OCR
RECOGNISING ACHIEVEMENT

GCE

Applied Science

Advanced GCE **A2 H575/H775**

Advanced Subsidiary GCE **AS H175/H375**

Mark Schemes for the Units

June 2008

H175/H375/MS/R/08J

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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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Advanced GCE Applied Science (Double Award)(H775)

MARK SCHEMES FOR THE UNITS

G622 Monitoring the activity of the human body

Question			Expected Answers	Mk	Additional Guidance
1	a		**E** before **C ;** **C** before **B ;** **B** before **A ;**	3	
	b		trachea has <u>cartilage</u> rings / hoops to support tube (when pressure reduced) or WTTE / mucous (glands) / ciliated (epithelial) cells **;** alveoli have very thin walls / one-cell thick / permeable to respiratory gases / highly vascularised / AW / layer of moisture/ large surface area **;**	2	**reject** bones just cartilage not acceptable max 1 mark for each of the sections
	c		diffusion **;**	1	
	d		*any **four** from:* ribs raised / ribs move up and out **;** sternum raised **;** by contraction/action of intercostal muscles **;** diaphragm lowered **;** by contraction of muscles **;**	4	**accept** involvement of nervous stimulus e.g. phrenic nerve
			Total	**10**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mk</th><th>Additional Guidance</th></tr>
<tr><td rowspan="6">2</td><td>a</td><td></td><td>
<table>
<tr><td>factor/a</td><td>e.cardio</td><td>spiro</td><td>sphyg</td><td>thermo</td></tr>
<tr><td>b.p</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>h.a</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>l.v</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>b.t</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>4</td><td>more than 1 tick per line 0 mark for that line</td></tr>
<tr><td>b</td><td></td><td>1 D ;
2 E ;
3 A ;
4 F ;
5 B ;</td><td>5</td><td></td></tr>
<tr><td>c</td><td>i</td><td><u>red</u> blood cell count / SAW ;
low number / wtte ;</td><td>2</td><td></td></tr>
<tr><td></td><td>ii</td><td>any two from:
blood (may carry pathogens / contaminated blood) - qualified statement ;
patient – qualified statement ;
sharps/needles ;</td><td>2</td><td>all marking points independent

reject incompetence</td></tr>
<tr><td></td><td></td><td>any two from:
contamination by blood / blood spillage ;
bruising of patient/fainting ;
self – puncture / AVP ;</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>any two from:
sterile equipment / new equipment ;
sterilise skin ;
wear protective clothing ;
safe disposal of sharps/ AVP ;</td><td>2</td><td>reject clean</td></tr>
<tr><td></td><td></td><td>any two from:
inform someone in authority ;
fill in an accident form ;
keep patient calm/stay calm ;
clear up if spillage / sharps / AVP ;</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>appropriate <u>explanation</u> of any level of risk ;</td><td>1</td><td></td></tr>
</table>

Question			Expected Answers	Mk	Additional Guidance
2	d	i	*any **four** from:* increase in [EPO] causes increased RBC (synthesis) **;** red blood cells carry oxygen **;** more RBC present =more oxygen (transported) **;** to muscle cells **;** more aerobic respiration enabled **;** more ATP available **;** delays anaerobic respiration / lactic acid accumulation / threshold **;** unfair / illegal advantage in competition **;**	4	
		ii	alcohol / nicotine / cannabis / cocaine / amphetamines etc **;**	1	**reject** steroids / nandrolone
		iii	*any **two** from:* (GL)C **;** (HPL)C **;** electrophoresis **;** (UV)Spectroscopy **;** (IR)Spectroscopy **;** NMR **;** mass spectrometry **;** haematocrit / count number of red blood cells for EPO/blood doping **;** ELISA test **;**	2	mark first 2 responses
		iv	*any **four** from:* take 2 samples **;** retain one for reference / SAW **;** ID qualitative **;** ID quantitative **;** compare with standard **;**	4	**allow** testing of an earlier and later sample if answer refers to EPO testing / blood doping
			Total	**31**	

Question			Expected Answers	Mk	Additional Guidance
3	a		description for each student **; ;** data for each student **; ;** comparison **;** additional data or statement **;**	6	e.g. greatest increase in pr **;** during 1st 30 minutes **;** greater increase shown by Luke **;** 92 cf 70 **;** increase in pr slows down **;** between 30 and 60 minutes **;** starting / resting pr regained by Cameron **;** after 150 minutes **;** starting / resting pr not regained by Luke **;**
	b		*any **six** from:* extra exercise involves increase in muscular contraction **;** rate of (aerobic) respiration increases **;** requires increased supply of oxygen ; and glucose **;** heart rate / pulse rate increases during exercise to meet demand **;** hr / pr increase continues / maintained after exercise ends to remove any lactic acid produced **;** ref. to oxygen debt **;** AVP **;**	6	explanation emphasis on 'increase'
	c		*any **two** from:* regular exercise improves efficiency of heart muscle **;** and muscles associated with ventilation **;** resting pulse rate lower **;** max pulse rate lower in Cameron **;** resting pulse rate regained quicker by Cameron**;**	2	marks awarded for explanation **not** for naming individual
	d	i	peak expiratory flow / owtte **;**	1	max speed air can be breathed out / ref to rate
		ii	*any **two** from:* zero meter **;** subject takes as deep a breath as possible **;** subject blows out as hard as possible **;** AVP **;**	2	*AVPs could be:* take the MAXIMUM of three / at rest **;** (reject average) sterilise mouth piece **;** lips firmly over mouth piece **;**
		iii	400 - 600 **;** dm^3/min **;**	2	**accept** range / correct single value within stated limits
			Total	**19**	

Question			Expected Answers	Mk	Additional Guidance
4	a	i	aerobic **;**	1	
		ii	glucose **;**	1	
		iii	ATP / adenosine triphosphate **;**	1	
		iv	lactic acid / lactate **;**	1	**ignore** oxygen debt
	b		*any **four** from :* (all living cells / muscles) require energy **;** (all cells / muscles) must respire **;** (all living cells / muscles) therefore require glucose **;** oxygen **;** (all cells / muscles) need to get rid of the waste products of respiration / CO_2 / excess water **;** human body is large and needs a transport system **;** heart muscle provides the means to move / pump materials / pump blood around body **;** AVP **;** QWC: • use of specialist terms **;** • spelling, punctuation and grammar **;**	4 2	 **allow** one error.
			Total	**10**	

Question			Expected Answers	Mk	Additional Guidance
5	a	i	*x-ray disadvantages **1** and **2**:* ionising / harmful radiation / increased cancer risk / dose accumulative / unsuitable for pregnant women / increase risk of mutation high-voltage supply (hazardous) **;**	2	
			*CAT or CT advantage **3**:* Can take pictures of soft tissues /described / 3D data **;**	1	
			*MRI advantages **4** and **5**:* Can take pictures of soft tissues/described **;** 3D data **;**	2	
			*Ultrasound advantage **6**:* images over time /monitor foetal development / equipment relatively cheap / can be more portable / cheaper to use **;**	1	
		ii 1	*any **three** from :* more x-rays absorbed by materials with higher atomic mass **;** several tissues absorb similar amounts of x-rays / ORA **;** contrast media of high atomic mass are used **;** e.g. iodine / barium (sulphate) / barium meal / barium swallow **;**	3	**accept** higher density as alternative to higher atomic mass ORA = they increase definition because taken up most by specific tissues
		ii 2	keep very still **;** to avoid 'blurring' of image **;** AVP **;**	2	AVP e.g. may get claustrophobic / frightened by the noise
		ii 3	a gel / coupling agent is used (between the probe and the skin) **;**	1	
		ii 4	*any **two** from:* risk assessment **;** patient may have metallic implant / pacemaker / owtte **;** patent may be claustrophobic **;** patient may be too fat / obese **;**	2	

Question			Expected Answers	Mk	Additional Guidance
5	b		*any **four** from:* ref to: informing patient or not ; will patient understand ; should patient's family be informed ; effect of bad news on patient / family members ; success rate ; cost effectiveness ; AVP ; QWC: • organisation **;** • appropriate use of English **;**	4 2	AVP e.g. raising false hope / consequences of religious beliefs affecting treatment
			Total	**20**	

Total for the paper = 90 marks

G623/01 Cells and Molecules - Plan

Planning Exercise
Investigation to determine the relative sugar content of Merlot and Syrah grapes.

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

how to prepare tissue; mass of tissue to use; dilution factors, how to set up dilution series; range of dilution to consider; colour standards; investigation of

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, 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: e.g.to enable comparison
P	appropriate range stated;	1	Related to prediction made.
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 appropriately labelled column headings
T	additional method to display data;	1	Any <u>different</u> display e.g. graph.
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 specific examples: equipment / materials / 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)*	

VARIABLES: age of tissue; mass of tissue; volume of juice; temperature used for test; volume of Benedict's or equivalent reagent; concentration of reagents used;

Accuracy: precision of water bath

Validity: comparison with secondary source

G623/02 Cells and Molecules

Question			Expected Answers	Mk	Additional Guidance
1	a		any ***three*** *from:* how to obtain tissue / microtome / razor / onion scale leaf **;** mount tissue in drop of water / stain on slide; place cover slip over drop **;** describe how **;** attempt to exclude air bubbles **;** use a stain / named stain **;** thin section **;** AVP **;**	3	**accept** second slide used instead of cover slip
	b	i	**A** chloroplast **;** **B** nucleus / nucleoplasm **;**	2	**ignore** nucleolus
		ii	*any* ***two*** *from:* clearer / S.A.W **;** E.M greater resolution **;** ability to distinguish between two points **;** max resolution for light microscope is 200 nm **;** **OR** more / greater magnification **;** explained via description of any relevant feature of electron microscope function **;**	2	**one** suggestion **plus** explanation 'greater resolution and greater magnification' - 1 mark only
			Total	**7**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mk</th><th>Additional Guidance</th></tr>
<tr><td rowspan="5">2</td><td>a</td><td></td><td>
<table>
<tr><th>feature</th><th>carbo</th><th>fat</th><th>protein</th></tr>
<tr><td>a. helix</td><td></td><td></td><td>✓</td></tr>
<tr><td>b. test</td><td></td><td></td><td>✓</td></tr>
<tr><td>c. reaction</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>e. test</td><td></td><td>✓</td><td></td></tr>
<tr><td>e. bond</td><td></td><td>✓</td><td></td></tr>
<tr><td>g. bond</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td>5</td><td>all three needed for condensation line</td></tr>
<tr><td rowspan="2">b</td><td>i</td><td>diagrams representing glycerol molecule and one fatty acid molecule as substrates and monoglyceride and water as products ;
bonding shown ;</td><td>2</td><td>accept molecular equation

accept condensation linkage as diagram or description</td></tr>
<tr><td>ii</td><td>any three from:
R-groups of fatty acids have hydrocarbon chains / owtte ;
saturated fats have no double bonds in chains / all C’s have 2 single H’s ;
poly-unsaturated, <u>more than 1/ many</u> double bond ;
saturated lipids are solid / fat , poly-unsaturated are liquid / oil ; relative reactivity ;
ease of metabolism ;
AVP ;</td><td>3</td><td>AVP e.g. statement about diet and two types of fat</td></tr>
<tr><td rowspan="2">c</td><td>i</td><td>D before C ;
C before A ;
A before E ;</td><td>3</td><td></td></tr>
<tr><td>ii</td><td>any four from:
controls activity of the cell ;
controls protein synthesis ;
specific section of DNA called a gene ;
specific DNA / codon / nucleotide sequence gives specific amino acid sequence (in protein) ;
specific DNA / amino acid sequence produces specific protein ;
specific protein (may be) a specific enzyme ;
enzyme controls specific chemistry
DNA controls genetic expression / SAW ;
organism is the outcome of its chemistry / SAW ;</td><td>4</td><td></td></tr>
<tr><td>d</td><td></td><td>A glycoprotein ;
B glycolipid ;
C cholesterol ;
D phospholipid ;</td><td>4</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>21</td><td></td></tr>
</table>

Question			Expected Answers	Mk	Additional Guidance
3	a	i	*any **two** from:* choice of suitable magnification **;** move the eyepiece / slide so that A/B/cell is underneath the graticule **;** record number of units (e.p.g divisions) **;** ensure max. value recorded **;** compare A with B / divide value for B by value for A **;**	2	e.p.g. eye piece graticule
		ii	*any **two** from:* use stage micrometer to calibrate graticule before use / convert e.p.g divisions into actual measurements **;** detail on scale / mm scale **;** use of scale on micrometer **;** stage micrometers are usually calibrated for set magnification **;**	2	
	b	i	*any **three** from:* probe with two electrodes **;** placed into culture **;** one electrode enclosed in glass tube **;** electric current flows / passes through culture / sample / between electrodes **;** narrow entrance / small hole in glass tube **;** cell(s) passing through hole **;** alters current / conductivity inside probe **;** deviations indicate number of cells **;** QWC: • appropriate use of English **;** • spelling, punctuation and grammar **;**	3 2	
		ii	automatic / easier / more reliable count / less opportunity for human error **;**	1	**ignore** more accurate / more precise
			Total	**10**	

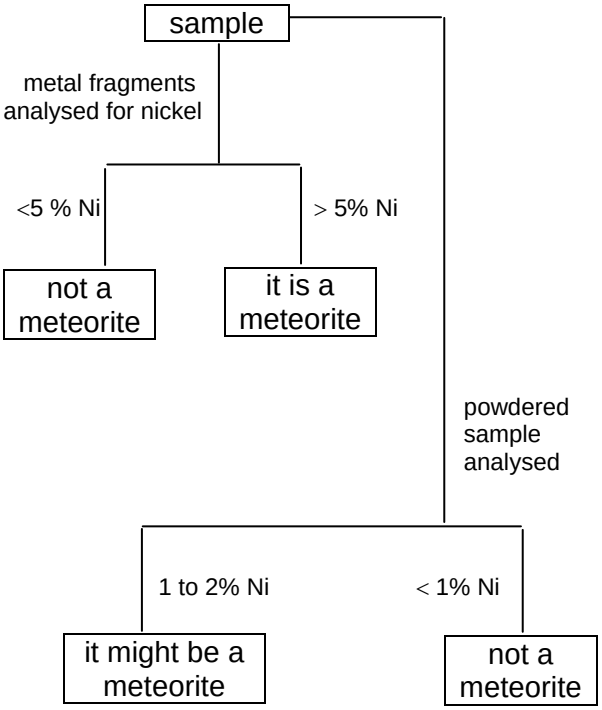
Question			Expected Answers	Mk	Additional Guidance
4	a		*any **two** from:* family history of the disease **;** personality changes **;** psychiatric disorders such as severe depression **;** progressive chorea* / OWTTE **;** dystonia / lack of muscle tone / OWTTE **;** dementia / general loss of intellectual abilities / memory loss / impaired judgement / impaired abstract thinking / OWTTE **;**	2	chorea* involves motor coordination disorder e.g. minor involuntary movement such as non-repetitive, non-periodic jerking **accept** correct ref to number of CAG repeats / more than normal /normal number between 10 -29 / accept number between 30 and 39 as HC
	b		*any **two** from:* abnormal cells / development of tissue **;** ref. to neoplastic cells / CINs * **;** abnormal nuclei **;** HPV particles **;**	2	CINs * = cervical intraepithelial neoplasia(s)
	c		*any **three** from:* cervical cancer may have been caused by sexual contact / involve sexual partner / papilloma virus **;** HC is a possible 'life-sentence' for other family members **;** whether or not to inform relatives **;** possibility of error arising during testing **;** whether or not patient should have children **;** whether or not to pursue selective abortion**;** patient's human rights / discrimination issues e.g. employment / insurance / mortgage facilities **;** patient may not want to know **;** AVP **;**	3	Candidates can gain marks for either HC-based or Cervical cancer-based answers or both. Some of those listed are more appropriate for one or other of these not necessarily both. Question does not ask candidates to specify which they are referring to so accept any correct ref.
			Total	**7**	

Total for the paper = 45 marks

G628 Sampling, testing and processing

Question			Expected Answers	Mk	Additional Guidance
1	a	i	to monitor the acidity of the water / measure the pH **;**	1	
		iii	the acidity of the water may not be homogeneous / to compare the samples / to collect representative samples **;**	1	
		iii	protective gloves / other precaution implying non ingestion of the water sample **;**	1	
		iv	*any **two** from:* description of bad weather conditions **;** drowning / falling / slipping in **;** animals **;** hypothermia **;** fast flowing water currents **;**	2	
		v	suitable method **;** safe **;** appropriate size of equipment **;**	3	
		vi	in case one is contaminated / to make sure that both samples give the same result/ for consistency / for reliability / for accuracy / to obtain an average **;**	1	
		vii	*any **two** from:* date **;** locality **;** time **;** hazard warning symbol **;** amount present **;** sample number **;**	2	
		viii	Make sure that its clean / washed / sterilised **;**	1	
		ix	$\frac{5.00 \times 5}{100} = 0.25$ **;** $\therefore$ Value is 5.00 – 0.25 = 4.75 **;**	2	
	b		Lower – more fossil fuels being burnt, more SO_2 and NO_2 **;** Higher – greater rainfall, dilution effect **;**	2	

Question			Expected Answers	Mk	Additional Guidance
1	c		*any **two** from:* as accurate as the meter method **;** 'easy' to use **;** portability **;** cost **;** quick **;** AVP **;**	2	
	d		$\frac{1.50}{0.120}$ = 12.5 (mg dm^{-3}) **;**	1	
	e	i	*any **three** from:* toxicity / environmental effects **;** availability **;** effectiveness **;** ease of application / time taken **;** effect of added calcium ions **;**	3	
		ii	*any **two** from:* volume / amount / mass of water **;** mass of liming agent **;** constant temperature **;** acidity of the water at the start **;**	2	
		iii	*any **three** from:* add calcium hydroxide in portions **;** monitor pH after each addition **;** mass of each portion **;** stir **;** find out how much has been added **;**	3	
		iv	$\frac{2.4 \times 10^5 \times 180}{36}$ **;** = 1.2×10^6g / 1200 kg / 1.2 tonnes **;**	2	
	f	i	217 600 tonnes;	1	
		ii	$\frac{155\,000 \times 100}{217\,600}$ = 71%;	1	
			Total	**31**	

Question			Expected Answers	Mk	Additional Guidance
2	a		use a magnet / conducts electricity / uses a metal detector **;**	1	
	b		nickel can cause dermatitis **;**	1	
	c		flow chart: mentions all four possibilities **;** is clear and logical **;** works completely **;** Possible answer is shown below.  	3	
	d	i	Density = 6.2 **;** g cm^{-3} **;**	2	independent marks
		ii	the volume is given to 3 significant figures, and it is incorrect to ∴give the answer to 5 significant figures **;**	1	
		iii	1	1	
	e		nickel / nickel tetracarbonyl / carbon monoxide are very toxic **;** the carbon monoxide can be recirculated **;**	2	
	f	i	1.2 kg / 1200 g **;**	1	
		ii	15 g **;**	1	**allow** ecf

Question			Expected Answers	Mk	Additional Guidance
2	g	i	*any **two** from:* heat **;** stronger / more concentrated **;** different acid **;** stir **;** uses a catalyst **;**	2	
		ii	so that others could follow it / to compare results / to allow evaluation / so that it can be repeated **;**	1	
		iii	$\frac{4.74}{2} = 2.37$ (g) **;**	1	
		iv	$\frac{2.37 \times 100}{9.48} = 25.0$ **;**	1	
		v	the coin is made of only copper and nickel **;** you could take the % of copper from 100 **;**	2	
	h		Maximum load is 360 N **;** Tensile strength = $\frac{360}{0.520} = 692$ (N mm^{-2}) **;**	2	**allow** ecf
	i		*any **five** from:* risk assessment **;** load at the bottom of the spring **;** power supply connected / complete circuit **;** power connected to top and bottom of spring **;** current on – load is lifted **;** current off – load goes down /'relaxes' **;** varies voltage **;** QWC: • organise relevant information clearly and coherently, using specialist vocabulary when appropriate **;** • ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear **;**	5 2	
			Total	**29**	

Question			Expected Answers	Mk	Additional Guidance
3	a	i	greater surface area / **more** dye extracted **;**	1	
		ii	risk assessment **;**	1	
	b	i	cotton needs a mordant, wool does not **;**	1	
		ii	use a different mordant / different dye **;**	1	
		iii	*any **two** from:* boil for longer **;** use a more concentrated dye solution **;** use a better mordant / more mordant **;** leave in dye for longer **;** repeat **;**	2	
		iv	wash with water **;** until the washings are no longer yellow **;**	2	
		v	*any **two** from:* use a wider range of fabrics **;** use the yellow dye mixed with other dyes **;** use different mordants **;** use a hotter temperature when dyeing **;** use a longer dyeing time **;** use more dye **;**	2	
		vi	temperature / concentration are not the same **;** starting condition of the fabric is different; different dye sources **;**	2	
		vii	*any **three** from:* availability of plants **;** stability of dye solution (on standing) **;** a yellow dye, already in use, may be 'better' **;** long term lasting properties of the dye are not known **;** may cause allergic reaction **;** amount of waste **;** AVP **;**	3	

Question			Expected Answers	Mk	Additional Guidance
3	c	i	*any **two** from:* how much alcohol **;** which alcohol to use **;** how much goldenseal root to use **;** temperature **;**	2	
		ii	effective at removing alcohol **;** safe / no flames **;** stops before boiling dry **;**	3	
		iii	no more yellow precipitate when dilute sulphuric acid is added **;**	1	
	d	i	e.g. some lost in filtering **;** did not extract all the berberine into the alcohol **;**	2	
		ii	the final product was damp / wet / contained impurities **;**	1	
		iii	mass of goldenseal roots = 15.0 g **;** % of hydrastine obtained = 2.8 **;**	2	**allow** ecf
	e	i	integration height of berberine = 2.9 cm integration height of hydrastine = 2.3 cm **;** % berberine = $\frac{2.9 \times 100}{(2.9 + 2.3)}$ = 56 **;**	2	
		ii	it contains two impurities / other compounds **;** these may be toxic **;**	2	
			Total	**30**	

Total for the paper = 90 marks

G635 Working waves

Question			Expected Answers	Mk	Additional Guidance
1	a	i	*any **two** appropriate points e.g.* can see in the dark **;** can see remotely **;** police less likely to be shot / safer **;** saves (police) time **;**	2	
		ii	answer in range 36 to 38°C **;**	1	
		iii	"from" temperature • in range -10°C to +10°C **;** "to" temperature • in range 36°C to 200°C **;** can easily detect temperature differences / objects warmer than surroundings **;** stated or implied appropriate example e.g. gunman / people / disturbed ground / cars **;**	4	
	b		objects on fire will be at these temperatures **;**	1	
	c	i	curve drawn entirely lower than person and labelled wall **;** peak to the right of peak for person **;**	2	
		ii	curve drawn entirely higher than person and labelled bonfire **;** peak to the left of peak for person **;**	2	
	d		λ_{red} = 7.0 x 10^{-7} m **;** (may be seen in working) v= fλ or f = v/λ **;** seen or implied f = 3.0 x 10^{8} / 7.0 x 10^{-7} = 4.3 x 10^{14} **;** Hz or hertz or s-1 **;** 2sf **;**	5	**allow** ecf in subsequent calculation for 4.0 x 10^{-7} m i.e. no mark for actual substitution in formula, but may be taken as evidence of formula if not explicitly stated **allow** any sf here, e.g. 4.29 / 4.28571428 x 10^{14} **reject** hz
	e	i	1. any value 1.0 x 10^{-7} to 4 x 10^{-7} m **;** 2. 3.0 x 10^{8} m s^{-1} **;**	2	
		ii	uv does not penetrate glass **;**	1	
			Total	**20**	

Question			Expected Answers	Mk	Additional Guidance
2	a	i	**X** core **;** **Y** cladding/ glass of lower refractive index than core **;**	1	**both** required for mark
		ii	either ray A or ray B or both deviating towards the normal as it/they enter/s core **;** **ray A** passes into cladding at first interface **;** deviated away from normal as it enters the cladding **;** [partially reflected ray may also be shown but not needed to score marks] **ray B** *any **two** from:* reflected at first core/cladding interface; reflections down fibre **;** (if shown entering the cladding) - deviated away from normal as it enters the cladding **;** **ray C** passing completely through undeviated **;**	5	
		iii	ray C ray has travelled shorter distance / zig-zag path is longer or wtte **;**	1	
	b	i	core much narrower (accept any ratio less than half as wide) **;**	1	**accept** realistic value of diameter of monomode
		ii	ray travels along axis of fibre or wtte **;**	1	
		iii	signal is less degraded or wtte **;** because monomode all rays travel same path **;** step index variety of paths **;** therefore signals arrive at different times **;** [accept diagram of degraded square wave in place of any of above]	4	

Question			Expected Answers	Mk	Additional Guidance
2	c	i	gradual change in glass / plastic **;** along radius **;** change in refractive index **;** refractive index less further from centre **;** QWC	4 1	
		ii	*any **two** from:* path lengths more uniform **;** path directions become closer to axis as they progress along fibre **;** rays tend to arrive together **;** less dispersion **;** longer distance (between repeater stations) **;** travels faster further from axis/where refractive index lower **;**	2	**accept** diagrams in place of words
	d	i	any other part of the em spectrum named **;**	1	
		ii	sound / water waves / shock waves / etc. **;**	1	**allow** longitudinal
			Total	**23**	

Question			Expected Answers	Mk	Additional Guidance
3	a		0 - 20 kHz voice ; 25.875 kHz - 1.104 MHz data ; more data because of wider bandwidth of data channel ;	3	
	b		analogue – amplitude / frequency proportional to size of signal / continuously variable ; digital signal is represented by a number / discrete states ; usually binary ; QWC	3 1	
	c		*any **two** appropriate answers e.g.* better quality ; faster data transmission / higher capacity ;	2	
	d		analogue to digital conversion / pulse code modulation ; *any **four** appropriate answers e.g.* samples signals at intervals ; regular intervals ; large number of samples in each cycle ; magnitude of sample assigned a number / quantisation ; (usually) binary ; transmitted as square wave / series of 1^s and 0^s ;	5	
	e		digital to analogue converter ; any appropriate example e.g. digital signal to loudspeaker ;	2	
			Total	**16**	

Question			Expected Answers	Mk	Additional Guidance
4	a		further from base station or wtte **;** obstructions **;**	2	
	b		*any **four** appropriate points e.g.* density of population / number of potential users **;** geographical features **;** number of channels possible on each frequency **;** cost **;** public opinion **;** (perceived) risk of living near transmitter **;** site availability **;**	4	**accept** example(s)
	c		cell is a geographical area **;** 0.5 – 20 miles in radius **;** base station / aerial is in the middle / at corners **;**	3	
	d		same frequency can be used in many cells **;**	1	**not** more frequencies
	e	i	full-duplex **;**	1	
		ii	full-duplex can send and receive at the same time **;** half-duplex can either send or receive at any one time **;**	2	
			Total	**13**	

Question			Expected Answers		Mk	Additional Guidance
5	a	i	narrower beam gives better quality (or vice-versa) **;**		1	
		ii	*any **five** from:* large proportion / ~97% of X-rays pass straight through ordinary film / sensor / light more readily absorbed **;** screen + film / sensor in place of just film / sensor **;** screen absorbs X-ray energy **;** re-emitted as light **;** film / sensor sensitive to light **;** so less X-rays / exposure time needed **;** front and rear intensifying screens **;** double sided film / sensor **;** fluorescence **;** screens made of zinc sulphide **;**		5	
	b	i	radioactive / gamma emitter **;** detected by gamma camera / scintillation detector **;**		2	
		ii	*any **two** from:* tracer is radioactive **;** radioactive substance might be transmitted to baby **;** greater risk of damage by radiation to children **;**		2	
		iii	*any **two** from:* short / 6 hour half life **;** gamma emitter **;** suitable (gamma) energy **;** quickly flushed from body / short biological half life **;** can be produced on site in hospital/from "cow" / by elution / from generator / ^{99}Mo (parent) **;** can be liquefied **;**	*corresponding reasons:* reduces dose / more energy to detector for same dose / will not stay in body long **;** escapes from body / less harmful than e.g. alpha **;** more detected for less dose **;** reduces dose **;** reduces need for storage / wastage / available when needed **;** can be injected **;**	4	

Question			Expected Answers	Mk	Additional Guidance
5	c	i	*any **two** from:* contrast medium / stops X-rays **;** the barium meal may involve radiation risk [NOT if implies Barium is radioactive] **;** shows up bowel or wtte **;**	2	
		ii	endoscope relatively modern development **;** unsuitable for frail patients **;**	2	
			Total	**18**	

Total for the paper = 90 marks

Grade Thresholds

Advanced GCE Applied Science AS (H175, H375) and
GCE Applied Science A2 (H575, H775)
June 2008 Assessment Session

Portfolio Unit Threshold Marks (AS)

Unit		Maximum Mark	a	b	c	d	e	u	Total nos of cands
G620	Raw	50	42	37	32	27	22	0	1578
	UMS	100	80	70	60	50	40	0	
G621	Raw	50	42	37	32	27	22	0	1769
	UMS	100	80	70	60	50	40	0	
G624	Raw	50	42	37	32	27	22	0	345
	UMS	100	80	70	60	50	40	0	
G625	Raw	50	40	35	30	25	21	0	248
	UMS	100	80	70	60	50	40	0	
G626	Raw	50	42	37	32	27	23	0	405
	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	69	62	55	48	42	0	1754
	UMS	100	80	70	60	50	40	0	
G623	Raw	90	72	63	55	47	39	0	592
	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	42	37	32	27	23	0	827
	UMS	100	80	70	60	50	40	0	
G629	Raw	50	42	37	32	27	23	0	368
	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	42	37	32	28	24	0	97
	UMS	100	80	70	60	50	40	0	
G632	Raw	50	43	38	33	28	23	0	239
	UMS	100	80	70	60	50	40	0	
G633	Raw	50	42	37	32	28	24	0	339
	UMS	100	80	70	60	50	40	0	
G634	Raw	50	42	37	32	27	22	0	383
	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	61	55	49	44	39	0	568
	UMS	100	80	70	60	50	40	0	
G635	Raw	90	63	55	47	40	33	0	539
	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
1.8	9.2	29.8	55.6	78.1	100.00
There were 1017 candidates aggregating in June 2008.					

Advanced Subsidiary GCE (Double Award) (H375):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
0.3	1.9	3.3	11.2	21.8	36.2	48.0	67.6	79.0	100.0
There were 394 candidates aggregating in June 2008.									

Advanced GCE (Single Award) (H575):

A	B	C	D	E	U
1.4	11.3	29.5	66.6	93.4	100.0
There were 537 candidates aggregating in June 2008.					

Advanced GCE (Double Award) (H775):

AA	AB	BB	BC	CC	CD	DD	DE	EE	U
1.2	2.3	5.8	16.1	27.8	44.7	63.2	78.7	90.9	100.0
There were 360 candidates aggregating in June 2008.									

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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