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

Science Entry Assessment

Question paper

GCSE (Year 10)
placement screener

Name _____ Date _____ Score _____

Time: about 50 minutes. GCSE Higher-tier (Year 10) combined-science screener. Answer ALL questions. Show your working for every calculation and give units. Where a question says 'explain', describe the reasons, not just the facts. You may use a calculator. Marks are shown in brackets. This paper is deliberately demanding: aim to attempt every part. Show your working where you can. Marks for each question are shown in brackets, like [2]. Total marks: **62**.

1 An animal cell and a bacterial cell both contain ribosomes and a cell membrane. State TWO structures found in the bacterial cell that are NOT found in the animal cell, and ONE structure found in the animal cell that the bacterial cell does not have. **[3]**

WORKING

Answer _____

BIOLOGY: CELL STRUCTURE

2 A potato chip (cylinder) of mass 4.20 g is left in a concentrated salt solution. After 30 minutes its mass is 3.57 g. (a) Calculate the percentage change in mass. (b) Explain, in terms of water potential and the cell membrane, why the mass changed in this direction. **[4]**

WORKING

Answer _____

BIOLOGY: OSMOSIS / REQUIRED PRACTICAL

3 Define an exothermic reaction. Then state, with a reason, whether the reaction shown by this energy profile is exothermic or endothermic: the reactants sit at 250 kJ, the products sit at 120 kJ, and there is a peak of 410 kJ between them. **[3]**

WORKING

Answer _____

CHEMISTRY: ENERGY CHANGES

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4 Calculate the relative formula mass (Mr) of calcium nitrate, Ca(NO3)2. Then calculate the percentage by mass of nitrogen in the compound. (Relative atomic masses: Ca = 40, N = 14, O = 16.) [4]

WORKING

Answer _____

CHEMISTRY: QUANTITATIVE CHEMISTRY

5 A car of mass 1200 kg accelerates from rest to 18 m/s. (a) Calculate its kinetic energy at 18 m/s. (b) The car then brakes to a stop over a distance of 27 m. Assuming all the kinetic energy is transferred by the braking force, calculate the average braking force. [4]

WORKING

Answer _____

PHYSICS: ENERGY AND FORCES

6 Two students measure the resistance of a fixed resistor. They record current (I) and potential difference (V): at 2.0 V, I = 0.25 A; at 4.0 V, I = 0.50 A; at 6.0 V, I = 0.75 A. (a) Calculate the resistance. (b) State what these data tell you about whether the component is ohmic, and justify your answer using the data. [3]

WORKING

Answer _____

PHYSICS: ELECTRICITY / REQUIRED PRACTICAL

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7 Describe how you would test an unknown colourless solution to find out whether it contains a reducing sugar (e.g. glucose) AND whether it contains starch. Give the reagent and the positive result for each test. [4]

WORKING

Answer

BIOLOGY: FOOD TESTS / REQUIRED PRACTICAL

8 Sodium reacts with chlorine to form sodium chloride. (a) Describe what happens to the electrons when sodium and chlorine atoms form ions. (b) Explain why solid sodium chloride does not conduct electricity, but molten sodium chloride does. [4]

WORKING

Answer

CHEMISTRY: IONIC BONDING

9 A wave on a string has a frequency of 25 Hz and a wavelength of 0.12 m. (a) Calculate the wave speed. (b) The frequency is then doubled while the speed stays the same. State and explain what happens to the wavelength. [3]

WORKING

Answer

PHYSICS: WAVES

10 In a respiration investigation, a student claims 'aerobic respiration and anaerobic respiration both release the same amount of energy from glucose'. Explain why this statement is wrong, and write the word equation for anaerobic respiration in human muscle cells. [3]

WORKING

Answer

BIOLOGY: RESPIRATION

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11 A student investigates the rate of reaction between marble chips (calcium carbonate) and dilute hydrochloric acid by measuring the volume of gas produced over time. Describe TWO changes the student could make to INCREASE the rate, and for ONE of them explain the increase using collision theory. **[4]**

WORKING

Answer

CHEMISTRY: RATES OF REACTION

12 The half-life of a radioactive isotope is 6 hours. A sample initially contains 8.0×10^6 undecayed nuclei. (a) Calculate how many undecayed nuclei remain after 18 hours. (b) Explain why it is impossible to predict exactly when a single particular nucleus will decay. **[4]**

WORKING

Answer

PHYSICS: RADIOACTIVITY

13 Explain how the structure of a leaf is adapted for efficient photosynthesis. Refer to at least THREE different features and link each feature clearly to its function. **[4]**

WORKING

Answer

BIOLOGY: PHOTOSYNTHESIS / ADAPTATIONS

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14 Hydrogen peroxide decomposes: 2H2O2 -> 2H2O + O2. A 0.50 mol sample of hydrogen peroxide fully decomposes. (a) Calculate the number of moles of oxygen gas produced. (b) Calculate the volume of this oxygen gas at room temperature and pressure (molar volume = 24 dm³/mol). [3]

WORKING

Answer _____

CHEMISTRY: MOLES AND GAS VOLUMES

15 STRETCH. A student investigating photosynthesis places pondweed at different distances (d) from a lamp and counts oxygen bubbles per minute. The bubble rate falls sharply as d increases. (a) Explain why light intensity is proportional to 1/d², not to 1/d. (b) At very high light intensity the bubble rate stops rising even when the lamp is moved closer. Name TWO factors that could now be limiting the rate, and explain how you would change the experiment to identify which one it is. [4]

WORKING

Answer _____

BIOLOGY: LIMITING FACTORS / INVERSE-SQUARE LAW (STRETCH)

16 STRETCH. A 200 W immersion heater is used to heat 0.50 kg of water. The temperature rises from 20 C to 44 C in 5.0 minutes. (Specific heat capacity of water = 4200 J/kg C.) (a) Calculate the useful energy gained by the water. (b) Calculate the total electrical energy supplied. (c) Calculate the efficiency of the heater as a percentage and suggest where the 'missing' energy went. [4]

WORKING

Answer _____

PHYSICS: SPECIFIC HEAT / EFFICIENCY / DATA EVALUATION (STRETCH)

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17 STRETCH. Crude oil is separated by fractional distillation. (a) Explain, in terms of intermolecular forces and boiling point, why long-chain hydrocarbons are collected near the bottom of the column and short-chain hydrocarbons near the top. (b) Long-chain molecules are cracked. Write a balanced symbol equation for the cracking of decane, $C_{10}H_{22}$, into octane (C_8H_{18}) and ONE other product, and name that product's use. **[4]**

WORKING

Answer

CHEMISTRY: CRUDE OIL AND CRACKING (STRETCH)

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

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