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Surname: StemUp Model Solution | Other names:

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Psychology

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

Monday 22 May 2017 – Afternoon
Time: 2 hours

Paper Reference
WPS02/01

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 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.
- Try to answer every question.
- Check your answers if you have time at the end.

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

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

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.

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 Jayla used a PET scan to research the areas of the brain that are active when reading a poem and when completing mathematical sums.

Jayla's research used an opportunity sample of 13 students aged between 18 and 22 years from a local university. Each student had two PET scans. One whilst reading a poem and a second whilst completing mathematical sums.

(a) Explain **one** strength of Jayla using a PET scan in her research.

(2)

PET scans give objective, quantitative data, as the computer shows which areas of Jayla's participants' brains are active (using a radioactive tracer) while reading the poem and doing the sums, so the results do not depend on her interpretation. This makes the study more reliable, as other researchers looking at the same scans should reach the same conclusions about brain activity.

(b) Explain **two** ways Jayla could have improved her study.

(4)

1 *Jayla could use a random sample instead of an opportunity sample, for example picking names from a list of all students at the university. This would reduce sampling bias, as every student would have an equal chance of being chosen, so the sample would be more representative.*

2 *She could use a larger sample with a wider age range, not just 13 students aged 18 to 22 from one local university, for example including older adults and non-students. This would mean her results about brain activity when reading and doing sums could be generalised to the wider population.*

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(c) Jayla decided to check her data using a statistical test at $p \leq 0.05$ in order to avoid a type I error.

Define the term 'type I error'.

(1)

A type I error is when the null hypothesis is rejected (and the alternative accepted) when the null hypothesis is actually true, a false positive.

(Total for Question 1 = 7 marks)

2 Lysander is undergoing light therapy for his seasonal affective disorder. He finds that in the winter he no longer wants to play football and spends more time in bed.

(a) Identify **three** symptoms of seasonal affective disorder that Lysander may have.

(3)

1 *Lack of interest or pleasure in normal activities, such as no longer wanting to play football.*

2 *Sleeping more than usual (hypersomnia) and finding it hard to get out of bed.*

3 *Persistent low mood, with lack of energy and tiredness during the winter months.*

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(b) Describe how light therapy would be used as a treatment for Lysander's seasonal affective disorder.

(3)

Lysander would sit in front of a light box which gives off bright artificial light (about 10 000 lux, much brighter than normal indoor lighting) for around 30 to 60 minutes each morning, for example while eating breakfast, without looking straight at the light. He could also use a dawn simulator, which gradually brightens his bedroom before he wakes, so it is easier for him to get up rather than spending more time in bed. The bright light reduces the secretion of melatonin by the pineal gland and resets his body clock, so he should feel less sleepy and his mood should improve, making him more likely to want to play football again. He would start the treatment in autumn, before his symptoms usually begin, and continue each day through the winter.

(Total for Question 2 = 6 marks)

3 Arissa wanted to conduct a correlation study for her psychology coursework. She decided to research whether the number of brothers and sisters her participants have affects the number of children her participants have.

(a) State a directional (one-tailed) hypothesis for Arissa's study.

(1)

The more brothers and sisters a participant has, the more children that participant will have (there will be a positive correlation).

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(b) Arissa asked her teachers how many brothers, sisters and children they have. The results are shown in **Table 1**.

Calculate the standard deviation by completing **Table 1** below.

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

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

(4)

Teacher	Number of children teacher has	$x - \overline{x}$	$(x - x)^2$
A	2	–1.2	1.44
B	1	–2.2	4.84
C	4	0.8	0.64
D	3	–0.2	0.04
E	6	2.8	7.84
Mean number of children	3.2	Sum of differences^2	14.8
Standard deviation = 1.92			

Table 1

Space for calculations.

Sum of $(x - \bar{x})^2$ = 1.44 + 4.84 + 0.64 + 0.04 + 7.84 = 14.8

Divide by $n - 1$ = 14.8 ÷ (5 − 1) = 14.8 ÷ 4 = 3.7

Standard deviation = $\sqrt{3.7}$ = 1.9235...

Standard deviation = 1.92 (to 2 decimal places)

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(c) Arrissa carried out a Spearman's rank test for a one-tailed test and found a calculated value of –0.58.

Explain whether Arissa's results were significant at $p \leq 0.05$.

(2)

Arissa's results were not significant at p≤0.05. For N = 5 on a one-tailed test the critical value is 0.900, and her calculated value of –0.58 (0.58 ignoring the sign) is less than 0.900, so she must retain her null hypothesis. Also, the correlation is negative, so it is in the opposite direction.

(Total for Question 3 = 7 marks)

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4 (a) Identify **two** areas of the brain that are thought to influence aggression in humans.

(2)

1 *The prefrontal cortex.*

2 *The limbic system, for example the amygdala and hypothalamus.*

(b) Explain **one** strength and **one** weakness of brain functioning as an explanation of aggression in humans.

(4)

Strength

There is research evidence supporting the role of the brain, giving the explanation credibility. Raine et al. (1997) used PET scans and found that murderers pleading not guilty by reason of insanity had lower activity in the prefrontal cortex than matched controls, linking reduced impulse control in this area to violent aggression.

Weakness

Much of the research on brain areas and aggression uses animals, such as stimulating the hypothalamus in cats, and animal brains differ from human brains. This means the findings may not generalise to human aggression, which is also strongly influenced by social and cultural factors that the brain explanation ignores, so it is reductionist.

(Total for Question 4 = 6 marks)

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5 In your studies of biological psychology you will have learned about one of the following contemporary studies in detail.

- Brendgen et al. (2005) Examining genetic and environmental effects on social aggression: A study of 6-year-old twins
- McDermott et al. (2008) Monoamine oxidase A gene (MAOA) predicts behavioural aggression
- Hoefelmann et al. (2006) Behaviours associated to sleep among high school students: cross-sectional and prospective analysis.

Evaluate **one** contemporary study from biological psychology.

(8)

Brendgen et al. (2005) aimed to find out how far genetic and environmental factors contribute to social aggression compared with physical aggression. They studied 234 pairs of 6-year-old twins (both MZ and DZ) from the Quebec Newborn Twin Study in Montreal, Canada. Aggression was measured through teacher ratings and peer ratings, where classmates nominated children who behaved in aggressive ways. Zygosity was assessed from a questionnaire on physical likeness, checked with DNA markers in a subsample. They found that physical aggression was explained mainly by genetic factors (around 60%), whereas social aggression, such as spreading rumours or excluding others, was explained much more by environmental factors, with genes accounting for only around 20%. Much of the link between the two types of aggression was genetic.

A strength is that the study was reliable. There was a 94% agreement between zygosity based on physical likeness and on genetic markers, so the twins were classified accurately as MZ or DZ, and using both teacher and peer ratings allowed the two sources to be compared, giving a fuller and more valid picture of each child's aggression. The large sample of 234 twin pairs also increases confidence in the results.

The study was also ethical, as informed consent was gained from the parents of the 6-year-olds, and the findings have practical applications: as social aggression is largely influenced by the environment, changes such as classroom programmes or parenting support

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could be used to reduce it.

However, all the twins came from Montreal, so the study may be ethnocentric and the findings may not generalise to other cultures where social aggression is shown or judged differently. The ratings were also subjective, as teachers and peers may have been biased, for example teachers may be less aware of social aggression as it is less visible than physical aggression, which lowers validity. The twin method also assumes that MZ and DZ twins share equally similar environments, but MZ twins may be treated more alike, which could inflate the genetic estimate.

Overall, the study is a well-controlled and reliable twin study which shows that different types of aggression have different causes, but because of its culturally limited sample and its reliance on subjective ratings, its conclusions should be applied to other populations with caution.

(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 Patricio is carrying out an observation to investigate whether children aged one year or four years prefer to play together or play alone. He observes two groups of children playing.

(a) State **one** way Patricio may have operationalised the variable of 'children playing together'.

(1)

Counting each time a child plays a game or shares a toy with at least one other child for 10 seconds or more.

(b) The results of Patricio's observation are shown in **Table 2** below.

Age of the children in years	Number of children playing together	Number of children playing alone
One	2	8
Four	7	3

Table 2

Calculate the percentage of children aged one year old who play together out of the total number of children who play together.

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

(1)

Space for calculations

Total playing together = 2 + 7 = 9

(2 ÷ 9) × 100 = 22.222...%

Percentage score *22.22%*

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(c) Patricio calculated the range for his results.

Define what is meant by the term 'range'.

(1)

The range is a measure of spread; the difference between the highest and the lowest score in a set of data (highest – lowest).

(d) Patricio used an overt observation for his study.

Explain **one** strength and **one** weakness of overt observations as a research method.

(4)

Strength

Overt observations are more ethical than covert observations, as the participants (or the parents of the children) know they are being observed and can give informed consent, and can withdraw if they want to. This means the researcher does not need to deceive anyone, so the participants' right to privacy is respected.

Weakness

Participants know they are being watched, so their behaviour may change (the observer effect). They may show demand characteristics or socially desirable behaviour, for example the four-year-olds may play together more than they normally would, which means the observation does not record natural behaviour, so it has lower validity.

(Total for Question 6 = 7 marks)

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7 Katya has a fear of wasps. She was stung by a wasp as a child.

(a) Define the term 'unconditioned stimulus' (UCS) as it is used in classical conditioning.

(1)

A stimulus that naturally, without any learning, produces an unconditioned (reflex) response, such as pain causing fear.

(b) State the neutral stimulus (NS) that had no original effect on Katya's behaviour.

(1)

The wasp (before she was stung it did not cause any fear).

(c) Give the conditioned response (CR) that Katya shows.

(1)

Katya's fear of wasps, for example feeling panic when she sees a wasp.

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(d) Compare classical conditioning and operant conditioning.

(6)

One similarity is that both are behaviourist explanations which state that behaviour is learned from the environment rather than being innate. Both can be considered scientific, as their principles were developed using controlled laboratory experiments with animals, for example Pavlov's dogs and Skinner's rats, so they are objective and replicable.

A difference is that classical conditioning is learning through association, where a neutral stimulus is paired with an unconditioned stimulus until it produces a conditioned response, whereas operant conditioning is learning through consequences, where behaviour that is reinforced is repeated and behaviour that is punished is less likely to be repeated. Also, classical conditioning deals with involuntary, reflexive behaviour such as salivating or fear, while operant conditioning deals with voluntary behaviour that the learner actively chooses, such as pressing a lever. This means operant conditioning can be seen as a more complete explanation of learning, as it can explain more complex behaviours.

Another similarity is that both can explain how phobias develop and are maintained. Classical conditioning explains how a fear is acquired through association, as with Katya being stung by a wasp, and operant conditioning explains why it is maintained, as avoiding wasps reduces anxiety, which is negatively reinforcing. Both have also led to therapies, such as systematic desensitisation from classical conditioning and token economy programmes from operant conditioning.

(Total for Question 7 = 9 marks)

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8 In your studies of learning theories and development you will have conducted a practical investigation.

(a) Describe the sampling method you used in your learning theories and development practical investigation.

(2)

We used an opportunity sample of children playing in a local park on one Saturday morning. We observed whichever children aged about 3 to 6 were in the play area at the time, so only children who happened to be in the park then had a chance of being in our observation.

(b) Describe the results of the quantitative data that you gathered in your learning theories and development practical investigation.

(2)

We found that boys spent more time playing with male-stereotyped activities than girls. The boys were tallied playing on the climbing frame and with toy cars a mean of 9 times each, compared with a mean of 4 times for the girls, who played more in the sand pit and on the swings.

(c) Explain **one** weakness of your learning theories and development practical investigation in terms of reliability.

(2)

Our behavioural categories, such as "rough and tumble play", were not clearly operationalised, so the two observers recorded different tallies for the same children. This means our observation had low inter-rater reliability.

(Total for Question 8 = 6 marks)

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9 Harbinder is carrying out an experiment to see if there is a difference in the amount of time it takes mice to run through a maze.

Each mouse is given 10 practice runs of the maze. Half the mice are given a food pellet each time they complete a practice run successfully, and half the mice do not get a food pellet at the end of each successful run.

Harbinder then times how long it takes each mouse to complete the maze.

(a) State the independent variable (IV) of Harbinder's experiment.

(1)

Whether or not the mouse is given a food pellet after each successful practice run of the maze.

(b) State the dependent variable (DV) of Harbinder's experiment.

(1)

The time in seconds that each mouse takes to complete the maze after the 10 practice runs.

(c) Describe **one** ethical issue that needs to be considered when using animals in psychological research.

(2)

Researchers must consider whether any pain or distress caused to the animals is justified by the benefits of the research. For example, the mice should not be deprived of food for long periods to make the pellets rewarding, and the researcher must know how distressing a procedure is for that species and use the smallest number of animals possible.

(Total for Question 9 = 4 marks)

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10 Assess the use of dream analysis as a therapy.

(8)

Dream analysis is a psychodynamic therapy developed by Freud, who called dreams "the royal road to the unconscious". During sleep the ego's defence mechanisms are weakened, so repressed unconscious desires and conflicts can rise towards consciousness. Because these desires would be too disturbing, they are disguised by the dreamwork, using processes such as condensation, displacement and symbolisation. The manifest content is what the client remembers of the dream, and the latent content is its hidden meaning. The client recalls the dream, often keeping a dream diary, and the analyst interprets the symbols to uncover the latent content. Once the unconscious conflict is brought into conscious awareness, the client can gain insight and work through it, relieving their symptoms.

There is some evidence that dream analysis can be effective. Freud (1909) analysed the dreams and fantasies of Little Hans and interpreted his fear of horses as a displaced fear of his father, and Hans's phobia was resolved. This suggests that uncovering unconscious conflicts through dream analysis can help clients. Dream analysis also aims to treat the underlying cause of a problem rather than just the symptoms, so in theory the problem should not return in another form.

However, dream analysis is highly subjective. The meaning of symbols depends on the analyst's interpretation, so two analysts could interpret the same dream differently, which makes the therapy unreliable. The concept of the unconscious cannot be measured, so the theory behind the therapy is unfalsifiable and lacks scientific credibility. The evidence comes mainly from case studies such as Little Hans, which was largely carried out through letters from his father, a supporter of Freud, so it may be biased and the improvement may have happened naturally as Hans grew older.

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Dream analysis is also time-consuming and expensive, as it can take months or years of regular sessions to resolve unconscious issues, so it is not available to everyone. It may also be distressing, as clients may uncover painful repressed memories. Furthermore, the activation-synthesis theory of Hobson and McCarley (1977) suggests dreams are the brain making sense of random neural activity during REM sleep, so they may have no hidden meaning to analyse.

Overall, dream analysis may give some clients valuable insight into their problems, but because it is subjective, difficult to test scientifically and costly, it is limited as a therapy and is less well supported than behavioural therapies such as systematic desensitisation.

(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) Little Albert: Conditioned emotional reactions

Evaluate the classic study by Watson and Rayner (1920).

(12)

Watson and Rayner (1920) aimed to see whether an emotional response such as fear could be learned through classical conditioning in a young child, whether it would generalise to other objects and whether it would persist over time. The participant was Little Albert, a healthy and emotionally stable baby. At about 9 months old he was tested with a range of stimuli, such as a white rat, a rabbit, a dog, cotton wool and masks, and showed no fear of them. However, he did show fear and cried when a steel bar was struck loudly with a hammer behind his head, so the loud noise was an unconditioned stimulus producing fear.

At 11 months, Albert was shown the white rat (the neutral stimulus) and, as he reached to touch it, the bar was struck. After seven pairings of the rat and noise over two sessions, he cried and crawled away when shown the rat alone, so the rat had become a conditioned stimulus producing a conditioned fear response. His fear generalised to similar furry objects such as the rabbit, the dog, a fur coat and a Santa Claus mask. When he was tested about a month later, the fear was still present though less intense. Albert left the hospital before any deconditioning could take place.

A strength of the study is that it was well controlled. The researchers tested Albert's baseline reactions before conditioning, so they knew he was not already afraid of the rat, and they carefully controlled when the bar was struck in relation to the rat. They also filmed the procedure and recorded detailed notes. This means the procedure was standardised and could be

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replicated, and cause and effect could be inferred: the pairing of rat and noise produced the fear.

The study also has practical applications. It provided evidence that phobias can be learned through association, which led to therapies based on classical conditioning. If fears are learned, they can be unlearned, for example in systematic desensitisation where the feared object is paired with relaxation. Jones (1924) used a similar counterconditioning approach to remove a fear of rabbits in a boy called Peter, which supports the practical value of Watson and Rayner's findings.

However, the study was a single case of one baby, so the findings may not be generalisable to other children or adults, as Albert may have reacted differently from other infants. There is also debate about whether Albert was a fully healthy baby. Beck et al. (2009) suggested Albert may have been Douglas Merritte, and later researchers argued that this child may have had neurological problems. If so, his reactions may not reflect normal emotional responses, reducing the validity of the findings. Albert also sucked his thumb during some trials, which reduced his fear, so his responses were not always consistent.

The study is also seen as highly unethical by today's standards. Albert was deliberately caused distress and fear, he could not consent and there is no evidence that his mother was fully informed, and he was not protected from harm. Although Watson and Rayner argued that they intended to decondition his fear, he left before this could be done, so he may have been left with a lasting phobia. The study would not be allowed today under ethical guidelines.

In conclusion, Watson and Rayner's study was an important, well-controlled demonstration that emotional responses can be classically conditioned, and it led to effective therapies for phobias.

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However, as it involved only one possibly unhealthy child and broke ethical guidelines, its conclusions about how all human fears develop must be treated with caution.

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12 Nalu's father works night shifts. When his father comes home from work he stays up until 1 o'clock (1300h) in the afternoon, then he sleeps for four hours before getting up to go back to work. Nalu has just started a new job where he also has to work night shifts like his father.

In the morning, when he gets home from his night shift, Nalu finds it difficult to go to sleep.

To what extent can biological psychology and learning theories explain why Nalu finds it hard to go to sleep in the morning?

(16)

Biological psychology explains Nalu's problem through circadian rhythms. The sleep-wake cycle is a roughly 24-hour rhythm controlled by an endogenous pacemaker, the suprachiasmatic nucleus (SCN) in the hypothalamus, and set by exogenous zeitgebers, mainly light. When light falls, the SCN signals the pineal gland to release melatonin, which makes us sleepy, and when it is light melatonin secretion falls. Core body temperature also rises during the day, making us more alert.

This applies to Nalu because he has just started night shifts, so his body clock is still set to being awake in the day and asleep at night. When he gets home in the morning it is light, so his melatonin levels are falling and his body temperature is rising, making him more alert just when he is trying to sleep. As his internal clock has not yet reset to his new routine, he suffers insomnia, and seeing daylight on the journey home keeps resetting his rhythm towards day-time waking.

There is evidence supporting the biological explanation. Sharkey et al. (2001) found that taking melatonin orally helped night shift workers to sleep during the day, which suggests that a lack of melatonin is part of the reason shift workers struggle to sleep in the morning. Gandhi et al. (2015) found that melatonin promoted the start and length of sleep in zebrafish, supporting its role in sleep. However, this was an animal study, so it may not generalise to humans like Nalu. Bhatti et al. (2014) found that night shift workers who were morning types had better levels of melatonin when sleeping in the day than evening types, so the biological effect depends on

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individual differences. This suggests Nalu might find the switch harder or easier than his father depending on his chronotype, which the basic biological explanation does not fully account for.

Learning theories offer a different explanation. Social learning theory states that we learn by observing role models and imitating their behaviour, especially when the model is similar to us, such as the same sex, and of high status. We pay attention to the behaviour, retain it, reproduce it and are motivated to do so through vicarious reinforcement, when we see the model rewarded. Nalu's father is a same-sex role model who also works night shifts, and he stays up until 1 pm before sleeping for four hours. Nalu may have observed this and now imitates it, staying up in the morning instead of going straight to sleep, especially if he sees his father coping well with his job. Bandura, Ross and Ross (1961) found that children were more likely to imitate same-sex models, particularly boys imitating aggressive male models, which supports the idea that Nalu would copy his father.

Operant conditioning states that behaviour that is reinforced is likely to be repeated. Nalu may be positively reinforced for staying awake in the morning, for example by spending time with his father or friends, eating breakfast or watching television, so staying up becomes a habit. However, operant conditioning struggles to explain his problem fully, as Nalu finds it difficult to sleep even when he wants to, and he should be negatively reinforced for going to sleep as it removes his tiredness. Much of the evidence for learning theories also comes from controlled laboratory studies, often with children or animals, so it may lack validity when applied to adult sleeping behaviour in the real world.

Learning theories also cannot explain why Nalu actually feels alert rather than simply choosing to stay up, whereas the biological explanation explains the physical difficulty through melatonin and body temperature. On the other hand, the biological explanation is reductionist, as it ignores

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the influence of Nalu's family and social environment on when he goes to bed.

In conclusion, biological psychology provides the stronger explanation of why Nalu finds it hard to go to sleep, as his circadian rhythm and melatonin levels are not yet adjusted to night work, and this is supported by research. Learning theories can explain why he chooses to stay up, by copying his father or being reinforced, but they do less well at explaining the insomnia itself. The best explanation is interactionist, with a biological body clock that has not yet adjusted and learned habits that make it harder for it to reset.

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(Total for Question 12 = 16 marks)

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