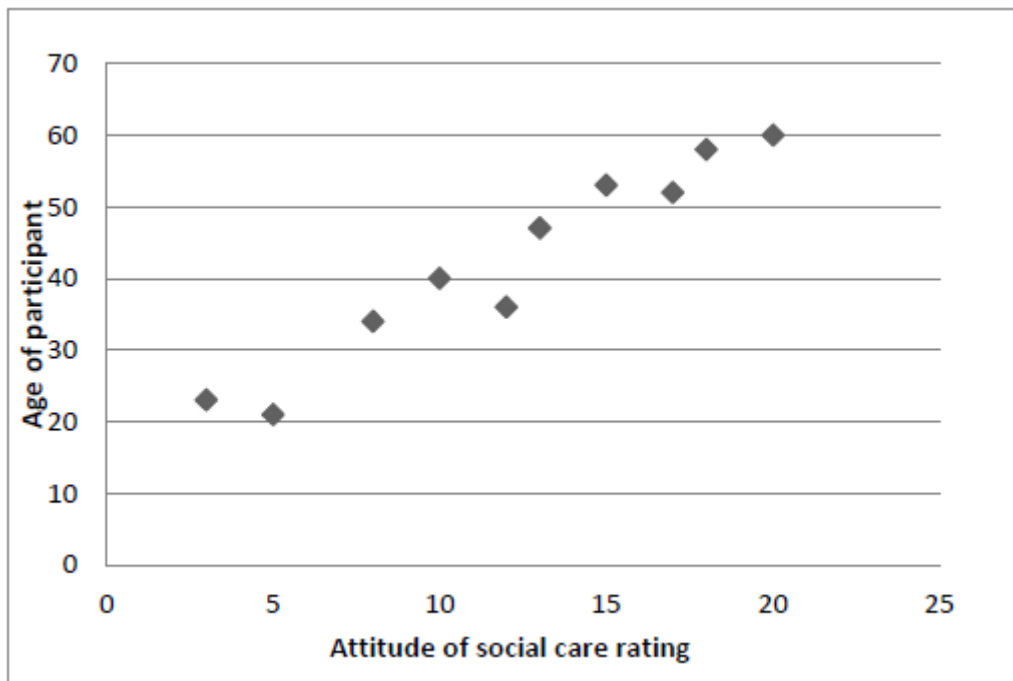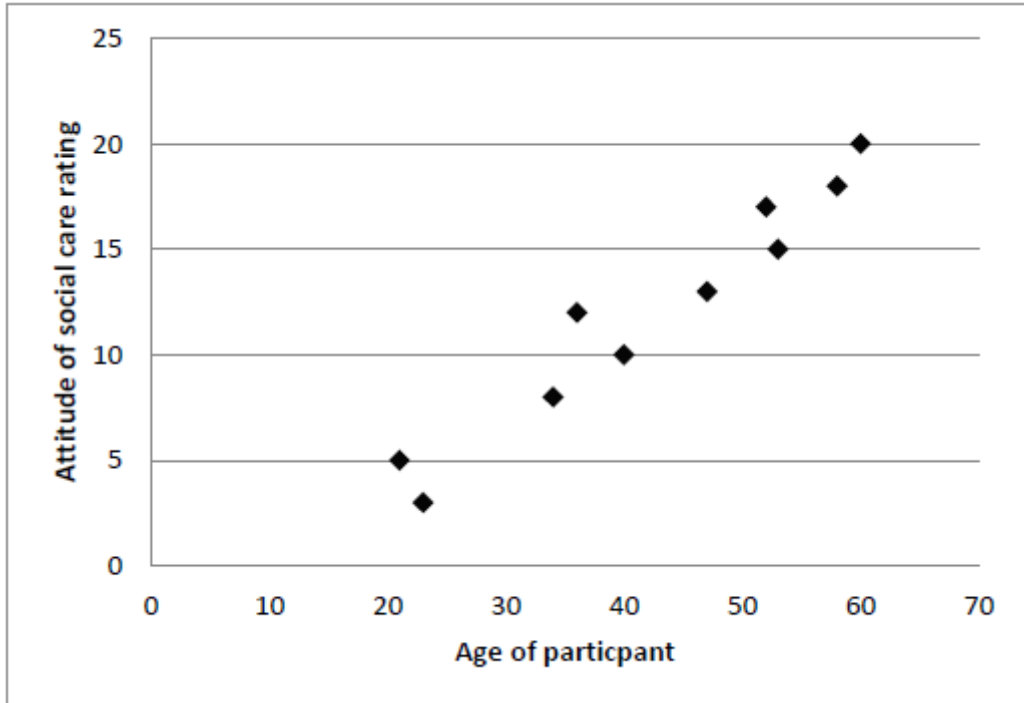# Correlation (A2 Only) - Mark Scheme

Q1.

(a) **[AO2 = 3]**

3 marks for the following points:

- Axes correctly labelled as Age of participant and Attitude to social care rating.
- Scales are suitable.

- Points plotted accurately.

(b)   **[AO2 = 2]**

   2 marks for: there is a **positive relationship** between age and interest in social care issues / as people get older their interest in social care increases (1) this is because as the values on one co-variable increase, so do the values on the other co-variable (1) OR as age increases so does attitude to social care **rating / score**.

(c)   **[AO2 = 2]**

   1 mark for knowledge of an investigator effect – this is when the person collecting the data has knowledge of what the research aim is / traits and that knowledge / those traits affect the data obtained.

   1 mark for a brief explanation of how investigator effects might have occurred in this study.

   If the researchers believed that older people would be more interested in social care they could have just given scores based on the age of the person.

(d)   **[AO3 = 2]**

   2 marks for explaining how investigator effects could have been avoided in the study. The answer needs to explain what could be done and how that would decrease / eliminate the effect.

   Possible content:
   - Discussion of separate observation by the two researchers and comparison – inter-rater reliability.
   - Having 'blind' rating of the discussion by someone who is unaware of the aim or research hypothesis.
   - Filming the discussions so there is a permanent record that can be checked by peer review of the data to confirm the scores / ratings.

   Credit other relevant procedures.

(e)   **[AO2 = 4]**

Level	Marks	Description
2	3 – 4	Explanation of how closed and open questions are beneficial is clear. The answer is generally coherent with effective use of terminology.
1	1 – 2	There is limited / partial reference to the benefit(s) of closed and open questions. The answer lacks accuracy and detail. Use of terminology is either absent or inappropriate. **OR** answer only refers to either closed or open questions at Level 2.
	0	No relevant content.

Possible content:
- Closed questions would present participants with options for their response so the researchers would be able to collate and display the information collected easily.
- Closed questions make it easy to compare specific response to questions the researchers wanted answered – they can be sure there will be certain information because they have restricted the options to include that information.
- Open questions allow respondents to interpret the question as they wish to and develop their response with detail or depth – so there is lots of information received.
- Open questions allow the researchers to pursue a line of enquiry that they may not have predicted but which comes to light because of a response by an interviewee.

Credit other relevant procedures.

(f)   **[AO2 = 3]**

- **1 mark** for an appropriate open or closed question – requiring information about a social care issue.
- **1 mark** for correct identification of this as an open or closed type of question.
- **1 mark** for a suitable explanation for why the choice was appropriate – this could relate to producing a type of data (closed – ease of analysis, open – lots of detail or depth to response / allows respondent to elaborate her / his reasoning for the response given) or it could focus on an issue of social care introduced by the candidate and not in the stem.

(g)   **[AO1 = 2   AO2 = 2]**

AO2
1 mark: the responses to the open questions in the interview constitute qualitative data.
Plus
1 mark: the attitudes ratings **AND / OR** the collated responses to the closed questions in the interview constitute quantitative data.

AO1
1 mark for an explanation of how the responses to the open questions is qualitative data ie is non-numeric / descriptive / retains detail of actions / thoughts / feelings.
Plus
1 mark for an explanation of how the ratings / collated responses to closed questions is quantitative data ie numerical such as a score / behaviour is represented in the form of a score on a scale.

(h)   **[AO3 = 4]**

2 marks for each explanation of how the chosen ethical issue could be dealt with.

1 mark for a brief muddled explanation.
2 marks for a clear explanation.

Consent – to be part of what is in essence two studies. Participants should be

forewarned – a briefing.

Protection from harm – at the end of participation all will have to be fully aware that they were rated for their social care interest and a low score might indicate they are 'uncaring'. They may wish to withdraw their data.

Right to withdraw – being made aware that they can at any time stop participating and at the end of their participation they can withdraw detail of their behaviour in the research.

The explanation must demonstrate an appreciation that people should be dealt with, with respect and competence.

Credit other relevant ethical issues.

Q2.

(a) **[AO2 = 2]**

1 mark – correlation

Plus:

1 mark – she is investigating the (numerical) relationship between two co-variables

(b) **[AO2 = 1]**

1 mark – scattergram

(c) **[AO2 = 1]**

1 mark – 10 children

(d) **[AO3 = 2]**

1 mark – pattern shows a (strong) negative correlation

Plus:

1 mark – suggesting that the more years are spent in an institution, the lower the language ability (or the fewer years spent in an institution), the better the language ability

(e) **[AO2 = 2]**

1 mark for correct answer 14 (or 15)

Plus:

1 mark for correct workings (18 − 4) or (18 − 4 + 1)

Q3.

(a) **[AO2 = 2]**

2 marks for explanation that a non-directional hypothesis is suitable or 'it should not be directional,' (1) as there is no reference to evidence that allows

the researchers to predict the direction of the results (1).
1 mark for a muddled/limited explanation of why the hypothesis should be non-directional or **1 mark** for stating non-directional.

(b)   **[AO2 = 3]**

3 marks for an appropriate non-directional operationalised hypothesis: 'There is a relationship between the map reading scores and the driving error ratings of motorists'.
2 marks for a non-directional statement with both key variables that lacks clarity or has only one variable operationalised.
1 mark for a muddled statement with some reference to variables.
0 marks for expressions of aim/questions/causal statements or statements with only one condition.

Full credit can be awarded for a hypothesis expressed in a null form.

(c)   **[AO2 = 2]**

1 mark for stating scattergraph or scattergram.

Plus

1 mark for explanation – because it shows a relationship between two variables.

(d)   **[AO2 = 3]**

Possible content
• General pattern - if a participant scored highly on the map reading task then they are also rated highly on the practical driving task, (or vice versa)
• This suggests a person who has good map reading ability also has good driving skills so these spatial abilities are (positively) related/correlated

Accept other relevant comments

(e)   **[AO2 = 2   AO3 = 4]**

Level	Marks	Description
3	5 – 6	Outline of the problem is clear and coherent. Discussion of how the method could be modified is appropriate and effective. The answer is clear and coherent. Specialist terminology is used effectively. One modification in detail can access this level.
2	3 – 4	Outline of the problem is clear. Discussion of how the method could be modified is mostly appropriate and effective. There is some appropriate use of specialist terminology.
1	1 – 2	Outline of the problem is vague/muddled. Discussion of how the method could be modified either lacks detail or is muddled. Specialist terminology is either absent or

	0	inappropriately used.
	0	No relevant content.

Possible problems:
- Researcher bias – using one observer means objectivity/reliability/validity cannot be checked

Possible modifications:
- Increasing the number of observers of the driving task because then the data is less subject to individual bias – the observations could then be correlated
- Recording the driver performance so that the data is not lost but can be reviewed as often as required.

Credit other relevant information.

(f) **[AO2 = 3]**

Possible content
- The test determines the strength of a relationship between two variables which is what the researchers were looking for in their initial aim
- The data are in related pairs
- The variables under test are both ratings measured at the ordinal level.

Credit other relevant information

(g) **[AO2 = 2   AO3 = 2]**

Level	Marks	Description
2	3 – 4	Explanation of an appropriate conclusion for this study is clear and mostly accurate. There is appropriate justification of the conclusion with reference to the critical values table. The answer is generally coherent with effective use of specialist terminology.
1	1 – 2	Some explanation of an appropriate conclusion is evident. There may be some justification of this with reference to the critical values table. The answer lacks accuracy and detail. Use of specialist terminology is either absent or inappropriate.
	0	No relevant content.

Possible content:

Conclusion
- The null hypothesis should be rejected and the alternative hypothesis accepted
- There is a significant (positive) relationship between the map reading ability and the driving ability of the participants
- Drivers who are skilled at map reading are also skilled at driving

Justification
- This relationship is a strong positive one as the calculated value of r_s of 0.808 exceeds the critical value for a two tailed test at $p=0.05$ where $n=9$ of 0.700.

Q4.

AO3 = 2

The graph indicates a fairly strong, positive correlation between scores on a stress questionnaire and days off through illness. The following can all receive a mark: direction, strength and a description of their relationship. Credit can also be given for mentioning the flattening of the graph at higher stress levels.

Q5.

AO3 = 6

Strength: can study relationship between variables that occur naturally. Can measure things that cannot be manipulated experimentally. Can suggest trends that can lead to experiments.
Weakness: It is not possible to say that one thing causes another. Just because there is a correlation between stress scores and days off it does not mean that stress caused people to take days off work, or there may be another variable connecting them. Elaboration through the use of an appropriate example can also receive credit.
Any other appropriate answer can get credit.

One mark for a brief outline of strength / limitation and a further mark for elaboration. For example, cannot say one thing causes another (1 mark) there may be a third variable that connects the two (2nd mark for elaboration.)

Q6.

Please note that the AOs for the new AQA Specification (Sept 2015 onwards) have changed. Under the new Specification the following system of AOs applies:

- AO1 knowledge and understanding
- AO2 application (of psychological knowledge)
- AO3 evaluation, analysis, interpretation.

Although the essential content for this mark scheme remains the same, mark schemes for the new AQA Specification (Sept 2015 onwards) take a different format as follows:

- A single set of numbered levels (formerly bands) to cover all skills
- Content appears as a bulleted list
- No IDA expectation in A Level essays, however, credit for references to issues, debates and approaches where relevant.

(a)   **AO2 / AO3 = 2**

Award 2 marks for an appropriate non-directional hypothesis which is operationalised. 'There is a relationship between happiness scores on a questionnaire and intelligence test scores'.

Award 1 mark for a non-directional hypothesis which is not fully

operationalised or lacks clarity ('there is a relationship between happiness and intelligence').
Award no marks for a null or directional hypothesis, or one that predicts a difference / link / association / connection.

(b) **AO2/AO3 = 4**

An interview is the most likely answer. An interview would be a more appropriate method than a questionnaire as it enables questions to be clarified and responses to be probed, thus overcoming the main disadvantages of questionnaires.

Students could also make a case for the analysis of diaries/written materials as a way of collecting data about happiness. These would generally overcome the problems of social desirability and demand characteristics inherent in questionnaires. Students could also make a case for the use of observation.

Award one mark for identifying an appropriate method. Award up to three further marks for an explanation of why this method would be better than a questionnaire.

(c) **AO2/AO3 = 2**

Award 1 mark each for any two of the following reasons:

- Study is looking for a correlation (relationship)

- Suitable for pairs of scores

- The data type obtained is ordinal, at least ordinal or interval level

- Linear relationship between scores.

(d) **AO2/AO3 = 3**

Students should state that the obtained value of + 0.42 exceeds the critical value for a twotailed test (.362) for N = 30. The results are therefore statistically significant (p ≤ 0.05) Award 2 marks for a student who supplies two pieces of information. Award 1 mark for a student who states that the results are significant but does not provide an explanation OR the student who states results are significant but uses incorrect values from the table. Award 0 marks for students who argue that results are not significant.

(e) **AO2/AO3 = 4**

This question requires students to interpret a further correlation co-efficient (this time demonstrating a non-significant negative correlation) and put both findings together. For full marks, answers should cover the two key bullet points below:

- At age 11, there is a significant positive correlation between happiness and intelligence, demonstrating that more intelligent children tend to be happier

- At age 16, the correlation is not statistically significant.

Students may also make the point that there may be a weak tendency for more intelligent teenagers to be less happy at 16 years of age, although this is

not statistically significant. Students may also refer to the contradiction in the results or provide an overall conclusion.

AO2 / AO3 Mark bands
4 marks Effective Effective analysis and understanding. The answer includes the findings of the two studies which are expressed clearly and fluently with appropriate reference to intelligence and happiness. Effective use of statistical terminology.
3 marks Reasonable Reasonable analysis and understanding. The answer is generally focussed and includes reference to both of the key findings which are reasonably clear. There is reasonable use of statistical terminology.
2 marks Basic Basic, superficial understanding. The answer is sometimes focussed OR covers only one of the key conclusions. Expression of ideas lacks clarity. Limited use of statistical terminology.
1 mark Rudimentary Rudimentary with very limited understanding. The answer is weak, muddled and may be mainly irrelevant. Deficiency in expression of ideas results in confusion and ambiguity. The answer lacks structure, often merely a series of unconnected assertions.
0 marks No creditworthy material is presented.

Q7.

(a) **AO2 / AO3 = 3**

A suitable non-directional hypothesis would be 'There is a correlation (relationship) between pupils' scores on a test of mathematical ability and pupils' scores on a test of musical ability'.

3 marks for a fully operationalised non-directional hypothesis.
2 marks for non-directional hypothesis that identifies both variables but does not operationalise them.
1 mark for non-directional hypothesis where the variables are not identified.
No marks for a null or directional hypothesis or one referring to association or difference.

(b) **AO2 / AO3 = 3**

The main issue is that the teacher has made up her own test:

- This involved subjective judgement on the part of the teacher who rates the students' musical ability. Her judgement may not reflect real differences in musical ability and is likely to differ from other people's judgement and / or any absolute criteria for tunefulness.

- Lack of reliability in rating musical ability would compromise the validity of the

measure.

- As the students can choose the song they will sing, the rating of ability could reflect the teacher liking / dislike of the song rather than the student's ability.

- The rating may be invalid as the students selected songs which varied in difficulty so the tunefulness reflected the difficulty of the song not the students' ability.

- Operationalising musical ability as tuneful singing is a very narrow measure. Someone can have musical ability such as playing an instrument which would not be reflected by this measure.

1 mark for identifying an appropriate reason.
2 further marks for elaboration, explanation of why it is a problem, how it might affect the result or for further reason(s).
Note that 3 marks can be awarded for one reason elaborated or more than one reason in less detail.

(c) **AO2 / AO3 = 3**

In the case of the maths test candidates could refer to split half or test retest as methods of checking reliability. They could also refer to checking the reliability of scoring by using two separate markers for the test and comparing the scores. Credit any other appropriate suggestion.

1 mark for identifying an appropriate method or a brief explanation eg 'repeat the maths test'.
2 further marks for appropriate elaboration.

(d) **AO2 / AO3 = 2**

The teacher chose to use a random sample because it would probably be more representative of the whole GCSE group than if she had used an opportunity or volunteer sample. Candidates could also say that she had ready access to her target population making it convenient for her to select a random sample.

No credit for definition of a random sample.
1 mark for a brief or muddled reason (it is not biased).
2 marks for a reason that clearly points to an advantage of random sampling. This could be achieved through a comparison with another method (it is less likely to be biased than a volunteer sample).
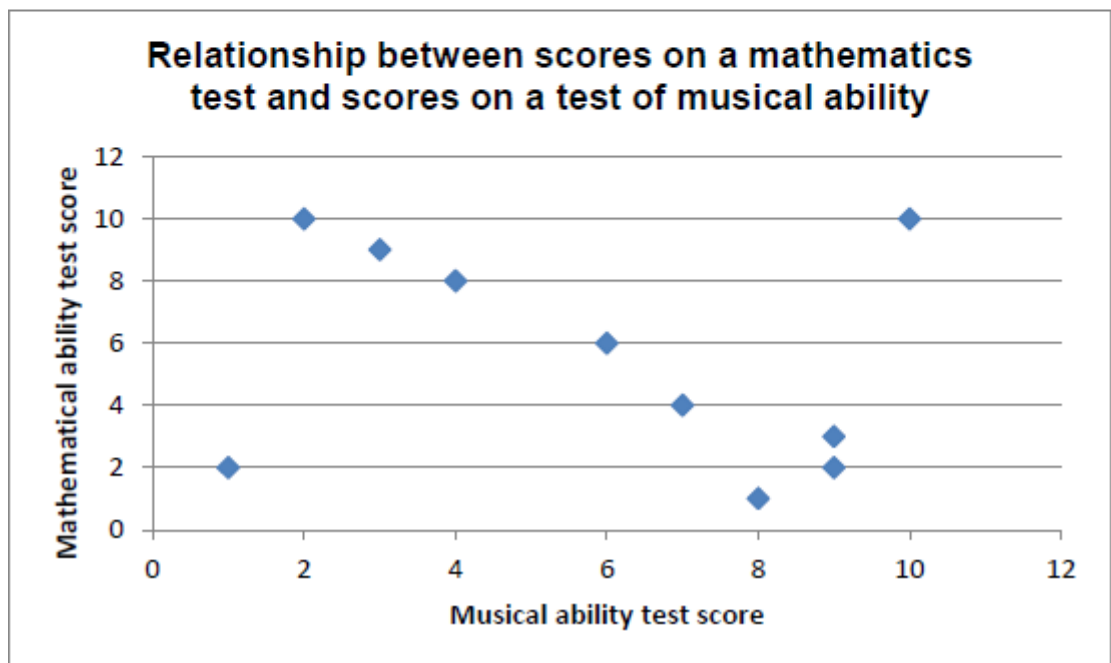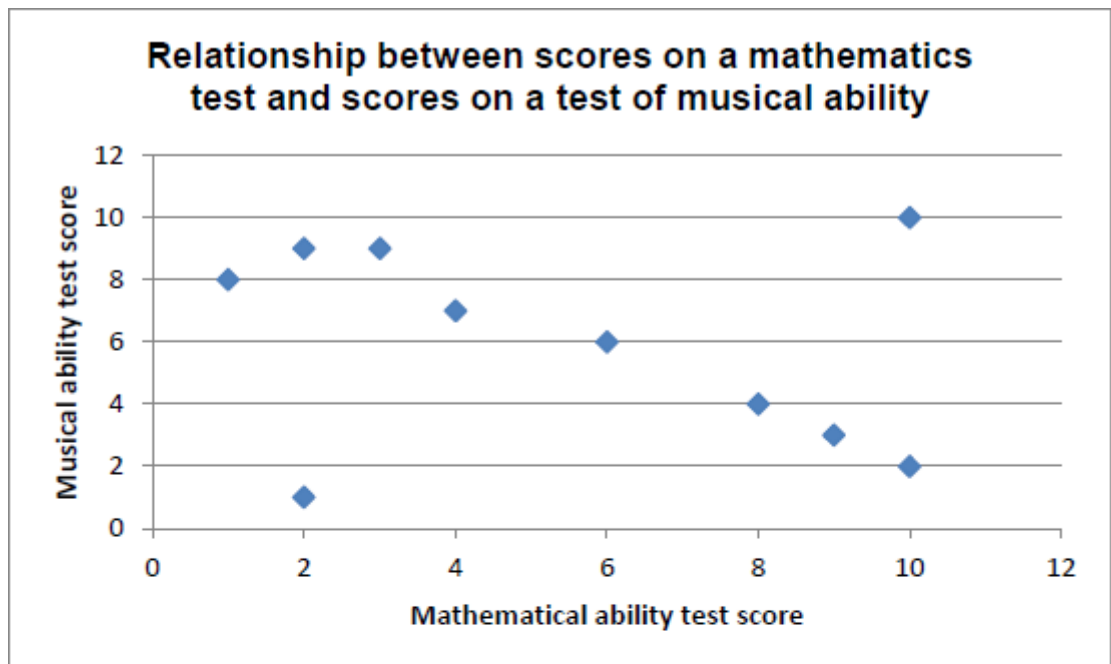
(e) **AO2 / AO3 = 3**

Credit should only be awarded for scattergraphs. Other graphs gain 0 marks.

1 mark for appropriately plotted scores.
1 mark for an appropriate title.
1 mark for correctly labelled axes.

Relationship between scores on a mathematics test and scores on a test of musical ability

Relationship between scores on a mathematics test and scores on a test of musical ability

(f)   **AO2 / AO3 = 3**

Up to 3 marks for a discussion of the relationship between mathematical and musical ability. Likely points include:

*   The graph seems to show a negative correlation between mathematical and musical ability.

*   This means that high scorers in mathematical ability tend to achieve low scores on musical ability and vice versa.

*   The presence of two strong outliers, means that the actual correlation is very weak and closer to zero.

- Comment on the small sample size which limits the conclusions that could be drawn.

- Credit can be achieved for plausible interpretations of the strength of the correlation which are justified (ie looks moderate to strong or the outliers make it weak in practice) or those based on rough calculations (around -0.2).

1 mark for a very brief answer eg negative correlation or zero correlation.
2 further marks for elaboration/discussion this could be focused on one point in detail or several points in less detail.

(g) **AO2 / AO3 = 10**

In this question, candidates are asked to design a study to test if there is a difference between left-handed and right-handed students in musical ability.

Design – 1 mark

- Award 1 mark for identification of an appropriate design (independent measures or matched pairs).

Sampling – 2 marks

- Award 1 mark for explaining an appropriate sampling method and 1 further mark for justifying why this method would be appropriate. As left-handed people are less common in the population than right-handed people this needs to be addressed in the sampling method.

Procedure and assessment of musical ability – 4 marks

Award 1 mark for procedure, 1 mark for assessing musical ability and two further marks for elaboration of either or both of these.

- Description of the procedure eg each participant will be given a standardised musical ability test, participants should be tested within a controlled environment, with minimal noise or distraction.

- Students are required to suggest a plausible alternative method of assessing musical ability to the one in the stem (eg singing a short, novel phrase played on the piano). Further credit could be given for stating that the test should be identical for all students or for explaining how it will be assessed.

Debrief – 3 marks

- Award up to 3 marks for writing a debrief. This could include the aim of the study, thanking participants for taking part, asking if they have any questions, relevant ethical considerations.

- If this is not suitable to be read out to participants, maximum 1 mark.

(h) **AO2 / AO3 = 3**

Award 1 mark for a clear table appropriate for the study described in (h).

Musical ability scores:

Participant number	Left handed	Right handed
1		
2		
3		

Award 1 mark for the identification of an appropriate statistical test for the proposed design.
Award 1 mark for one correct justification eg a test of difference, at least ordinal level data.

Q8.

AO3 = 4

The graph shows a strong negative correlation between score on depression scale and weeks of treatment. The more treatments the lower the depression. However, there also seems to be a plateau, where between 2-3.5 weeks there is very little change in depression.

1 mark for each of the following:

- Strength (it is a moderately strong / strong correlation)

- Direction (negative)

- Description of the relationship (the longer the treatment the lower the depression score)

- Indication of plateau / change in direction.

Q9.

Please note that the AOs for the new AQA Specification (Sept 2015 onwards) have changed. Under the new Specification the following system of AOs applies:

- AO1 knowledge and understanding
- AO2 application (of psychological knowledge)
- AO3 evaluation, analysis, interpretation.

(a) **AO2 / AO3 = 1**

One mark for an accurate reason: The decision to use a directional hypothesis was based on findings of previous research which pointed to an effect in a particular direction ie memory is poorer with age.

(b) **AO2 / AO3 = 3**

A suitable directional hypothesis would be 'There is a negative correlation

(relationship) between age and recall accuracy rating'.

- 3 marks for a fully operationalised hypothesis as above

- 2 marks for a directional correlational hypothesis that identifies age and recall as the two variables but is not fully operationalised

- 1 mark for a directional hypothesis where the variables are not identified ('there will be a negative correlation') or where the hypothesis lacks clarity.

Award zero marks for a non-directional or null hypothesis or any hypothesis predicting a difference or association.

(c) **AO1 = 1**

One mark for an accurate definition: The extent to which results or procedures are consistent or simply 'consistency'.

(d) **AO2 / AO3 = 3**

One mark for identification of a way of ensuring reliability. By far the most likely answer here is inter-rater reliability.

Two marks for some explanation/elaboration: using two separate psychologists and comparing them.

Three marks for an accurate and clear explanation: using two separate psychologists to rate the typed accounts for accuracy and comparing / correlating the ratings to see how similar they are.

Candidates could make a case for test retest which would involve the same psychologist re-examining the ratings after a period of time.

(e) **AO2 / AO3 = 2**

Award one mark for correct identification of one of each type of data.

- Qualitative data: the patient's responses, the typed accounts, the doctor's notes.

- Quantitative data: the ratings of recall accuracy on a scale of 1 – 10, ages of patients.

(f) **AO2 / AO3 = 2**

One mark for each accurate reason given:

- the researchers are testing for a correlation or a relationship between two variables.

- the data is to be treated as ordinal because the recall accuracy is in the form of ratings.

(g) **AO2 / AO3 = 2**

One mark for stating that the result is significant.

Second mark for explaining that -.52 exceeds .306 (p ≤ 0.05, n=30 for a one-tailed test).

(h)　**AO1 = 2**

One mark for a brief or muddled answer which hints at rejecting HO / accepting the H1 in error.

Two marks for explaining the term: where the researcher rejects the null hypothesis (or accepts the research / alternative hypothesis) when in fact the effect is due to chance – often referred to as an error of optimists.

(i)　**AO2 / AO3 = 3**

3 marks for a clear explanation which is based on comparison of the calculated value of r_s with the critical value at the 0.01 level of significance and indicates competence in use of statistical tables as follows:

- A Type 1 error is unlikely because the calculated value of r_s (-0.52) exceeds the critical table value at both the 0.05 and 0.01 level for a one-tailed test.

- The chance of a Type1 error occurring is therefore less than 1%.

- This means that the researchers can be 99% certain that the results obtained are not due to chance.

Award one mark for a brief explanation (it is significant at 0.01).
Award two further marks for an explanation which refers to two of the above points.

Award one mark for stating that the obtained value (-0.52) exceeds the critical value (0.306) by a reasonable margin.