change position / proteins / lipids move around ; proteins 'floating in a sea of lipid' / owtte ; proteins in the lipid bilayer give the mosaic appearance ;	5	
			Total	**21**	

Question			Expected Answers	Mk	Additional Guidance
2	(a)		correct use of each of the listed words in appropriate context examples: the section is transferred to the slide using a fine-haired brush **; ;** a small drop of distilled water is placed on the slide using a pipette **; ;** etc. QWC organisation ; appropriate use of English ;	5 2	 read the whole passage. look for each listed word. consider context. organisation – appropriate sequence / order a u o Eng – look for 'flow'
			Total	**7**	

Question			Expected Answers	Mk	Additional Guidance
3	(a)		*Myosotis* Image = 3mm ; 1 mm represents 6/2 µm / 2 µm ; *Cucurbita* pollen grain image = 80 mm ; actual size = 80 x 2 / 160 ;	4	Alternative method 1: 80; divide by 3; multiply by 6 ; Answer 159.9 / 160 ; Alternative method 2: Myosotis Image = 3 mm ; Magnification = 3 divided by 0.006 ; = 500 ; Actual Size of Cucurbita = 80 000 divided by 500 / 160 ; General 2 marks for measurement (3 and 8) ;; 1 mark for method (ratio or using magnification = image size divided by actual size) ; 1 mark for Answer If correct answer *only* given award 4 marks
	(b)		*Cucurbita* image = 80 000 ; actual size = 159.9 or 160 / ecf magnific'n = 80 000 / 159.9 or 80 000 / 160 or M = I / A ; = 500.3 or 500 ;	3	NB Actual size statement is **not** awarded a mark in this section
			Total	**7**	

Question			Expected Answers	Mk	Additional Guidance
4	(a)	(i)	1 to count (number of cells) ; 2 to measure (actual size of a cell or cell structure) ;	2	Context of question demands some reference to cells in 1 or 2. Ref necessary to gain both marks. If not then 1 only for 'count' and 'measure'
	(b)	(i)	nucleus of B larger / not spherical / less stained ; OR Cell B longer / more irregularly shaped	1	
		(ii)	1 [normal] any large cell with smaller nucleus ; 2 [abnormal cell] any large cell with larger, more heavily stained nucleus ;	2	
		(iii)	use of stains (to distinguish between healthy and abnormal) ;	1	
	(c)		*any **four** from:* ELISA uses enzyme reactions to identify presence of antigen ; pathogens have specific antigens ; monoclonal antibody is coupled /owwtte to enzyme ; if specific antibody to disease-antigen is present ; monoclonal-enzyme will link to antibody ; colourless substrate added / ref to colour change ; intensity of colour relates to amount of antigen ;	4	
			Total	**10**	

G628 Sampling testing & processing

Question			Expected Answers	Marks	Additional Guidance
1	a	i	*any **three** from:* place sample taken from / position on beach ; random sampling technique / different places; appropriate amount to collect / size /quantity; condition of seaweed / age / wet / dry / damaged ; number of seaweed samples to take ; health & safety / suitable clothing ; time of day / tide position ; weather ;	3	
		ii	rain removes soluble iodine / soluble salts ; therefore the results are not comparable / fair;	2	**do not accept** fair tests **do not accept** contamination
	b	i	to remove traces of impurities / seawater / contaminants / clean ;	1	
		ii	iodine is lost if the temperature is too high ;	1	
		iii	heat for a longer period of time ;	1	**do not accept** higher temperature
		iv	B ;	1	**allow** B & D but not D alone
		v	the seaweed was not dry at the start / some ash was spilled / temperature too high / heating time too long ;	1	

Question			Expected Answers	Marks	Additional Guidance
1	c		*any **three** from:* suitable risk assessment **;** how much water / ash to use **;** stirring / shaken **;** whether to warm or not / reference to temperature conditions **;** method of filtration not given **;**	3	**do not accept** references to time **do not accept** Cool down **do not accept** use of distilled water v tap water
	d	i	risk assessment **;**	1	**do not accept** PPE
		ii	*any **two** from:* open fire - method of heating needs to be enclosed / electrical heating / Bunsen burner / controlled heating **;;** toxicity / heavy use of a lead cover – use of another suitable material for the lid **;;** danger of iodine vapour escaping – mentions a more effective cooling method **;;** toxic fumes escaping – needs extractor / fume cupboard **;;** earthenware apparatus brittle - use of a more suitable material **;;**	4	**do not accept** goggles/gloves etc.

Question			Expected Answers	Marks	Additional Guidance
1	e	i	*any **four** from:* where to collect ; how to collect ; how many samples to collect ; when / time of day to collect ; condition of sample ; size of each sample ; how to store ; considers hazards / weather when collecting / PPE ; how often to collect ;	4	
		ii	**1** washing (with fresh water) ;	1	
			2 use of warm oven / other suitable drying method ; Weighing to constant mass described ;	2	**accept** leaving it to dry
		iii	*any **one** from:* concentration / volume of the sodium hydroxide solution ; amount of sample ; risk assessment / health & safety guidance ;	1	**accept** 'amount' / mass of sodium hydroxide (solution) **accept** all samples in some sodium hydroxide **do not accept** apparatus
		iv	to avoid splashing of the sodium hydroxide solution / danger of fire (from the alcohol present) / (toxic or harmful or corrosive) fumes or gases ;	1	
		v	glass wool / gravel / sand / use of a centrifuge / decant / muslin cloth / sieve / evaporation / distillation/ sintered glass ;	1	**do not accept** vacuum filtration

Question			Expected Answers	Marks	Additional Guidance
1	f	i	viscosity varies or changes or is affected by temperature / in order to compare results **;**	1	**do not accept** a fair test
		ii	water bath / insulation **;**	1	**do not accept** thermometer **accept** heating mantle
		iii	increases…….decreases **;**	1	**accept** 'decreases…….increases'
		iv	1.65 **;**	1	
		v	viscosity varies with the length of the polymer (chain) **;**	1	**ignore** reference to temperature
	g		hydrophilic – 'water loving' **;** polymer – a compound containing (many) repeating units / structure **;**	2	
			Total	**35**	

Question			Expected Answers	Marks	Additional Guidance
2	a		the percentage of lead varies (from 5% to 10%) ;	1	
	b		unsafe roofs / flooding / falling rocks / collapse ;	1	**accept** 'poisonous gases' Dangerous needs to qualified
	c		**1** washing / clean the samples / putting them in a sealed bag / take sample from within spoil heap ;	1	
			2 ensure that the apparatus / equipment is clean before use / wash ;	1	
	d	i	add the sample to a measuring cylinder containing a known volume of water ; measure the new volume and subtract the volumes from each other ;	2	**accept** the use of a eureka can
		ii	10 /10.0 ± 0.2 ;	1	
		iii	intermediate values can be found / it can show values outside the accepted range / can show trends / correlation /anomalies / pattern / values shown more clearly / easier to interpret ;	1	**do not accept** more accurate
		iv	the percentage of other minerals present may vary / not homogeneous ;	1	

Question			Expected Answers	Marks	Additional Guidance
2	e		*any **two** from:* ease of use **;** suitability of use; effectiveness **;** availability **;** amount to use **;** impact on environment **;** AVP e.g time taken /additional PPE / other hazards **;**	2	**accept** no side reactions **accept** it is corrosive
	f		*any **two** from:* sulphur dioxide is irritant / toxic **;** lead / lead compounds are toxic **;** high temperature / heat required **;**	2	reference to toxic / irritant without qualification -1 mark
	g	i	$\frac{85 \times 1200}{100}$; (= 1020) **;**	1	also **accept** 85% check
		ii	180 **;**	1	
		iii	$\frac{180 \times 85}{100}$ = 153 **;** 180 – 153 = 27 **;**	1 1	**accept** ecf from (ii)
	h	i	to remove impurities / contaminates / to clean**;**	1	**accept** may have impurities
		ii	how long to leave it / identity / quantity of **A ;**	1	**do not accept** references to Health & Safety
		iii	hazard warning label / concentration / date / AVP **;**	1	
		iv	values of lead <2% are not detected / the % of lead is determined visually **;**	1	

Question			Expected Answers	Marks	Additional Guidance
2	h	v	as a control / in case it contains lead / if turns pink without paint ;	1	
	i		*any **two** from:* more accurate / at least as accurate / quantifiable ; can detect low(er) concentrations of lead ; easier to use ; quicker ; non-invasive ; more reliable ; safer - no contamination on toy ; AVP ;	2	**do not accept** safer / better
	j	i	(lead (ions) react with) impurities / chemicals in tap water ;	1	
		ii	*any **four** from:* use of funnel ; dissolve crystals in small volume of water ; ensuring that no crystals / solution is lost / rinsing ; make up to the mark ; use of meniscus ; mix well / ensure all solid dissolved ;	4	
			QWC organise relevant information clearly and coherently ;	1	
		iii	concentration = 4.5 ; % Lead = 1.8 ;	1 1	 ECF

Question			Expected Answers	Marks	Additional Guidance
	k	i	a material containing two or more metals / elements **;**	1	
		ii	1.84 **;**	1	
		iii	sample 4 / 1.47 (mm) **;**	1	
		iv	altering the quantity of arsenic added to the lead / allowing the lead to fall a greater distance / changing sieve / having the molten lead at a different temperature **;**	1	
			Total	**36**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	through cracks or holes in floors or walls / open windows or doors / ventilation (bricks) / AVP **;**	1	
		ii	poorly fitting windows / one may have double glazing / one may leave the windows open more / difference in insulation / size (building) **;**	1	
		iii	leave windows open / install a fan and outlet pipe below floor level / improve ventilation / close gaps or cracks in floor **;**	1	**do not accept** concrete floors
		iv	more windows open / more ventilation / air pressure is different **;**	1	
	b	i	address **;** when it was put there **;** where it was put in the house **;** hazards **;** identity **;**	2	
		ii	**1** radon levels vary in the house / range of readings **;**	1	**do not accept** fair test
			2 so that the results from each detector can be compared / to take an average **;**	1	**do not accept** fair test
		iii	so that any later radiation cannot affect the results **;**	1	

Question			Expected Answers	Marks	Additional Guidance
3	b	iv	*any **five** from:* mention of health and safety/risk assessment ; measure 25cm^3 ; use of suitably graduated glassware ; suitable vessel to hold sodium hydroxide solution and detector ; heat / use of boiling water ; reference to time / one hour ; mention of the need to top up the heating bath ;	5	
			QWC ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear ;	1	
		v	0.05 ;	1	
		vi	12 tracks (in each slide of 0.05 cm x 0.05 cm) ; 12 x 20 x 20 or 4800 tracks in 1 cm^2 ;	2	
		vii	218 ;	1	
			Total	**19**	

G635 Working waves

Question			Expected Answers	Marks	Additional Guidance
1	a	i	lower / shorter / AW / $\lambda_b < \lambda_r$ / red longer / bigger / than blue **;**	1	
		ii	higher / AW / $f_b > f_r$ **;**	1	**accept** RA
		iii	same / <u>very</u> nearly the same **;**	1	**accept** 3 x 10^8 m/s (for both) /almost the same with value
		iv	v = fλ / $f = \frac{v}{\lambda}$ / $\lambda = \frac{v}{f}$ **;** 3.0 x 10^8 = f x 4.2 x 10^{-7} **;** f = 7.1 x 10^{14} (Hz) ;	3	stated or implied. no penalty for incorrect sf in this question
	b	i	fig.1.2 is darker/less bright than Fig.1.3 or RA **;** (some of) sunlight is absorbed (by polariser)/ direction of polarisation of polariser is 90^0 to / not fully lined up with direction of polarisation of (scattered) (sun)light **;**	2	**do not accept** less clear
		ii	the brightness of the sky/image will change **;** the brightness of the sky/image will (gradually) increase or RA (at some stage in the rotation) **;**	2	**accept** darker / clarity for first mark
	c		sound / longitidinal **;**	1	**accept** other examples of longitudinal e.g. p-waves
	d	i	electromagnetic / e.m. **;**	1	**do not accept** just transverse **do not accept** just an example of an electromagnetic wave, e.g. radio

Question			Expected Answers	Marks	Additional Guidance
1	d	ii	*any **two** from:* gamma/γ ; X ; ultraviolet/uv ; infra red/ir ; micro ; radio ;	2	
		iii	**both** answers correct according to selected regions γ / X will uv / ir / micro / radio will not	1	
			Total	**15**	

Question			Expected Answers	Marks	Additional Guidance
2	a		heating / increase in temperature / slows / damages / wears the surface **;**	1	**allow** burns / fire **do not accept** stops
	b		example of colour(s)/different colours/ example of shade(s) of grey /different shades of grey**;** corresponding to different temperatures/from hot and cold/conveyor belt & elsewhere **;**	2	
	c		*any **three** from:* difference in temperature **;** (radiation) frequency/ wavelength is changed / image is different colours **;** intensity is greater **;** detector converts input (e.g. infra red/photon/radiation) into output (e.g. digital / electronic / electrical signal **;** description of sensor hardware **;** digital / electronic / electrical signal converted to (visible) display **;**	3	
	d		*any **two** from* repair/reduce wear/tear **;** cannot see with naked eye **;** can inspect surfaces inside casings **;** preventative maintenance / avoid breakdowns **;** cost effective for given reason **;** speed/ease of use **;** can be tested without stopping machinery; safer **;** to see whether there is overheating/see hot spots **;** AVP **;**	2	e.g. may be unaware of the problem if didn't have thermal imaging system **do not accept** just cheap **do not accept** easy to manipulate

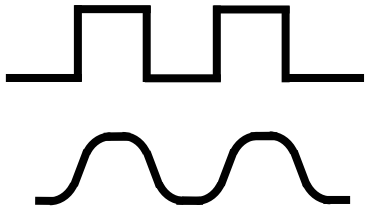
Question			Expected Answers	Marks	Additional Guidance
	e	i	red ; because hot body spectrum extents into visible region / very hot objects emit red ;	2	**accept** orange
		ii	*any **two** from:* white ; more of visible spectrum / (wider) range of (visible) wavelengths / (wider) range of (visible) frequencies ; peak moves towards blue/ peak moves towards high frequency/ peak moves towards low wavelength ; greater intensity ;	2	**accept** yellow / silver / bronze **accept** range of colours.. Other colours not enough
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	output varies according to the signal amplitude / output varies according to the signal voltage / vice versa**;** continuous variation/any value **;**	2	**do not accept** "not digital" **do not accept** just "continuous". **accept** appropriate sketch signal / voltage / amplitude varies continuously scores 2 marks
		ii	frequency division multiple access **;**	1	
		iii	(spectrum) split into many frequencies **;** different users use different frequencies **;**	2	or base station has many frequencies
	b	i	signal consists of binary / 1s and noughts pulses / square wave **;** discrete levels **;**	2	**accept** drawing of square wave for first mark **accept** "can only take set values". Not "can only take a set number of values"
		ii	code division multiple access **;**	1	
		iii	**1** (data transfer rate) too slow / less data can be transmitted with TDMA / FDMA ora **;**	1	**allow** "low information capacity" **do not accept** bandwidth too low /
			2 *any **two** from:* each signal is coded **;** each signal is spread over the entire bandwidth **;** at the receiver the code is used to recover the signal **;**	2	**accept** converted to binary e.g. "uses all the frequencies"

Question			Expected Answers	Marks	Additional Guidance
3	c	i	lots of people trying to make calls **;** only a limited number of channels / frequencies available (in locality / from nearest base station/s) **;**	2	**accept** sensible alternatives
		ii	*any **two** from:* signal too weak **;** too far from base station **;** network providers do not always put base stations in areas of sparse population **;**	2	**allow** "there was no reception" **accept** cell too large
		iii	*any **one** from:* because mountain between Sheila and base station **;** too far from base station **;** signal too weak;	1	e.g. "too many obstructions" **allow** "there was no reception"
	d	i	half duplex **;**	1	**do not accept** simplex. Simplex is communication that is always in the same direction e.g. TV
		ii	(full) duplex **;**	1	
	e	i	can switch frequencies / can use 2 frequencies**;**	1	accept switch to a different bandwidth **do not accept** just can be used in different parts of the world (e.g. Europe & USA)
		ii	works with two (or more) types of (transmission) technology /digital & analogue supported;	1	**allow** system instead of Technology or examples e.g. works with 1G and 2G/ works with FDMA & CDMA **do not accept** just can be used in different parts of the world (e.g. Europe & USA) **do not accept** just 2 or more modes in which it can switch to

Question			Expected Answers	Marks	Additional Guidance
3	f		faster (data transmission) **;** *plus any **two** from:* can use phone at same time as computer **;** higher frequency transmission **;** greater bandwidth separate frequency for phone **;** cheaper (for continuous connection);	3	
			Total	**23**	

Question			Expected Answers	Marks	Additional Guidance
4	a		*any **three** from:* very large information capacity / high speed **;** low material costs **;** small cable size **;** negligible crosstalk **;** high immunity to interference **;** complete electrical isolation **;** large repeater spacing **;** wiretapping is more difficult **;**	3	 **allow** more calls/conversations at once **allow** just cheaper **do not accept** immune to electrocution **allow** Can travel large(r) distances, Less attenuation **do not accept** easier to have in awkward places
	b	i	<u>total internal reflection</u> / TIR **;**	1	
		ii	angle of incidence < critical angle **;** *or* imperfections in / dirt on surface **;** Imperfect end connections **;**	1	**accept** e.g. enters fibre at too high an angle relative to axis [OWTTE] (it is refracted into cladding)/ light source angled out of angle of acceptance when total internal reflection isn't reached **allow** scratches, marks, damage or breakage **do not accept** just "Light comes out at the ends" **do not accept** "Leaking at the ends"
	c	i	less **;**	1	
		ii	greater **;**	1	

Question			Expected Answers	Marks	Additional Guidance
4	d	i	same frequency as input ; 2 ½ cycles only with (at least) some rounding of the corners ; vertical lines now sloping (allow straight or curved) ;	3	**accept** sine wave e.g.  multiple lines lose marks unless all lines meet marking point
		ii	different rays have different path (lengths) (in the fibre) ; depending on the angle at which they enter / number of reflections / rays go in different directions (along the fibre); so signals arrive at different times / are spread out over a period of time ;	3	**allow** different rays travel at different rates/ speeds
		iii	any non-communication application, e,g, illumination / endoscope / short distance transmission ;	1	**do not accept** when incoherent fibres were being used
	e		*any **three** from:* refractive index varies gradually ; refractive index varies radially /between core and cladding ; refractive index less nearer cladding ; rays follow a curved path ; curved paths closer in length ; rays travel faster nearer cladding ; rays travel faster in longer paths ; time to follow paths is same / similar ; paths become closer to axis as they progress along fibre ;	3	**do not accept** "make the rays travel at the same speed along the fibre" **accept** diagram to show any or all of these points
			QWC	1	

Question			Expected Answers	Marks	Additional Guidance
	f		thinner core **;** indication of dimensions **;** so only one path is possible /light travels (straight) down the centre**;**	3	any figure between 1 – 10 μm **do not accept** just single beam/ single ray
			Total	**21**	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	irradiated: exposed to (ionising radiation) **;** radioactive: emitting (ionising) radiation / α / β / γ source (implanted / injected / swallowed) inside patients body **;**	2	**accept** (has been) given a radiation dose **do not accept** into contact with radiation **accept** giving off radiation **do not accept** radiation is in the body
		ii	appropriate example of irradiation e.g. undergoing γ therapy **;** appropriate example of radioactive e.g. therapeutic implant **;**	2	 **accept** undergoing X-ray/CAT scan. **do not accept** just given radiotherapy **accept** injected with radioactive tracer **do not accept** just given radiotherapy
	b		ionise (molecules in) cells / ionisation **;** *any **two** from:* causes chemical reaction **;** can kill/change cells **;** can cause mutation (of cells) **;** uncontrolled cell reproduction; can cause cancer / specific examples inc leukaemia **;**	3	 e.g. damages DNA; so cells cannot maintain themselves & reproduce / causes Genetic damage
	c		film badge / dosemeter or alternative specified personal monitor **;**	1	**allow** GM tube

Question			Expected Answers	Marks	Additional Guidance
5	d		***two*** *from:* reduce exposure (time) **;** increase distance **;** personal shielding **;** other shielding **;** avoid unnecessary procedures **;**	2	**accept** "duty rota"
	e	i	*any* ***two*** *from:* grid prevents scattered radiation reaching the film **;** scattered radiation would make the image blurred / less sharp **;** scattered radiation would make the image have less contrast **;** grid is made of lead (strips) **;** scattered radiation is intercepted / stopped / absorbed (by the lead / grid) **;** grid placed directly in front of the film **;**	2	e.g. "scattered X rays not shown on image therefore image will be clearer" scores this mark
		ii	*any* ***two*** *from:* (narrow beam) makes image sharper / clearer/reduces blur / wider beams produce more scatter/blur **;** X-rays come from source that is not a single point /a small area of the target / source) **;** each point on this area produces a slightly different image **;** beam size reduced by diaphragm / cone **;** lead absorbs unwanted parts of the beam **;** (visible) light used to adjust diaphragm **;**	2	**do not accept** beam is being focussed

Question			Expected Answers	Marks	Additional Guidance
5	f		*any **four** appropriate from:* *(In CAT scanners):* X-ray tube / detectors rotate around body ; images taken from all angles (about patient's long axis) ; more information is available because more images taken ; computer used to combine information ; produces image of a slice through body ; can be made into a 3D image ; shows soft tissue ; patient is exposed to more X-rays ;	4	**do not accept** just "take a slice"
			QWC ;	1	
			Total	**19**	

Grade Thresholds

Advanced GCE Applied Science AS (H175, H375) and
GCE Applied Science A2 (H575, H775)
June 2009 Assessment Session

Portfolio Unit Threshold Marks (AS)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G620	Raw	50	43	38	33	28	23	0	2004
	UMS	100	80	70	60	50	40	0	
G621	Raw	50	43	38	33	28	23	0	2240
	UMS	100	80	70	60	50	40	0	
G624	Raw	50	42	37	32	27	22	0	344
	UMS	100	80	70	60	50	40	0	
G625	Raw	50	43	37	32	27	22	0	261
	UMS	100	80	70	60	50	40	0	
G626	Raw	50	42	37	32	27	23	0	414
	UMS	100	80	70	60	50	40	0	

Examined Unit Threshold Marks (AS)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G622	Raw	90	66	58	50	42	35	0	2101
	UMS	100	80	70	60	50	40	0	
G623	Raw	90	73	65	57	49	41	0	618
	UMS	100	80	70	60	50	40	0	

Portfolio Unit Threshold Marks (A2)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G627	Raw	50	44	39	34	29	24	0	855
	UMS	100	80	70	60	50	40	0	
G629	Raw	50	43	38	33	29	25	0	360
	UMS	100	80	70	60	50	40	0	
G630	Raw	50	42	37	32	27	22	0	132
	UMS	100	80	70	60	50	40	0	
G631	Raw	50	44	39	34	29	24	0	109
	UMS	100	80	70	60	50	40	0	
G632	Raw	50	44	39	34	29	25	0	217
	UMS	100	80	70	60	50	40	0	
G633	Raw	50	43	38	33	28	24	0	334
	UMS	100	80	70	60	50	40	0	
G634	Raw	50	43	38	33	28	24	0	380
	UMS	100	80	70	60	50	40	0	

Examined Unit Threshold Marks (A2)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G628	Raw	90	64	59	54	49	45	0	524
	UMS	100	80	70	60	50	40	0	
G635	Raw	90	72	64	56	49	42	0	605
	UMS	100	80	70	60	50	40	0	

Specification Aggregation Results

Uniform marks correspond to overall grades as follows.
Advanced Subsidiary GCE (H175):

Overall Grade	A	B	C	D	E
UMS (max 300)	240	210	180	150	120

Advanced Subsidiary GCE (Double Award) (H375):

Overall Grade	AA	AB	BB	BC	CC	CD	DD	DE	EE
UMS (max 600)	480	450	420	390	360	330	300	270	240

Advanced GCE (Single Award) (H575)

Overall Grade	A	B	C	D	E
UMS (max 600)	480	420	360	300	240

Advanced GCE (Double Award) (H775)

Overall Grade	AA	AB	BB	BC	CC	CD	DD	DE	EE
UMS (max 1200)	960	900	840	780	720	660	600	540	480

Cumulative Percentage in Grade

Advanced Subsidiary GCE (Single Award) (H175):

A	B	C	D	E	U
1.5	8.2	25.0	52.8	77.5	100.0
There were 1423 candidates aggregating in June 2009.					

Advanced Subsidiary GCE (Double Award) (H375):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
0.0	1.9	4.5	10.5	23.3	36.7	53.0	66.1	75.7	100.0
There were 339 candidates aggregating in June 2009.									

Advanced GCE (Single Award) (H575):

A	B	C	D	E	U
2.2	11.4	36.9	70.6	92.3	100.0
There were 609 candidates aggregating in June 2009.					

Advanced GCE (Double Award) (H775):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
0.0	0.6	4.9	11.9	26.0	43.4	64.8	82.3	93.3	100.0
There were 345 candidates aggregating in June 2009.									

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.

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