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MARKSCHEME

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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 1

24 pages

Examiners should be aware that in some cases, candidates may take a different approach, which if appropriate should be rewarded. If in doubt, check with your Team Leader.

In the case of an "identify" question read all answers and mark positively up to the maximum marks. Disregard incorrect answers. In all other cases where a question asks for a certain number of facts *eg* "describe two kinds", mark the **first two** correct answers. This could include two descriptions, one description and one identification, or two identifications.

It should be recognized that, given time constraints, answers for part (c) questions are likely to include a much narrower range of issues and concepts than identified in the markband. There is no "correct" answer. Examiners must be prepared to award full marks to answers which synthesize and evaluate even if they do not examine all the stimulus material.

SECTION A

1.   **Mobile Wallet**

(a)   (i)   **Identify *two* pieces of information that are being collected by the grocery store's computer system when the bill is paid.**   *[2 marks]*

Answers may include:
- customer's name
- credit/debit card type (Visa/Mastercard/America Express *etc*)
- credit/debit card number
- credit/debit card PIN
- expiry date of credit/debit card
- total amount of bill
- date/time of the bill
- items purchased.

Award [1 mark] for each item identified up to a maximum of [2 marks].

(ii)   **Define the term *RFID*.**   *[2 marks]*

Answers may include:
- radio-frequency identification
- data collection that uses a radio frequency wireless system to transfer data
- wireless system that uses tags to track data
- short range identification system that uses antennas to transmit signals.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(iii)   **Define the term *encryption*.**   *[2 marks]*

Answers may include:
- translates plain text into cipher text
- encodes messages that can only be read by authorized users
- used to secure data/information/websites
- converts data into code
- uses algorithms to scramble information.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(b) **(i)** **Explain *one* reason why encryption is used in this case.** *[2 marks]*

Answers may include:
- to prevent unauthorized access to data when data is transferred over the network to server
- to ensure that the customer's personal details and banking information are safe (*ie* information cannot be accessed without encryption key)
- to protect from credit card fraud or identity theft – information cannot be accessed without encryption key
- wireless network encryption – used to protect wireless data transfer against "eavesdropping" and "spoofing".

Award [1 mark] for the reason identified, and [1 mark] for the appropriate explanation of it. Award a maximum of [2 marks] for the response.

(ii) **Explain *two* disadvantages for the customer of using "the wallet".** *[4 marks]*

Answers may include:
- cell phone battery may not be charged – cannot use cell phone to make purchases
- reliability – signal from RFID may not be available to process payment, cannot purchase groceries
- stores may profile user data and send unwanted emails/texts to customers
- availability – wallet may not be available at all stores, users would be required to use another payment method
- the store will collect information from customers using the wallet about their shopping habits (*ie* could invade customer privacy)
- if the wallet gets lost or stolen, other individuals may be able to perform transactions causing a financial loss to the customer (*ie* some clients have the bad habit of storing their cards pin numbers in the cell phone).

Do not accept hacking the account. This is not related specifically to "the wallet".

Award [1 mark] for each disadvantage identified, and [1 mark] for an explanation of that disadvantage. Award a maximum of [4 marks] for the response.

(c)   **To what extent are the security measures used by the store during purchases appropriate?**   *[8 marks]*

Answers may include the following security measures indicated in the scenario:
- secured access to data – the setup only allows authorized users access to data
- credit card verification – PIN is required to verify user
- data backup – to ensure data is not lost, data can be recovered
- antivirus software – installed to protect system from viruses
- encryption of data – data is encrypted so if it is intercepted it is not possible to read information without key
- uses NFC (Near Field Communication) – an RFID with a short range so hackers would have to be very close to steal data
- WiFi security – the encryption of wireless network to protect data that is transferred between devices and servers.

Weaknesses of the security measures. Additional security measures that the store should have considered:
- data backup – to ensure data is not lost, data can be recovered
- antivirus software – installed to protect system from viruses
- sharing information policy – store has a policy agreeing not to sell data to third party companies
- database server location/access – location of servers is within the same country of store so external governments or other political entities do not have access to it.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

2.   DRM (Digital Rights Management) Cloud movies

(a)   (i)   Identify *two* features of digital rights management (DRM).   *[2 marks]*

Answers may include:
- protect digital media files by encrypting with a key
- secure control over file usage (*ie* viewing, printing, modifying, saving, *etc)*
- expire documents on a certain date, time limit, or after number of views, *etc*
- terminate access to a protected file
- control the locations from where file can be viewed
- limit number of devices or users to access file.

Award [1 mark] for each item identified up to a maximum of [2 marks].

(ii)   Apart from movies, identify *two* other media that use DRM.   *[2 marks]*

Answers may include:
- software – productivity software/gaming software
- audio files/podcasts/music – CDs/internet music
- e-Books
- documents
- photographs/pictures/images
- television programs.

Award [1 mark] for each item identified up to a maximum of [2 marks].

(iii)   Define the term *intellectual property*.   *[2 marks]*

Answers may include:
- creative rights of an individual
- ownership of intangible items and/or ideas – names, designs, artwork, writing, audio tracks/videos
- property protected by trademarks, copyright, or patents.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(b)   *Ultra Violet* **has policies on its website describing the user agreement. Explain** *two* **policies that might be included and how they protect the rights of users.**   *[6 marks]*

Answers may include:
- user's personal information is kept secure – user information will not be changed or manipulated by company
- secure data – user information will be saved in the database and cannot be accessed by search engines
- data sharing – user information will not be shared with third party companies
- security – user data will be protected from viruses with software and hardware
- secure data transfer – user information will be encrypted (*eg* personal details, credit card information)
- data backup – servers will be backed up so user data will not be lost, and access will not be compromised
- users will only be able to access *Ultra Violet* media using *Ultra Violet* – provides user access to age-appropriate media.

Award [1 mark] for each policy identified, up to [2 marks] for each appropriate explanation he policy and how it protects the rights of users. Award a maximum of [6 marks] for the response.

(c)   **Customers may either purchase their movies from online services such as** *iTunes* **by downloading them and storing them on their computer** *or* **streaming them from** *Ultra Violet***. Evaluate these** *two* **options.**   *[8 marks]*

Answers may include:
iTunes
- anytime-anywhere access – *iTunes* movies can be downloaded directly to device, and no internet required to view files once purchased
- need a significant amount of storage on device if you want to download several movies
- ease of use – many users already have an *iTunes* account
- accessibility – can access media from computers and mobile devices
- viewing – can be viewed on home televisions using devices such as an *AppleTV*.

UltraViolet
- streaming is limited to amount of bandwidth – movies could have buffering or playback problems
- requires internet access to stream from the cloud
- up to 12 devices can be accessed at a time
- does not require large amounts of storage on computer
- can have both the DVD and streamed version of the movie.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

3. Senior Care goes hi-tech with virtual doctor visits

(a) (i) Identify *two* input devices required for the videoconference to take place. *[2 marks]*

Answers may include:
- camera/webcam
- microphone/headset
- remote control to increase/decrease volume.

Award [1 mark] for each item identified up to a maximum of [2 marks].

(ii) There have been issues with the accuracy of the information held in the database. Describe how validation and verification are used to ensure data is accurate. *[4 marks]*

Answers may include:
Validation
- automatic process to check that the data entered is reasonable using a set of rules
- validation types used to check data, such as: format, length, range, type, lookup
- process of checking data against set of validation rules is used to ensure data is accurate
- validation process does not check the accuracy of data, checks if data is reasonable.

Verification
- ensures the data entered exactly matches the original source
- ensures database contains as few mistakes as possible
- double entry verification – entering the data twice and comparing the two copies (*eg* passwords entered twice for verification)
- proofreading data verification – visually checking the data entered against the original paper document.

N.B. Both validation and verification must be described in the response.

Award [1 mark] for each requirement identified up to a maximum of [2 marks] and award [1 mark] for the description of each requirement up to a maximum of [2 marks]. Award a maximum of [4 marks] for the answer.

(b)   **Explain *three* technical issues would be needed to be addressed in order to set up an effective videoconferencing system.**   *[6 marks]*

Answers may include:
- bandwidth – video latency and buffering issues arise due to insufficient bandwidth
- security – protection against unauthorized access during transmission
- hardware specifications – workstations must be able to support video conferencing (*eg* processing power, headset, webcam)
- software – software will need to be installed to run the videoconferencing system that meets requirements (*eg* screensharing, accommodates the required number of participants)
- providing the necessary physical components to avoid interference (*ie* forests, hills, curves, *etc*).

*Award **[1 mark]** for each type of information identified, and **[1 mark]** for each appropriate explanation of it. Award a maximum of **[6 marks]** for the response.*

(c) **The nursing home technical staff are considering replacing the existing database with a new one. The two options being considered are:**
- **purchasing a commercial package that has been developed for institutions such as nursing homes**
- **developing the database themselves.**

Evaluate these *two* **options.** *[8 marks]*

Answers may include:
Commercial packages
- cannot be customized – may only partially meet needs of the nursing home
- templates – reports are already designed and ready to use
- initial cost – more expensive initially for nursing home
- nursing home staff will find it easier and more intuitive to use
- nursing home can receive customer support from the company online or on the phone
- looks more professional
- nursing home does not have to dedicate any of their time to the development process (*eg* specifications, design, testing *etc*)
- nursing home may have to alter the way they work in order to fit in with the way that the software has been designed
- there will probably be operations required by the nursing home that cannot be done with the software.

Database created by nursing home
- the program can be customized to suit needs of nursing home
- hard for the nursing home to design if not experienced, which can be very time consuming
- the software used for development tends to be relatively cheap to purchase, the major costs come from the time to design and develop product
- support is available for the software program as there are many other users using the same software
- it is easy to share files produced by the software with others as they may have the software available to open the file
- the nursing home can make the database work the way they want, rather than having to adapt the way they work to meet the restrictions of the software
- nursing home may expect to pay more for it than for a packaged solution (both in time and money) and need a professional developer on staff at nursing home
- it has been specifically designed for particular requirements and can be tailored to fit with the nursing home's needs
- it can be customized to work to interface with other software at the nursing home to provide a fully integrated IT system
- it is much more flexible than commercial software and can be modified and changed over time as requirements and nursing home practices change
- a large investment of their time is required during the development process, will take longer to implement than commercial package
- it can be difficult to get support
- the design of the database may not be well-documented and difficult to update later
- no commercial training materials exist and must be developed specifically for this database.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

SECTION B

4.   Project Management

(a)   (i)   Outline the type of Project Management development methodology that is used in the figure above.   *[2 marks]*

Answer is:
- waterfall.

A brief explanation of the methodology may include:
- clearly defined stages such as analysis design and evaluation
- each stage is completed before proceeding to the next stage
- conceptual model used in project management
- ensures that all user requirements are met and agency strategic goals and objectives are met.

Award [1 mark] for the correct identification of the model plus [1 mark] for a brief explanation of the model to a maximum total of [2 marks].

(ii)   State *two* hardware requirements that a computer will need in order to develop videos.   *[2 marks]*

Answers may include:
- sufficient processing speed in their computer
- sufficient RAM
- sufficient external storage
- sufficient hard disk space
- graphics card
- appropriate ports/cables.

Award [1 mark] for each requirement stated up to a maximum of [2 marks].

(iii)   State *two* design requirements for developing the video.   *[2 marks]*

Answers may include:
- overall structure (storyboard)
- internal structure (details for the video clips)
- transitions/effects
- scripts
- audio/music/narration.

Award [1 mark] for each feature stated up to a maximum of [2 marks].

(b)   Explain why the use of a development methodology similar to the one in the Gantt chart on the opposite page may not be appropriate in the development of the advertising video.   *[6 marks]*

Answers may include:
- implies stages that may not exist
- assumes that one stage follows another
- does not model parallel development of modules
- if there are problems in one stage, this negatively impacts the following stages
- difficult to make any changes to middle or any stages after the process started
- difficult to move back to the previous stage
- any mistake that happens during any of the middle stages impacts the remaining stages of development
- lack of integration between the stages of development.

Marks	Level descriptor
0	No knowledge or understanding of ITGS issues and concepts related to the topic. No use of appropriate ITGS terminology.
1–2	Minimal knowledge and understanding of ITGS issues and concepts related to the topic. Minimal use of appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.
3–4	A description or partial explanation with limited knowledge and/or understanding of the ITGS issues and concepts related to the topic. Some use of appropriate ITGS terminology. Some reference is made to the scenario in the stimulus material.
5–6	A thorough explanation with a detailed knowledge and understanding of the ITGS issues and concepts related to the topic. An explanation that uses appropriate ITGS terminology. Explicit and relevant references are made to the scenario in the stimulus material.

(c)   **Discuss whether project management tools such as Gantt and PERT charts enable IT projects, such as the Crystals Fitness Centre video project, to be successfully completed.**   *[8 marks]*

Answers may include:
- tools such as Gantt charts provide a framework, but may stifle creativity and ingenuity
- provides an excellent presentation tool for illustrating sequence of the task and demonstrating individual resources scheduled to time, but different scheduling possibilities cannot be shown in the same chart
- visualizing the project schedule makes it very easy for the project manager to communicate the project schedule to various stakeholders as well as to the project team, but Gantt charts are not well suited for conveying complex dependencies or projects having significant potential variability in completion dates
- allows visibility into possible extreme delivery dates, but if some activities take longer than expected, the critical path originally being managed to might end up being wrong.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between the IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

5. **Managing the IT support at OBI International**

(a) **(i)** **One of the responsibilities of the IT support team is the installation of software. State *two* additional responsibilities of an IT support team.** *[2 marks]*

Answers may include:
- provide IT support, resolve technical issues
- configure company's IT equipment
- provide training to employees in the use of system and applications
- ensure the company's IT assets are reasonably safeguarded at all times
- keep IT systems down time to a minimum and all IT systems running to the standard appropriate for each end-user
- help select suppliers of software and hardware to ensure that the company uses the best available products at the best available price.

Award [1 mark] for each responsibility stated up to a maximum of [2 marks].

(ii) **Identify *four* necessary requirements to ensure that all software installed on OBI International systems meets legal requirements.** *[4 marks]*

Answers may include:
- determine what software applications are installed on the computers
- perform periodic spot checks on individual computers to make sure all software is legitimate
- conduct a periodic software inventory or "audit"
- remove and replace any unauthorized software found
- expressly forbid the illegal copying of software
- limit who can install software
- purchase all the commercial software used in the company only from licensed distributors to ensure authenticity
- check legality of available online updates before updating any software online to make sure it is lawful in all countries where the company has offices.

N.B. Do not accept making a policy.

Award [1 mark] for each requirement identified up to a maximum of [4 marks].

(b) **Explain *three* policies that should be introduced to ensure that the IT support team meets the needs of OBI International and its employees.** *[6 marks]*

Answers may include:
- IT support services must be available to all company departments whenever there is a need, *eg* responding to any queries made by end users to the IT department regarding issues with hardware and software
- the technical support consultant must attempt to contact the user who reported the problem within the established response time goal, *eg* within 24 hours
- IT support services must make all effort to resolve problems in an appropriate timescale, *eg* log in issues within five minutes
- if the normal support process does not produce the desired results, or if the problem has changed in priority, the problem will be escalated to the next level of support following established guidelines
- IT support services must safeguard data sent from the company or on company IT systems abiding by the established rules that guide the protection of confidential information, *eg* use of passwords, levels of hierarchy for access, *etc*.

Award [1 mark] for each policy identified and award [1 mark] for an appropriate explanation of that policy up to a maximum of [2 marks]. Award a maximum of [6 marks] for the answer.

(c) **The Senior Managers at OBI International chose to have its IT support provided by outsourced companies rather than the in-house IT department.**

Evaluate this decision. *[8 marks]*

Answers may include:
In-house IT department
- firsthand knowledge of specific IT structure
- immediate response to problems
- limited expertise
- high cost (*ie* IT support salaries, cost of specialized support software, training for IT support staff).

Outsourced companies
- combined knowledge and expertise across a wide range of IT areas
- personalised service and protection
- 24/7 expert availability to fix problems
- more cost effective (*ie* do not need to maintain an IT support department)
- privacy concerns (*ie* access to data stored on company IT systems).

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

SECTION C

6.   **Driverless trains?**

(a)   (i)   **Define the term** *sensor*.   *[2 marks]*

Answers may include:
- responds to a physical stimulus
- measures or detects a real-world condition
- detects (senses) changes in the ambient conditions
- one example of a sensor (*eg* mercury in a thermometer responds to temperature changes).

N.B. Other examples of sensors are accepted. Accept only one example for a sensor in the response.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(ii)   **Describe** *two* **characteristics that make this robotic train system an expert system.**   *[4 marks]*

Answers may include:
- operates an interactive system, *eg* obtains input data from information collected from sensors and based on this establishes the safest and smoothest mode of operation based on information input by experts
- storage and retrieval of knowledge, *eg* when new decisions are made, this additional information is added to the expert system
- makes logical inferences based on knowledge stored / remembers a logical chain of reasoning, *eg* makes decisions, aids the decision-making process.

Award [1 mark] for each characteristic identified and award [1 mark] for the description of that characteristic up to a maximum of [2 marks]. Award a maximum of [4 marks] for the answer.

(b) **The developers of this system are creating a training simulator so that new operators can gain experience in "driving" the Maglev trains on the routes under varying conditions.**

Explain what considerations will need to be included in the development of the robotic train simulation to ensure the training can cover all possible situations that may be encountered. *[6 marks]*

Answers may include:
- routes
- weather conditions
- speed
- weight of trains
- power of engines / brakes.

Marks	Level descriptor
0	No knowledge or understanding of ITGS issues and concepts related to the topic. No use of appropriate ITGS terminology.
1–2	Minimal knowledge and understanding of ITGS issues and concepts related to the topic. Minimal use of appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.
3–4	A description or partial explanation with limited knowledge and/or understanding of the ITGS issues and concepts related to the topic. Some use of appropriate ITGS terminology. Some reference is made to the scenario in the stimulus material.
5–6	A thorough explanation with a detailed knowledge and understanding of the ITGS issues and concepts related to the topic. An explanation that uses appropriate ITGS terminology. Explicit and relevant references are made to the scenario in the stimulus material.

(c)   **The managers of a new Maglev train system are considering whether to have a driver on the train or to have no driver and operate the train remotely.**

Evaluate these *two* options.   *[8 marks]*

Answers may include:
- unmanned systems saves on costs of drivers salaries
- more predictable running times
- automated and computerised failure detection and response
- unmanned systems remove elements of human error
- computerised systems control train movements more precisely and more reliably than humans
- avoids disruptions by striking train drivers
- concerns about the safety of an unmanned system in a crisis situation
- passengers' confidence may be lower if a high speed train is driverless
- humans can adapt to changing situations
- the expert system's decision making is limited to what it knows
- mis-trust of the IT system (*eg* high speeds involved, accident by hitting the track wall, no person to assist all in an emergency).

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

7.   Robotic Vacuums

(a)   (i)   Identify *two* characteristics that classify the *Samba* as a robot.   *[2 marks]*

Answers may include:
- sensing (uses sensors to perceive information)
- movement (performs physical action)
- intelligence (makes a decision)
- electronically programmed to do a specific task.

Award [1 mark] for each correct item identified up to a maximum of [2 marks].

(ii)   Define the term *microprocessor*.   *[2 marks]*

Answers may include:
- a silicon chip
- contains a CPU
- controls the logic of digital devices
- integrated circuit
- accepts digital data as input
- processes digital data according to instructions stored in its memory
- provides results as output.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(iii)   Identify *two* characteristics of fuzzy logic.   *[2 marks]*

Answers may include:
- reasoning
- based on degrees of truth
- mathematical logic
- works with ranges of values
- allows degrees of imprecision.

Award [1 mark] for each of the points stated above up to a maximum of [2 marks].

(b)   (i)   Explain how fuzzy logic can be used by the *Samba* in cleaning the room.   *[2 marks]*

Answers may include:
- *Samba* will use sensors such as those which gather data about the reflectivity of the carpet, *ie* how clean or dirty it is
- if the reflectivity of the carpet does not meet the value expected in the system, the fuzzy logic will override this setting and either shorten or lengthen the time for cleaning
- the carpet is cleaned to the standard required and saves energy for cleaning that is not needed.

N.B. Other parameters such as built-in furniture may be considered.

*Award **[1 mark]** for a reason identified, and **[1 mark]** for an appropriate explanation of that reason. Award a maximum of **[2 marks]** for the response.*

(ii)   Explain why the *Samba* uses a range of sensors.   *[4 marks]*

Answers may include:
- to navigate the home with relative autonomy
- to establish the size of the room
- to avoid steps (or any other kind of unlevel areas)
- to learn it has encountered an obstacle
- to follow very closely along walls and around objects (like furniture) without touching them
- to determine its own cleaning path.

[0 marks]
No knowledge or understanding of ITGS issues and concepts.
No use of appropriate ITGS terminology.

[1–2 marks]
A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical and only describes the models.

[3–4 marks]
A detailed response with a detailed knowledge and understanding of the topic making explicit references to the scenario. Appropriate ITGS terminology is used throughout the response.

(c)   **To what extent will voice recognition systems be effective in future models of the *Samba*?**   *[8 marks]*

Answers may include:
- poor quality audio input device
- background noise
- use of preset vocabulary
- enunciation of commands
- different language/dialect/accents acknowledged
- multiple users may not be recognised by the system.

In part (c) of this question it is expected there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to social and ethical impacts.

Please see generic markband information sheet on page 24.

SL and HL paper 1 part (c) and HL paper 3 question 3 markband

Marks	Level descriptor
No marks	• *A response with no knowledge or understanding of the relevant ITGS issues and concepts.* • *A response that includes no appropriate ITGS terminology.*
Basic **1–2 marks**	• *A response with minimal knowledge and understanding of the relevant ITGS issues and concepts.* • *A response that includes minimal use of appropriate ITGS terminology.* • *A response that has no evidence of judgments and/or conclusions.* • *No reference is made to the scenario in the stimulus material in the response.* • *The response may be no more than a list.*
Adequate **3–4 marks**	• *A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts.* • *A response that includes limited use of appropriate ITGS terminology.* • *A response that has evidence of conclusions and/or judgments that are no more than unsubstantiated statements. The analysis underpinning them may also be partial or unbalanced.* • *Implicit references are made to the scenario in the stimulus material in the response.*
Competent **5–6 marks**	• *A response with knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately in places.* • *A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis.* • *Explicit references to the scenario in the stimulus material are made at places in the response.*
Proficient **7–8 marks**	• *A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately throughout.* • *A response that includes conclusions and/or judgments that are well supported and underpinned by a balanced analysis.* • *Explicit references are made appropriately to the scenario in the stimulus material throughout the response.*