Hampstead Tuition Centre
Small-group Maths, English & Science in Hampstead

Science Entry Assessment

Question paper

Year 9
placement screener

Name _____ Date _____ Score _____

Time: about 65 minutes. Hampstead Tuition Centre - Year 9 Science Entry Assessment (bridging KS3 to GCSE). Answer every question and show full working in all calculations, with correct units. A calculator is allowed. This paper is demanding and reaches toward GCSE-level reasoning: lead questions are on-level, later ones are multi-step. Method marks are awarded, so attempt every part. Use 'root 400' to mean a square root. Show your working where you can. Marks for each question are shown in brackets, like [2]. Total marks: **63**.

1 An atom of lithium has mass number 7 and atomic number 3. State (a) the number of protons, (b) the number of neutrons, and (c) the number of electrons in a neutral lithium atom. **[3]**

WORKING

Answer _____

CHEMISTRY: ATOMIC STRUCTURE

2 A student investigates the reactivity of metals by adding magnesium, zinc and copper to dilute hydrochloric acid. Magnesium fizzes vigorously, zinc fizzes slowly, copper does not react. (a) Place the three metals in order of reactivity, most reactive first. (b) Name the gas produced and give the test for it. (c) Write a word equation for the reaction of zinc with hydrochloric acid. **[4]**

WORKING

Answer _____

CHEMISTRY: REACTIVITY SERIES AND REACTIONS OF ACIDS

3 A 1500 kg car accelerates from rest to 20 m/s in 8 seconds. (a) Calculate its acceleration (state the equation). (b) Calculate the resultant force needed (F = ma). (c) Give the units for acceleration and force. **[4]**

WORKING

Answer _____

PHYSICS: ACCELERATION AND NEWTON'S SECOND LAW

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4 A gene for flower colour has a dominant allele R (red) and a recessive allele r (white). Two plants both with genotype Rr are crossed. (a) Write out the four offspring genotypes (the Punnett square). (b) State the ratio of red to white offspring. (c) Explain why a white-flowered plant must have the genotype rr. [4]

WORKING

Answer

BIOLOGY: GENETICS AND INHERITANCE

5 (a) Define an exothermic reaction and an endothermic reaction in terms of energy transfer to the surroundings. (b) A reaction causes the temperature of a solution to fall from 22 C to 16 C. State whether it is exothermic or endothermic and justify your answer. [4]

WORKING

Answer

CHEMISTRY: ENERGY CHANGES IN REACTIONS

6 Describe how a light ray behaves when it passes from air into a glass block. (a) Name what happens to the ray's direction and the correct term for it. (b) State which way the ray bends relative to the normal as it ENTERS the glass. (c) Explain in terms of speed why this happens. [4]

WORKING

Answer

PHYSICS: REFRACTION OF LIGHT

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7 The equation for aerobic respiration is: glucose + oxygen -> carbon dioxide + water (+ energy). (a) Name the cell structure where most aerobic respiration happens. (b) Write the word equation for ANAEROBIC respiration in human muscle cells. (c) Explain why anaerobic respiration releases less energy per glucose molecule than aerobic respiration. [4]

WORKING

Answer

BIOLOGY: AEROBIC AND ANAEROBIC RESPIRATION

8 A student measures the current through a fixed resistor at different voltages: 2 V -> 0.4 A; 4 V -> 0.8 A; 6 V -> 1.2 A. (a) State the relationship between voltage and current shown. (b) Calculate the resistance using R = V / I (use any one pair of values). (c) Predict the current when the voltage is 9 V. [4]

WORKING

Answer

PHYSICS: OHM'S LAW AND CIRCUIT DATA (REQUIRED PRACTICAL)

9 Explain how a vaccine protects a person from a disease. Put these stages in the correct order and explain each briefly: (i) memory cells remain; (ii) dead/weakened pathogen (antigen) is injected; (iii) white blood cells make antibodies; (iv) on later infection antibodies are made quickly. Why does this prevent illness the second time? [4]

WORKING

Answer

BIOLOGY: IMMUNITY AND VACCINATION

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10 A solution of an unknown salt is tested. (a) Name the apparatus used to measure exactly 25.0 cm³ of a solution accurately for a titration. (b) An acid is added to an alkali until neutral. Name a suitable indicator and state the colour change you would see at the end point when adding acid to alkali. (c) Give one reason why a precise measuring instrument is used rather than a measuring cylinder. [4]

WORKING

Answer

CHEMISTRY: TITRATION AND APPARATUS (REQUIRED PRACTICAL REASONING)

11 The periodic table arranges elements in groups and periods. (a) State what all elements in the same GROUP have in common about their electrons. (b) Group 1 metals get more reactive going down the group. Explain why, in terms of the outer electron. (c) Predict whether potassium (lower in Group 1) reacts more or less vigorously with water than sodium. [4]

WORKING

Answer

CHEMISTRY: PERIODIC TABLE AND GROUP 1 TRENDS (GCSE-STRETCH)

12 A weather balloon rises and the air pressure outside falls. (a) Explain, in terms of particles, why air pressure decreases as you go higher in the atmosphere. (b) The balloon expands as it rises. Explain why, linking the inside and outside pressure. [4]

WORKING

Answer

PHYSICS: GAS PRESSURE AND THE ATMOSPHERE (STRETCH)

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13 STRETCH. Copper oxide reacts with sulfuric acid to make copper sulfate and water. A student wants pure, dry copper sulfate crystals from this reaction. (a) Why is excess (more than enough) copper oxide added? (b) How is the leftover solid copper oxide then removed? (c) Describe how the dissolved copper sulfate is turned into dry crystals, naming the two key steps. [4]

WORKING

Answer

CHEMISTRY: PREPARING A SOLUBLE SALT (REQUIRED PRACTICAL REASONING)

14 STRETCH. A roller-coaster car of mass 500 kg is at the top of a track 20 m high and is momentarily stationary. (g = 10 N/kg.) (a) Calculate its gravitational potential energy at the top (GPE = m × g × h). (b) Assuming no energy is wasted, state its kinetic energy at the bottom and explain why. (c) Use KE = 1/2 × m × v² to calculate its speed at the bottom. Show all working. [4]

WORKING

Answer

PHYSICS: ENERGY CONSERVATION, GPE AND KE (MULTI-STEP CALCULATION)

15 STRETCH. Diamond and graphite are both made only of carbon atoms, yet diamond is extremely hard while graphite is soft and slippery and conducts electricity. Explain these differences using ideas about bonding and structure. [4]

WORKING

Answer

CHEMISTRY: GIANT COVALENT STRUCTURES AND PROPERTIES (GCSE-STRETCH)

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16 STRETCH. A student writes the balanced symbol equation for the complete combustion of methane as: CH4 + 2O2 -> CO2 + 2H2O. (a) Explain what 'balanced' means by referring to the number of atoms of each element. (b) Name the two products and state which one would turn limewater milky. (c) Explain in terms of energy why complete combustion is described as an exothermic reaction. [4]

WORKING

Answer

CHEMISTRY: BALANCED EQUATIONS AND COMBUSTION (GCSE-STRETCH)

End of assessment. Hand your paper back when you are finished. Well done!

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