1.3 Areas of knowledge: the natural and human sciences

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS natural sciences • human sciences • falsifiability • paradigm shift • provisional • replication

Objective

Study two **areas of knowledge**: the **natural sciences** and the **human sciences**: how they produce knowledge, why their claims are **provisional**, and the special problems of studying people.

You must be able to:

- explain the role of hypothesis, experiment and falsification
- explain why scientific knowledge is provisional
- explain paradigm shifts (Kuhn)
- explain why studying humans is harder than studying objects
- compare the methods of the two areas

1 Key knowledge and worked examples

■ Natural sciences

Scientists form **hypotheses**, test them with **observation** and **experiment**, and share results for **peer review**. Karl Popper: a scientific claim must be **falsifiable**: some observation could show it is wrong. Thomas Kuhn: science sometimes changes through **paradigm shifts** (e.g. from Newton's physics to Einstein's relativity for very high speeds and strong gravity). So scientific knowledge is **provisional**: the best current explanation, open to change.

■ Human sciences

Psychology, economics, sociology and anthropology study people, who **think**, **change** and **react** to being studied. Problems: the **observer effect** (people behave differently when watched); ethics limit experiments; results may depend on culture. The **replication crisis**: in a 2015 project, about 36 % of 100 published psychology results were replicated with statistically significant results.

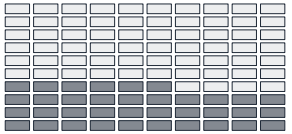
Worked comparison. A chemist can repeat an experiment with identical samples; a psychologist cannot find two identical people. So human sciences rely more on **statistics**, large samples and careful design.

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2 Practice

2.1 Explain what Popper meant by **falsifiability**. [2]

2.2 In a 2015 project, 100 psychology studies were repeated and about 36 gave statistically significant results again. Calculate the percentage that did **not**, and explain what this suggests about knowledge in the human sciences. [3]



2.3 Explain Kuhn's idea of a **paradigm shift**, with an example. [4]

2.4 Compare the methods of the natural and human sciences, and evaluate whether the human sciences are "less scientific". [6]

3 Exam-style questions

3.1 *(Essay-style.)* "In the natural sciences, the aim is certainty; in the human sciences, the aim is understanding." Discuss. [10]



3.2 Explain **two** ethical limits on producing knowledge in the human sciences. [5]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

a claim is scientific only if some possible observation could show it is false; e.g. “all swans are white” can be falsified by one black swan; “everything happens for a reason” cannot

2.2

$100 - 36 = \mathbf{64}\,\%$; many published results may depend on small samples, chance or publication bias; knowledge in the human sciences should be treated as provisional and checked by replication

2.3

a paradigm is the shared framework of theories and methods of a science; anomalies build up that the paradigm cannot explain; a new framework replaces it, changing what scientists see as problems and evidence; example, e.g. from an Earth-centred to a Sun-centred model; from Newton to Einstein

2.4

natural sciences: controlled experiments, repeatable conditions; human sciences: surveys, observation, statistics, natural experiments; problems in human sciences: observer effect, ethics, culture; natural sciences also have limits, e.g. cosmology cannot run experiments on the universe; “scientific” may mean method and openness to testing, not certainty; a reasoned judgement

3.1

Mark with the TOK markbands (out of 10): [9-10] excellent: clear, focused, convincing links, well-chosen examples, implications explored; [7-8] good: focused, mostly clear links, relevant examples; [5-6] satisfactory: some focus, links partly explained; [3-4] basic: limited links, description more than analysis; [1-2] rudimentary. Points that may be included: understanding of the claim; natural sciences: knowledge is provisional, not certain (Popper, Kuhn); example from the natural sciences; human sciences: interpretation and meaning matter, but they also seek prediction (economics, psychology); example from the human sciences; a conclusion: both seek reliable explanation; the claim draws too sharp a line

3.2

informed consent: participants must agree knowing the risks; example, e.g. no secret experiments on people; avoiding harm: some experiments cannot be done, e.g. raising children in isolation; so some questions are studied only indirectly; ethics committees decide what is allowed

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