2021 SAASTA SCIENCE OLYMPIAD, GRADES 7-9 – MEMORANDUM

Question No.	Answer	Explanation
1	A	Oxygen is a gas, aluminum a solid and helium a gas at room temperature.
2	B	Mass depends only on amount of matter. Heating will increase the kinetic energy of particles, causing them to move faster and the object will expand.
3	B	There are no components between the connection points of V_3 and V_4 that uses or supplies energy, therefore they measure the same difference in potential energy.
4	A	In water, the vapour pressure reaches standard atmospheric pressure at 100 °C. In areas above sea level, such as Gauteng, where the atmospheric pressure is less than standard atmospheric pressure, the boiling point will be lower than 100 °C.
5	C	In a circuit containing only a parallel combination of resistors, the voltage across each resistor within the parallel combination is the same as the voltage across the battery. This does not change if resistors are added to or removed from the parallel combination.
6	D	In order to keep up with the earth's rotation around its own axis at such great distance and to overcome gravity, satellites must move at very high speed.
7	D	Named after the discoverer, prof. Peter Higgs, a British theoretical physicist.
8	A	Metal oxides are bases.
9	B	At 65 °C the temperature stays constant as energy is used to change the state (phase) of the matter, indicating that the unknown substance boils at 65 °C
10	C	At 48 °C the temperature stays constant. Some molecules have changed to the gas phase while others are still in the liquid phase.
11	B	Dmitri Mendeleev is a Russian chemist who was dedicated to find a way of better organizing the subject.
12	C	Substances in the mixture travels at different speeds on the material and separates, sometimes showing different colours.
13	C	Both N and O will be gasses at -20 °C, but only O will be a liquid at -150 °C.
14	B	Copper(II) chloride solution can be broken down to copper metal and chlorine gas. Copper is deposited on one electrode (cathode) and chlorine gas is formed as bubbles at the other electrode (anode)
15	B	Positive and negative charges attract. Both Q_1 and Q_2 are positively charged and will attract charge Q_3, therefore pulling it to the left.
16	D	The net charge on the three objects is positive. When they touch negative electrons will be transferred from M to the rod and from N to M until all three have equal positive charge.
17	A	B and C consist of one type of atom. A and D is compounds.
18	A	Secondary & tertiary consumers are at the top of the food chain.
19	D	The weight of an object is the gravitational FORCE exerted on it by the Earth. The basic SI unit of all Forces is the Newton. The basic SI unit of mass (amount of matter a substance consist of) is the kilogram

20	A	When a liquid is heated some molecules evaporates into the gas phase.
21	B	Shorter, thicker wires have less resistance.
22	C	Charges must balance. (2 x +3) cancels (3 x -2)
23	A	N 78%, O 21%, CO_2 & other 2%
24	A	Electrons are found outside the nucleus, while protons and neutrons are inside the nucleus.
25	C	Double the amount of waves with halve the height.
26	C	Resistors in parallel split the current, not the voltage.
27	A	High temperature and low humidity enhances evaporation of water.
28	D	Lime is a base and will gradually increase the pH to above 7.
29	A	Only negative electrons can be transferred. Anions are negatively charged.
30	D	The pre-fixes di- and tri- are only used in names of molecules consisting of non-metals.
31	B	Metals (left) forms cations, non-metals (right) forms anions.
32	C	30 minutes = 0,5 hours $speed\ (v) = \frac{distance\ (d)}{time\ (t)} = \frac{60\ km}{0{,}5\ h}$ = 120 km/h
33	C	Animal cells do not have a cell wall or chloroplasts for photosynthesis.
34	C	Energy is released when glucose reacts with oxygen to form carbon dioxide and water. (aerobic means “in the presence of oxygen”).
35	A	Glucose is increased to provide more energy to cells through respiration.
36	B	Illustration must correspond with formulae.
37	D	Both Q and S has molecules consisting of 2 identical atoms.
38	C	UV light has highest energy and frequency.
39	B	Water enters via roots through xylem.
40	B	Data is transferred as pulses of Infra-red light
41	A	Detergent containing basic ammonia
42	D	Volume (V) = l x b x h = 4.0 cm x 1.0 cm x 2.0 cm = 8.0 cm^3 $Density\ (D) = \frac{mass\ (m)}{volume\ (V)}$ $4.0\frac{g}{cm^3} = \frac{mass\ (g)}{8.0\ cm^3}$ $mass = 4.0\frac{g}{cm^3}\ x\ 8.0\ cm^3 = 32.0\ g$
43	C	Angle between normal and refracted ray
44	D	Increase in temperature or light intensity will increase the rate of transpiration, but humidity increase will decrease the rate. At high humidity the air is more saturated with water vapour and evaporation slows down.When is temperature increased, the water molecules move faster, and the rate of evaporation from stomata is therefore much faster, causing an increase in the rate of transpiration of the plant.At high light intensity, the rate of photosynthesis increases. As photosynthesis increases, the amount of stored glucose in the guard cells increases. This lowers the water potential of the leaf (i.e. the contents of the leaf are less dilute). As the water potential decreases, more water enters the guard cells making them more turgid. The turgor pressure of the

		guard cells leads to an opening up of stomata, causing an increase in the rate of transpiration of the plant.
45	D	Found to the right on the Periodic Table.
46	D	Current in series circuit is the same everywhere.
47	B	All organic fuels from crude oil consist of Carbon. Chlorine is used to purify drinking water. Copper is a cheap conductor of electricity. Iodine kills bacteria.
48	B	$Actual\ size = \frac{30\ mm}{1000} = 0{,}03\ mm$
49	C	1. The number of protons in the nucleus of the atom is equal to the atomic number (Z). In this question we have number of protons = 17 2. The number of electrons in a neutral atom is equal to the number of protons. Therefore, in this question, number of electrons = 17 3. The mass number of the atom (M) is equal to the sum of the number of protons and neutrons in the nucleus. In this question mass number = 38 4. The number of neutrons is equal to the difference between the mass number of the atom (M) and the atomic number (Z). Hence, number of neutrons = 35 - 17 = 18.
50	C	Speed is represented on the y-axis. A horizontal line means no change in speed.
51	A	Mass depends on amount of matter and does not change. Weight is influence by gravity (g-force) and is larger on earth than on the moon.
52	C	Oxygen exist and react as a diatomic molecule, O_2 (if not bonded to another element). The correct formula for magnesium oxide is MgO (ratio 1:1). This eliminates options A and B. Conservation of atoms: Chemical equations must be written as balanced chemical equations. The total number and type of atoms of the reactants is the same as in the products. This eliminates option D and proves option C to be correct. Conservation of atoms lead to the conservation of matter (mass). For option C (Adding molecular mass of each atom on each side of the equation): Total mass of reactants:(2 x 24,3) + (2 x 16,0) = 80,6 g. Total mass of products: 2 x 40,3 = 80,6 g. For option D the mass of reactants vs products will differ.
53	C	An ovum is the largest and the sperm the smallest cell in the human body. Sperm is mobile while the ovum is unable to move. One ovum is produced monthly in the female body while several million sperm are produced daily
54	C	Brass is a mixture (alloy) of copper and zinc. Air consist of a mixture of gasses. Copper is a pure element. Iron oxide is a compound of Iron and oxygen.
55	B	$Cost = \frac{1200}{1000}\ x\ 2\ x\ 1{,}5 = R\ 3.60$
56	C	Chlorine is disinfectant, and is added to public water supplies to kill disease-causing pathogens, such as bacteria, viruses etc.
57	A	Low temperature and high pressure are required to liquefy gas to liquid. There is a lot of space between the particles of a gas. On applying high pressure, the particles of gas move and get so close that they start attracting each other sufficiently forming a liquid. When gas is compressed too much, heat is produced, so it is necessary to cool it.

		Cooling lowers the temperature of compressed gas and helps in liquefying it, Hence, a gas can be liquefied by applying high pressure and lowering the temperature (cooling).
58	D	Jupiter, Saturn, Uranus, and Neptune have rings. Saturn's rings are bright, wide, and colourful.
59	A	The independent variable is the factor that is manipulated (changed) during the experiment. In this case increasing the amount of cells increases the potential difference.
60	B	The dependent variable is the factor that is measured during the experiment. In this case, the current.
61	D	V and I increases proportionally. They are directly proportional to each other. The graph must then be a straight line through the origin.
62	D	Filtration: Filtrate runs through the filter and the residue stays behind.
63	A	Satellites are faster when closer to the earth because gravity is stronger. Stronger gravity means that the satellite needs to travel further in a fixed time to maintain its altitude. Gravity weakens with altitude; hence, the satellites need to move more slowly.
64	D	Haemoglobin is a protein in red blood cells that carries oxygen to your body's organs and transports carbon dioxide back to your lungs. If your haemoglobin level is lower than normal, it means you have a low red blood cell count. (anemia)
65	C	Water moves from lower solute concentration to where solute concentration is higher ... from the beaker into the potato cells and through to the concentrated sugar solution.
66	A	V of rock = V total - V water = 30 - 20 = 10 ml
67	C	All are gasses. Only Argon is in group 18 (VIII) on the periodic table, known as the noble gasses.
68	A	Carbon is a non-metal that can conduct electricity. Graphite (inside of a pencil) consist of C-atoms.
69	D	Wire T short circuits (bypass) bulb X. The total resistance in the circuit decrease and the current increases.
70	D	All the products except glass are carbon based by-products of crude oil.
71	A	Alexander Fleming was a Scottish physician-scientist who was recognised for discovering penicillin. The simple discovery and use of the antibiotic agent has saved millions of lives.
72	D	Table salt (NaCl) consist of only sodium ions and chlorine ions
73	D	R_2 is connected in parallel with R_4 and R_5. R_1 is in the series part of the circuit.
74	B	Galileo was an Italian astronomer, physicist, mathematician, philosopher and inventor. Among his inventions were telescopes, a compass and a thermometer.
75	A	Salts consist of positive cations (metal ions) and negative anions (non-metal) packed together in a crystal structure.
76	D	The four newly discovered elements: nihonium (atomic number 113), moscovium (atomic number 115), tennessine (atomic number 117), and oganesson (atomic number 118).
77	D	Vitamin K is used by the body to help blood clot.
78	A	An object has potential energy because of its position above its lowest point. It has kinetic energy when it is moving. At A and – A, the pendulum has only potential energy. At B it has only kinetic energy.

79	C	Distance for 1st 60 min = 45 x 60/60 = 45 km Distance for last 20 min = 70 x 60/60 = 25 km Total distance = 75 km
80	C	The angle of incidence - between normal and incident ray. The angle of emergence - between normal and emerging ray. The angle of deviation - between incident and emerging ray.
81	A	Oil, ice and alcohol are less dense than water and will tend to float on top of water.
82	C	Aluminum is ideal for aircraft manufacture because it is lightweight and strong. Furthermore, aluminum has a high resistance to corrosion.
83	C	Because CO_2 is 1.67 times denser than air, it can be poured from one beaker to another. Although the gas is invisible, the beaker can be placed on a scale ... the reading will increase as the gas is poured over.
84	B	The average normal body temperature is generally accepted as 37°C. In science, 25 °C are used as room temperature for calculations.
85	D	Styrofoam is not recyclable because not enough material is left after breaking it down to make new products.
86	C	All are South African inventions except the telephone, discovered by Alexander Bell, an American Scientist.
87	C	Volume of cube = l x b x h = 1 cm x 1 cm x 1 cm = 1 cm3
88	B	A weight increase of 2 N results in a 4 cm increase in length ... therefore a further increase of 5 N will result in a length increase of 10 cm.
89	D	Density of X = m/V = 30/20 = 1.5 $g.cm^{-3}$ ... Larger than density of water (1 $g.cm^{-3}$). Density of W = 8/10 = 0.8 $g.cm^{-3}$ Density of Z = 20/40 = 0.5 $g.cm^{-3}$ Density of Y = 27/30 = 0.9 $g.cm^{-3}$
90	A	Order of EM-waves from lower to higher energy - Radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays and gamma rays.
91	A	An acid reacts with metals to form a salt and hydrogen gas. Hydrogen gas explodes with a popping sound when it burns in oxygen.
92	D	Black holes can form when the center of a massive star collapses in upon itself. This collapse also causes a supernova, or an exploding star, that blasts part of the star into space.
93	D	The amount atoms of each element that reacts must be the same on the side of the products.
94	D	The shorts cannot be white. A white short reflects all colours of light and would appear red in red light.
95	C	Only plants have chloroplasts for photosynthesis. Both plants and animals have respiration in mitochondria of cells to release energy from glucose.
96	A	The independent variable is the factor that is manipulated (changed) during the experiment. In this case increasing the amount of bulbs.
97	B	The dependent variable is the factor that is measured during the experiment. In this case, the brightness of the bulbs.
98	C	In order to for the investigation to be fair, only one variable (independent) at a time must be changed. All others must be kept constant. In this experiment the number of cells is a constant variable.

99	A	If more bulbs are added in series, the total resistance will increase, the current will decrease and the bulbs would be dimmer.
100	C	The balloon is negatively charged after contact with the jersey. When in contact with the wall, the negative charges in the balloon will repel the negative charges (electrons) in the wall.