Please check the examination details below before entering your candidate information

Candidate surname: StemUp Model Solution

Other names:

Pearson Edexcel
International Advanced Level

Centre Number

Candidate Number

Time 2 hours

Paper reference **WPS02/01**

Psychology

International Advanced Subsidiary
PAPER 2: Biological Psychology, Learning Theories and Development

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 96.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- The list of formulae and statistical value tables are printed at the start of this paper.
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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FORMULAE AND STATISTICAL TABLES

Standard deviation (sample estimate)

$$\sqrt{\left(\frac{\sum(x-\bar{x})^2}{n-1}\right)}$$

Spearman's rank correlation coefficient

$$1-\frac{6\sum d^2}{n\left(n^2-1\right)}$$

Critical values for Spearman's rank

	Level of significance for a one-tailed test				
	0.05	**0.025**	**0.01**	**0.005**	**0.0025**
	Level of significance for a two-tailed test				
N	**0.10**	**0.05**	**0.025**	**0.01**	**0.005**
5	0.900	1.000	1.000	1.000	1.000
6	0.829	0.886	0.943	1.000	1.000
7	0.714	0.786	0.893	0.929	0.964
8	0.643	0.738	0.833	0.881	0.905
9	0.600	0.700	0.783	0.833	0.867
10	0.564	0.648	0.745	0.794	0.830
11	0.536	0.618	0.709	0.755	0.800
12	0.503	0.587	0.678	0.727	0.769
13	0.484	0.560	0.648	0.703	0.747
14	0.464	0.538	0.626	0.679	0.723
15	0.446	0.521	0.604	0.654	0.700
16	0.429	0.503	0.582	0.635	0.679
17	0.414	0.485	0.566	0.615	0.662
18	0.401	0.472	0.550	0.600	0.643
19	0.391	0.460	0.535	0.584	0.628
20	0.380	0.447	0.520	0.570	0.612
21	0.370	0.435	0.508	0.556	0.599
22	0.361	0.425	0.496	0.544	0.586
23	0.353	0.415	0.486	0.532	0.573
24	0.344	0.406	0.476	0.521	0.562
25	0.337	0.398	0.466	0.511	0.551
26	0.331	0.390	0.457	0.501	0.541
27	0.324	0.382	0.448	0.491	0.531
28	0.317	0.375	0.440	0.483	0.522
29	0.312	0.368	0.433	0.475	0.513
30	0.306	0.362	0.425	0.467	0.504

The calculated value must be equal to or exceed the critical value in this table for significance to be shown.

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Chi-squared distribution formula

$$X^2 = \sum \frac{(O-E)^2}{E} \qquad df = (r-1)(c-1)$$

Critical values for chi-squared distribution

	Level of significance for a one-tailed test					
	0.10	**0.05**	**0.025**	**0.01**	**0.005**	**0.0005**
	Level of significance for a two-tailed test					
df	**0.20**	**0.10**	**0.05**	**0.025**	**0.01**	**0.001**
1	1.64	2.71	3.84	5.02	6.64	10.83
2	3.22	4.61	5.99	7.38	9.21	13.82
3	4.64	6.25	7.82	9.35	11.35	16.27
4	5.99	7.78	9.49	11.14	13.28	18.47
5	7.29	9.24	11.07	12.83	15.09	20.52
6	8.56	10.65	12.59	14.45	16.81	22.46
7	9.80	12.02	14.07	16.01	18.48	24.32
8	11.03	13.36	15.51	17.54	20.09	26.12
9	12.24	14.68	16.92	19.02	21.67	27.88
10	13.44	15.99	18.31	20.48	23.21	29.59
11	14.63	17.28	19.68	21.92	24.73	31.26
12	15.81	18.55	21.03	23.34	26.22	32.91
13	16.99	19.81	22.36	24.74	27.69	34.53
14	18.15	21.06	23.69	26.12	29.14	36.12
15	19.31	22.31	25.00	27.49	30.58	37.70
16	20.47	23.54	26.30	28.85	32.00	39.25
17	21.62	24.77	27.59	30.19	33.41	40.79
18	22.76	25.99	28.87	31.53	34.81	42.31
19	23.90	27.20	30.14	32.85	36.19	43.82
20	25.04	28.41	31.41	34.17	37.57	45.32
21	26.17	29.62	32.67	35.48	38.93	46.80
22	27.30	30.81	33.92	36.78	40.29	48.27
23	28.43	32.01	35.17	38.08	41.64	49.73
24	29.55	33.20	36.42	39.36	42.98	51.18
25	30.68	34.38	37.65	40.65	44.31	52.62
26	31.80	35.56	38.89	41.92	45.64	54.05
27	32.91	36.74	40.11	43.20	46.96	55.48
28	34.03	37.92	41.34	44.46	48.28	56.89
29	35.14	39.09	42.56	45.72	49.59	58.30
30	36.25	40.26	43.77	46.98	50.89	59.70
40	47.27	51.81	55.76	59.34	63.69	73.40
50	58.16	63.17	67.51	71.42	76.15	86.66
60	68.97	74.40	79.08	83.30	88.38	99.61
70	79.72	85.53	90.53	95.02	100.43	112.32

The calculated value must be equal to or exceed the critical value in this table for significance to be shown.

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Wilcoxon Signed Ranks test process

- Calculate the difference between two scores by taking one from the other
- Rank the differences giving the smallest difference Rank 1

  Note: do not rank any differences of 0 and when adding the number of scores, do not count those with a difference of 0, and ignore the signs when calculating the difference
- Add up the ranks for positive differences
- Add up the ranks for negative differences
- T is the figure that is the smallest when the ranks are totalled (may be positive or negative)
- N is the number of scores left, ignore those with 0 difference

Critical values for the Wilcoxon Signed Ranks test

	Level of significance for a one-tailed test		
	0.05	0.025	0.01
	Level of significance for a two-tailed test		
n	0.1	0.05	0.02
N=5	0	–	–
6	2	0	–
7	3	2	0
8	5	3	1
9	8	5	3
10	11	8	5
11	13	10	7
12	17	13	9

The calculated value must be equal to or less than the critical value in this table for significance to be shown.

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SECTION A

BIOLOGICAL PSYCHOLOGY

Answer ALL questions in this section. Write your answers in the spaces provided.

1 State what is meant by the term 'external zietgeber'.

An external zeitgeber is an environmental cue, such as light or social cues, that resets and synchronises a biological rhythm (our body clock) with the natural 24-hour cycle.

(Total for Question 1 = 1 mark)

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2 Haziq carried out a correlation between testosterone levels and the number of aggressive acts in a month. He used a volunteer sample of two males and five females.

Haziq's results are shown in **Figure 1**.

A scatter graph to show the correlation between level of testosterone and number of aggressive acts in a month

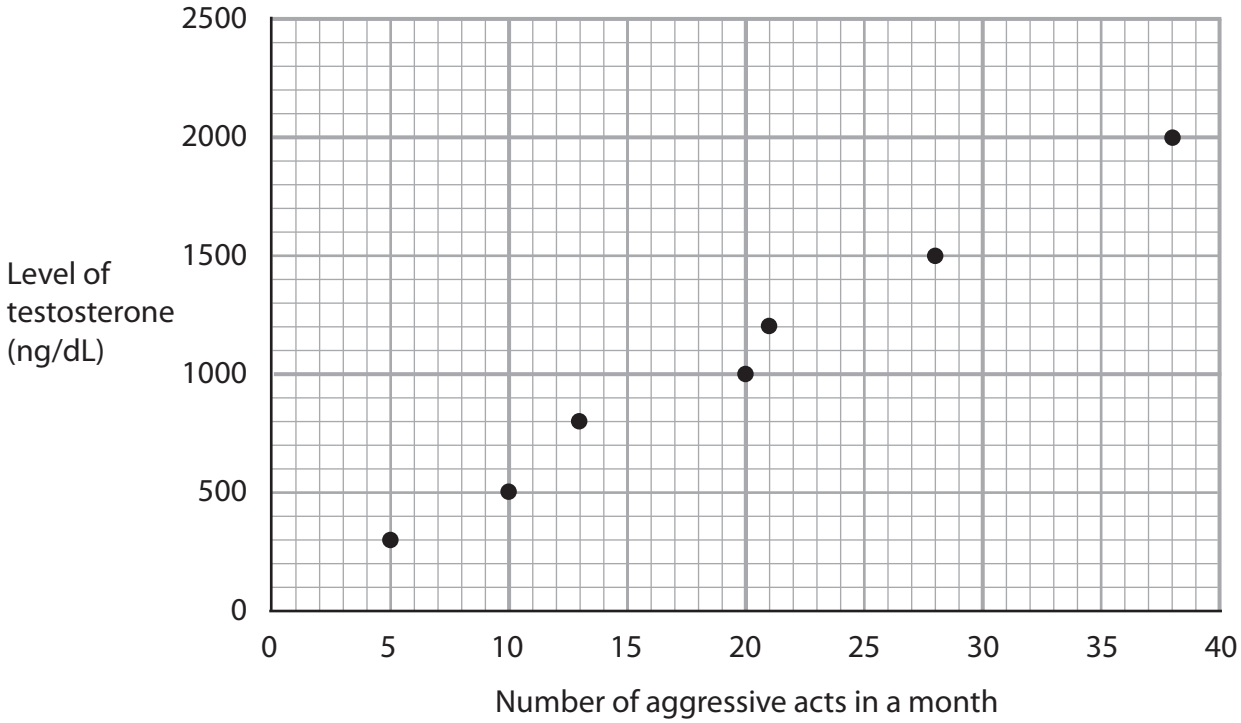


Figure 1

(a) Identify the type of correlation shown in **Figure 1**.

(1)

Positive correlation: as the level of testosterone increases, the number of aggressive acts in a month also increases.

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(b) Haziq carried out a Spearman's rank test on his data. He used the p=0.05 level of significance rather than the p=0.01 level of significance. Haziq found that at p≤0.05 his correlation was significant.

Explain **one** difference between the p=0.05 and the p=0.01 levels of significance in relation to Haziq's correlation.

(2)

At p≤0.05 there is up to a 5% probability that Haziq's correlation between testosterone and aggressive acts happened by chance, whereas p≤0.01 is stricter, allowing only a 1% probability. So Haziq is more likely to find a significant correlation at p≤0.05 and less likely to make a type II error, wrongly keeping the null hypothesis that testosterone is not related to aggression, although he has a greater risk of a type I error than at p≤0.01.

(c) Haziq decided to carry out the correlational research again, but this time with a stratified sample of 149 participants, as he thought this would improve his correlational research.

Justify whether changing the sample would improve Haziq's correlational research.

(2)

Changing the sample would improve his research. His volunteer sample of two males and five females was small and biased, but a stratified sample of 149 would include males and females in the same proportions as the target population, so it is more representative. This means Haziq can be more confident that his findings about testosterone levels and aggression are generalisable.

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Haziq decided to carry out another investigation into the number of aggressive acts that boys aged 12 to 16 years old carried out in a month.

The results for Haziq's investigation are shown in **Table 1**.

Total number of boys aged 12 to 16 years old	Total number of aggressive acts carried out in a month
99	914.56

Table 1

(d) Give the order of magnitude for the total number of aggressive acts carried out in a month.

(1)

Space for calculations

$914.56 = 9.1456 \times 10^2$

Order of magnitude 9.1456×10^2

(e) Calculate the mean number of aggressive acts carried out in a month.

You **must** give your answer to **three** decimal places.

(1)

Space for calculations

$914.56 \div 99 = 9.23797...$

Mean 9.238

(Total for Question 2 = 7 marks)

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3 (a) Describe the role of the limbic system in aggression.

(4)

The limbic system is a group of structures deep in the brain that regulates emotions and basic urges, including fear and aggression. The amygdala detects threats in the environment and alerts the prefrontal cortex (PFC) that a situation may be threatening. If the PFC processes the situation as threatening, the amygdala can trigger a fight response, so the person becomes aggressive. A hyperactive amygdala, or weak control of it by the PFC, can therefore lead to more reactive aggression. The hypothalamus controls the expression of emotions, including aggression, and regulates hormones such as testosterone through the pituitary gland, so it determines how the aggression is expressed. The hippocampus stores memories of past threats, so it helps the amygdala judge whether a situation needs an aggressive response.

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(b) Explain **two** weaknesses of the limbic system as an explanation for aggression.

(4)

1 *The explanation is reductionist, as it reduces aggression to brain structures and ignores other causes. For example, social learning theory states that aggression is learned by observing and imitating role models, which the limbic system cannot explain.*

2 *Much of the evidence comes from unique case studies such as Phineas Gage, so it may not be generalisable. Gage had very specific damage to his brain from an iron rod, which would not be the same as the damage or activity in other people's limbic systems.*

(Total for Question 3 = 8 marks)

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4 In your studies of biological psychology, you will have carried out a practical investigation.

(a) State **one** aim of your practical investigation.

(1)

To investigate whether there is a negative correlation between the number of hours slept per night and self-rated aggression score.

(b) Describe the procedure of your practical investigation.

(4)

We designed a questionnaire with two closed questions: how many hours do you usually sleep per night, and how aggressive do you feel on a typical day, rated on a scale of 1 (not at all aggressive) to 10 (very aggressive). We used opportunity sampling and gathered 20 students from our college aged 16 to 18 who gave their informed consent. Each participant answered the questionnaire on their own in a quiet classroom, and we left the room so they would not feel pressured. They put their answers in an envelope with no name on it so that the data were anonymous. We then ranked the two sets of scores and carried out a Spearman's rank correlation test.

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(c) Explain **one** conclusion you made from your practical investigation.

(3)

We concluded that people who sleep fewer hours per night feel more aggressive. This is because we found a significant negative correlation between hours slept and aggression score. Our calculated value was rs = −0.582, and with N = 20 for a one-tailed test at p≤0.05 the critical value is 0.380. As 0.582 is greater than 0.380, the result was significant, so we rejected the null hypothesis.

(d) Explain **one** improvement you could have made to the way you gathered your data for your practical investigation.

(2)

We could have asked participants to keep a sleep diary every night for a week, noting the time they went to sleep and woke up. This would make the data more valid because it would record the hours they actually slept rather than them estimating their usual sleep.

(Total for Question 4 = 10 marks)

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5 In your studies of biological psychology, you will have learned about the following classic study in detail:

- Raine et al. (1997).

Assess Raine et al. (1997) in terms of generalisability and ethics.

(8)

Raine et al. (1997) used 41 murderers (39 male and 2 female) who had pleaded not guilty by reason of insanity (NGRI) in California, and 41 controls matched for age and sex, including six people with schizophrenia matched to six murderers with schizophrenia. All participants were kept free of medication for two weeks before the study. Each was injected with a glucose tracer, carried out a continuous performance task for 32 minutes and then had a PET scan. The murderers had lower glucose metabolism in the prefrontal cortex and abnormal asymmetries in areas such as the amygdala.

In terms of generalisability, a sample of 41 murderers is fairly large for a brain scanning study, and matching them with controls means the differences can be generalised to the target population of NGRI murderers. However, because the murderers had all pleaded insanity, the results may not be true of other murderers who did not claim to be insane. Also, only two were female, so the findings may not generalise to women, and they only apply to murder rather than other types of violent behaviour.

In terms of ethics, the continuous performance task was a simple visual task that did not cause distress, so it did not breach the protection from harm guideline. Participants gave informed consent and their identities were kept confidential. However, keeping participants who had schizophrenia off their medication for two weeks may be seen as unethical even though they consented, as it could cause them distressing symptoms. The injection of a radioactive tracer also carries a small risk of harm.

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Overall, Raine et al. (1997) is generalisable to NGRI murderers but less so to other offenders or women, and although it was mostly ethical, removing medication raises concerns about protection from harm.

(Total for Question 5 = 8 marks)

TOTAL FOR SECTION A = 34 MARKS

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SECTION B

LEARNING THEORIES AND DEVELOPMENT

Answer ALL questions in this section. Write your answers in the spaces provided.

6 Rosie has recently started to pull her brother Jim's hair. Her mother uses operant conditioning to teach Rosie not to pull his hair. Every day that Rosie does not pull Jim's hair their mother gives her a sticker. Once Rosie has 10 stickers she can have some ice cream.

(a) Identify the primary reinforcer that Rosie's mother uses with Rosie.

(1)

The ice cream is the primary reinforcer.

(b) Rosie no longer pulls her brother's hair, but she recently pulled the dog's tail. Rosie's mother took away her favourite toy for a day as a punishment.

State the type of punishment that Rosie's mother used after Rosie pulled the dog's tail.

(1)

Negative punishment, as her mother took away something she liked (her favourite toy).

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(c) The use of punishment did not teach Rosie how to play nicely with the dog.

Explain why punishment did not help Rosie learn how to play nicely with the dog.

(2)

Punishment only showed Rosie that pulling the dog's tail has a negative consequence, losing her toy, so it may stop that behaviour. However, punishment does not teach any new behaviour; it only discourages the undesirable one, so it did not show her how to play nicely with the dog, for example stroking it gently.

(Total for Question 6 = 4 marks)

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7 Mackenzie carried out an observation with children aged two years old. He aimed to see how many boys did or did not play with a doll and how many girls did or did not play with a doll.

Once he had collected his results he wanted to carry out a chi-squared test on his data. Some of his calculations are shown in **Table 2.**

		Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Boys	**Did play with a doll**	6	6.5	–0.5	0.25	0.04
	Did not play with a doll	4	3.5	0.5	0.25	0.07
Girls	**Did play with a doll**	7	6.5	0.5	0.25	0.04
	Did not play with a doll	3	3.5	–0.5	0.25	0.07
				Chi-squared =		0.22

Table 2

(a) Calculate the chi-squared for the data gathered by Mackenzie in his observation by completing **Table 2**.

You **must** give your answer to **two** decimal places.

(2)

Space for calculations

$0.25 \div 6.5 = 0.0385$ $0.25 \div 3.5 = 0.0714$

$\chi^2 = 0.0385 + 0.0714 + 0.0385 + 0.0714 = 0.2198$

$\chi^2 = 0.22$ (2 d.p.)

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(b) Mackenzie gathered his sample of two-year-old children through opportunity sampling.

Describe how Mackenzie may have gathered his opportunity sample of two-year-old children.

(2)

Mackenzie could have gone to a local nursery near where he lives, at an arranged time with the manager's permission and parents' consent. He would then choose the first ten two-year-old boys and the first ten two-year-old girls who were available at the nursery on that day.

(c) Mackenzie did not find a significant difference in his first observation. He decided to repeat the observation but used boys and girls aged seven years old.

He calculated chi-squared for the second observation and found a calculated value of 3.68.

Explain whether Mackenzie found a significant difference at $p \leq 0.05$, using a two-tailed (non-directional) test where $df = 1$.

The formulae and statistical tables can be found at the front of this paper.

(2)

Mackenzie did not find a significant difference between the boys and girls aged seven in whether they did or did not play with a doll. This is because, with df = 1 for a two-tailed test at p≤0.05, the critical value is 3.84, and his calculated value of 3.68 is less than 3.84, so he must accept the null hypothesis.

(Total for Question 7 = 6 marks)

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8 Haneen is 17 years old. She has seen her father change the oil in her mother's car several times. Her mother always thanks Haneen's father and bakes him his favourite cake after the oil has been changed.

Haneen has changed her car oil for the first time. She feels a sense of pride in her achievement and has decided to do the oil change in the future when her car needs it.

(a) Describe, using social learning theory, why Haneen changes her car oil.

(4)

Haneen has paid attention to her father changing the oil in her mother's car several times. Her father is a role model for her, as he is someone important in her life, so she is more likely to imitate his behaviour. She retained how the oil is changed in her memory and was able to reproduce it, as at 17 she has the physical ability to change the oil herself. She was motivated through vicarious reinforcement, as she saw her father being thanked and rewarded with his favourite cake. She is motivated to do it again in the future through intrinsic reinforcement, as she felt a sense of pride in her achievement.

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(b) Explain **one** weakness of social learning theory as an explanation for Haneen's behaviour.

(2)

Research such as Bandura, Ross and Ross (1961) was carried out on young children, so it may not apply to Haneen, who is 17. She has more complex cognitive processes, so she may have decided to change her oil for other reasons, such as saving money, rather than simply imitating her father, so it may not be a valid explanation of her behaviour.

(c) Compare social learning theory and Freud's psychosexual stages of development.

(4)

Both theories describe how children imitate behaviour. In social learning theory children imitate role models they observe, and in Freud's theory children identify with the same-sex parent in the phallic stage and take on their behaviours and values.

However, social learning theory is more scientific than Freud's theory, as it is supported by empirical evidence from controlled lab experiments such as Bandura, Ross and Ross (1961), whereas Freud's evidence comes mainly from case studies such as Little Hans. Also, Freud says behaviour is driven by unconscious sexual desires through fixed stages, while social learning theory says learning is conscious and can happen at any age.

(Total for Question 8 = 10 marks)

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9 In your studies of learning theories and development, you will have learned about the following contemporary study in detail:

- Capafóns et al. (1998).

(a) Describe the procedure used with the treatment group in Capafóns et al. (1998).

(4)

The participants' fear of flying was first measured with several measures, including the EPAV fear of flying scale and physiological measures such as heart rate. They then sat in a flight simulator and were shown a video of a simulated plane trip, from take-off to landing, with the sounds of a flight. The treatment group then received a standardised systematic desensitisation programme of between 12 and 15 sessions. They were taught relaxation techniques and then imagined themselves in a hierarchy of flying situations while staying relaxed. Afterwards they were measured again in the flight simulator to compare their fear with before treatment.

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(b) Explain **one** strength of Capafóns et al. (1998).

(2)

A strength is that Capafóns et al. (1998) used physiological measures of fear such as heart rate, which makes the data reliable. This is because they produce objective numerical data that can be analysed by other researchers to see whether they come to the same findings.

(Total for Question 9 = 6 marks)

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10 Evuska liked peanut butter sandwiches until she ate one as a child and it got stuck in her throat making her choke.

She now has a phobia of peanut butter sandwiches and chokes and gags when she sees one. Evuska also chokes and gags when she sees other sandwiches.

Discuss classical conditioning as an explanation of Evuska's phobia.

You must make reference to the context in your answer.

(8)

Classical conditioning explains how we learn to associate a reflex response with a new stimulus. Before conditioning, an unconditioned stimulus (UCS) produces an unconditioned response (UCR), which is a natural reflex. For Evuska, the UCS was the food getting stuck in her throat, and the UCR was the reflex of choking and gagging. The peanut butter sandwich was a neutral stimulus (NS), as she liked it and it did not cause choking before the incident.

During conditioning, the NS is paired with the UCS. When Evuska ate the peanut butter sandwich it got stuck in her throat, so the sandwich was paired with the choking. After conditioning, the peanut butter sandwich became a conditioned stimulus (CS) and the choking and gagging became a conditioned response (CR), which is fear. This is why Evuska now chokes and gags when she just sees a peanut butter sandwich, even without eating it.

This happened after only one pairing, which is called one-trial learning. This explains how Evuska's phobia developed from just one bad incident as a child, as the fear was so strong. Evuska has also shown generalisation, where the CR occurs to stimuli similar to the CS. She now chokes and gags when she sees other sandwiches, not just peanut butter ones, as they look similar.

Classical conditioning is supported by Watson and Rayner (1920), who showed that a fear of a white rat could be conditioned in Little Albert, which then generalised to similar objects, just as Evuska's fear has spread to other sandwiches. However, classical conditioning does not explain

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why Evuska's phobia has lasted, as the CR should extinguish when she sees sandwiches without choking. Operant conditioning explains this, as avoiding sandwiches reduces her fear, which negatively reinforces the avoidance.

Overall, classical conditioning explains well how Evuska's phobia started through one-trial learning and spread through generalisation, but it needs operant conditioning to explain why it is maintained.

(Total for Question 10 = 8 marks)

TOTAL FOR SECTION B = 34 MARKS

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SECTION C

Answer ALL questions in this section. Write your answers in the spaces provided.

11 In your studies of learning theories and development, you will have learned about the following classic study in detail:

- Watson and Rayner (1920).

Evaluate the study by Watson and Rayner (1920) in terms of reliability and validity.

(12)

Watson and Rayner (1920) aimed to see whether an emotional response, fear, could be classically conditioned in an infant. Little Albert was a healthy, emotionally stable baby. At about nine months old he was tested with a white rat, a rabbit, a dog, a monkey, masks, cotton wool and burning newspaper and showed no fear. However, he cried when a steel bar was struck with a hammer behind his head.

At 11 months and 3 days, the white rat was presented and the bar was struck as Albert reached for it. After seven pairings in total, Albert cried and crawled away when the rat was shown alone. At 11 months and 15 days his fear had generalised to a rabbit, a dog, a fur coat, cotton wool and a Santa Claus mask, and he was given building blocks between trials, which he played with happily. His fear was also tested in a different room, and one month later. They concluded that emotional responses can be conditioned and transfer to similar objects.

The study has good reliability because it used a standardised procedure. Albert was tested on the same objects before conditioning, which gave a baseline to compare the later results with, and the same pairing of the rat with the loud noise was repeated several times. Giving Albert the building blocks between trials checked that he was only afraid of the conditioned objects and not of everything, so his responses were consistent. The procedure was also filmed, so others can check how Albert responded.

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However, the study is hard to replicate to test its reliability. Albert was deliberately frightened and distressed, and he was removed before he could be deconditioned, so the study would be unethical to repeat today. As there is only one participant, we cannot check whether other infants would respond in the same way, so the reliability of the findings cannot be confirmed.

The study has some validity as it is a controlled experiment. The loud noise was the only stimulus paired with the rat, so it is likely the conditioning caused Albert's fear rather than another variable. Its conclusions have real-world validity too, as they show how phobias can develop, which led to treatments such as systematic desensitisation and flooding.

However, validity is reduced because the researchers assumed that Albert was afraid of the rat from his crying and moving away, but he could not tell them what he was feeling, so their interpretation may be subjective. His fear was weaker in a new room and the conditioning had to be freshened, suggesting the fear was not fully established. Also, as only one infant was used, the results lack population validity and may not generalise to adults, who may not be conditioned as easily because of their more complex thinking.

In conclusion, Watson and Rayner (1920) is reliable in its standardised, controlled procedure and has some validity in explaining how phobias develop. However, as it used only one infant whose fear was interpreted by the researchers, and it cannot ethically be repeated, both its reliability and validity are limited.

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(Total for Question 11 = 12 marks)

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12 Ion and Nikola are two researchers who were each asked to carry out an investigation into aggression.

Ion decided to carry out a twin study to investigate whether aggression was due to genes or the environment. He gave his participants a questionnaire to measure their levels of aggression.

Nikola decided to carry out an animal experiment to investigate whether aggression was due to the structure of the brain. She used rats and investigated the effect on aggression of stimulating different areas of the brain.

Evaluate Ion and Nikola's use of twin studies and animal experiments to investigate aggression.

You must make reference to the context in your answer.

(16)

Twin studies compare the similarity in a behaviour between monozygotic (MZ) twins, who share 100% of their genes, and dizygotic (DZ) twins, who share about 50%. A concordance rate is calculated for each type of twin. If MZ twins have a higher concordance rate for aggression than DZ twins, this suggests aggression is partly due to genes, since both types of twins are assumed to share a similar environment. The twins must be checked for zygosity, for example through DNA testing or blood group. Ion could find MZ and DZ twins from a twin register, give each twin the same questionnaire on aggression, and compare the scores for each pair.

A strength is that twin studies are a natural way to separate nature and nurture without manipulating anyone, so they are ethical. Using a twin register would allow Ion to gather a large sample, making his findings more generalisable, and checking zygosity through a number of methods means the twins can reliably be put into the MZ or DZ groups. Brendgen et al. (2005) used twins and found that physical aggression was largely explained by genetic factors, whereas social aggression was more influenced by the environment, showing twin studies can give detailed conclusions about aggression.

However, even MZ twins do not share exactly the same environment, and MZ twins are often treated more alike than DZ twins, so a higher concordance for aggression could be due to

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nurture, reducing validity. If Ion has a large sample it may be difficult to check all of them for zygosity, so some twins may be wrongly categorised. Also, Ion's questionnaire is self-report, so twins may give socially desirable answers and under-report their aggression, whereas Brendgen et al. (2005) used teacher and peer ratings, which are more objective.

Animal experiments involve manipulating an independent variable (IV) and measuring its effect on a dependent variable (DV) in animals such as rats, while controlling extraneous variables. The IV and DV are operationalised so the researcher knows exactly what is changed and how aggression is measured. Nikola could use two groups of rats and stimulate the amygdala in one group and not the other, measuring aggression as the number of attacks or bites on another rat placed in the cage. She could make sure all the rats had the same amount of food and were kept in the same conditions, so hunger is not a factor in their aggression.

A strength is that animal experiments are highly controlled, so Nikola can establish cause and effect between stimulating an area of the brain and aggression. Operationalising the DV gives validity, as she knows exactly what counts as an aggressive act, and the standardised procedure means the experiment can be repeated to test reliability. Brain areas involved in aggression, such as the amygdala and hypothalamus, are similar in rats and humans, so the results can be generalised to some extent. Procedures such as brain stimulation would also be unethical to carry out on humans.

However, the human brain is more complex, with a larger prefrontal cortex that can control aggressive urges, and human aggression is affected by social factors, so the findings may not generalise to humans. The tight control also means the results lack ecological validity, as aggression in rats in their natural environment is caused by many factors, not just brain structure. There are ethical issues too, as stimulating the brain may cause the rats pain and

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distress, so Nikola must follow the Animals (Scientific Procedures) Act 1986, use as few rats as possible and minimise suffering.

In conclusion, Ion's twin study can show whether genes contribute to aggression in humans, but cannot fully separate genes from the environment, and his questionnaire may lack validity. Nikola's experiment can show cause and effect between brain structure and aggression with tight control, but may not generalise to humans. Using both methods together gives the strongest evidence about the biological causes of aggression.

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(Total for Question 12 = 16 marks)

TOTAL FOR SECTION C = 28 MARKS
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