## National Science Olympiad Competition – 2023 Provincial Level 10 / 11 Grades

Time : one hour and 30 minutes

Nai	me: School:				
	Answer all the questions.				
	* For multiple choice question, underline the correct or t	the most appropriate answer.			
	y on the space provided.				
01.	In the following answers, there are four SI units that have spectrum common property unlike the other. What is the unit which is different (a). J (b). A (c). V	ial names. Three of them have a ent from the others? (d). N			
02.	Electric current is supplied to the resisters shown in the figure, from a battery, the electromotive force of which is 45 V and the internal resistance is 1 $\Omega$ . What is the voltage difference across each resistor X, Y and Z respectively?	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			

(a).	15 V, 20 V and 10 V	(b).	10 V, 20 V and 15 V
(c).	9 V, 13.5 V and 18 V	(d).	9 V, 18 V and 13.5 V

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03. Masses of two spheres A and B, which are positioned at the same height and same horizontal level are 2m and m respectively. Sphere A of the mass of 2m is released to fall vertically down under the gravitation. Sphere B of the mass of m is given a velocity v towards the horizontal direction. What is the true statement below, about the motion of the spheres?

- (a). Sphere A touches the ground first. (b). Sphere B touches the ground first.
- (c). Both the spheres touch the ground at the same time.
- (d). Both the spheres reach the same point on the ground.
- 04. Tensile strength of steel is greater than that of concrete. Compressive strength of concrete is greater than that of steel. Steel wires are embedded in concrete to reinforce them. Accordingly what concrete slab shown below, is more strong and stable?



- 05. What are the two latitudes of Earth, on which the sun comes to the zenith only once a year?
  - (a). Tropic of cancer and tropic of capricorn.
- (b). Antarctic circle and equator.
- (c). Tropic of capricorn and equator. (d).
- (d). Tropic of cancer and antarctic circle.
- 06. Following phenomena occur in a certain stratum of the atmosphere.
  - \* Temperature increases with the increase of height.
  - \* Building up and breaking down of ozone molecules occur.
  - What is this stratum of atmosphere?
  - (a). Troposphere. (b). Stratosphere. (c). Mesosphere. (d). Thermosphere.
- 07. What is the most stable position for the flower pot, shown in the following figures?



- 08. Some statements about a building are given below.
  - (A) Outer walls are colour washed green.
  - (B) Rain water that falls on the roof is harvested and used for washing purposes.
  - (C) Electricity for the building is supplied by solar panels fitted on the roof.

What statements above can be used to consider this building as a green building?

- (a). Only (A) and (B). (b). Only (A) and (C).
- (c). Only (B) and (C). (d). All (A), (B) and (C).
- 09. Following are four graphs showing the variation of current flowing through four electric conductors P, Q, R and S, versus the potential difference applied across them.

Out of them what is the ohmic conductor (conductor that follows Ohm's law) having the highest resistance?

(a) P (b) Q (c) R (d) S



10. A ball is released from a certain height on to a rigid horizontal surface. After total elastic collision on the surface, the ball bounced back to the same height. Out of the following what is the velocity-time graph that shows this motion of the ball.



11. A light strip with two weights P and Q is balanced on a knife edge as shown in the figure below. There are three statements below on what can be done to keep the strip balanced, when the water container is raised up and weight Q is dipped in water. (X) – Weight P should be moved towards the knife edge. Water (Y) – Weight P should be moved away from the knife edge. container (Z) – Weight P should be decreased appropriately. What statement/s above is / are true? (a) Only (X). (b) Only (Y). (c) Only (X) and (Z). (d) Only (Y) and (Z). 12. What is the human organ that acts as an endocrine gland as well as an exocrine gland? (a). Pituitary. (b). Pancreas. (c). Thyroid. (d). Adrenals. 13. Energy changes of two chemical reactions are given below.  $A + B \rightarrow C + D$ ;  $\Delta H = +3400 \text{ kJ mol}^{-1}$  $C + D \rightarrow E + F$ ;  $\Delta H = -5300 \text{ kJ mol}^{-1}$ Accordingly what can be the energy change when the following reaction occurs?  $A + B \rightarrow E + F; \Delta H = ?$ (a). Release 1 900 kJ mol<sup>-1</sup>. (b). Absorb 1 900 kJ mol<sup>-1</sup>. (c). Release 8 900 kJ mol<sup>-1</sup>. (d). Absorb 8 900 kJ mol<sup>-1</sup>. 14. If a carrier female and a healthy male for haemophilia were married and have children, what is the probability of having diseased females? (a)  $\frac{1}{4}$ (b)  $\frac{1}{3}$ (c)  $\frac{1}{2}$ (d) 0 15. What is the type of human cells that do not contain DNA? (a) Smooth muscle cells. (b) White blood cells. (c) Red blood cells. (d) Cardiac muscle cells. 16. Why are algae not included in Kingdom Plantae? (a). Because most of them do not have chloroplasts. (b). Because their cells are not differentiated into tissues. (c). Because they are not autotrophs. (d). Because they do not have organized nuclei. 17. Out of those given below, what is not a difference between the fishes of Chondrichthyes and Osteichthyes?

	Chondrichthyes	Osteichthyes
(a)	Tail fin is heterocercal.	Tail fin is homocercal.
(b)	Gill slits are not covered by an operculum.	Gill slits are covered by an operculum.
(c)	Have a cartilaginous skeleton.	Have a bony skeleton.
(d)	Do not show bilateral symmetry.	Show bilateral symmetry.

18. What is the tissue of flowering plants, given below, the cells of which have mitochondria?					have the largest number of
	(a). Xylem.	(b). Phloem.	(c).	Meristem.	(d). Sclerenchyma.
19.	19. When gastric juice extracted out from the stomach was added to a sample of lime stone in a a gas evolved. What is the causal constituent in the gastric juice for the above observation an evolved?				
	(a). Pepsin and carbon	dioxide.	(b).	Hydrogen ions and	carbon dioxide.
	(c). Pepsin and ammor	nia.	(d).	Hydrogen ions and	water vapour.
20.	There are four factors that affect the size of population of an organic species in an ecosystem. Out of those factors, what can be practically addressed to stabilize the global human population?				
	(a). Birth rate.	(b). Death rate.	(c).	Immigrations.	(d). Emigrations.
21.	Out of those given belo acid rains?	ow, what is the gas that ac	ets as	a greenhouse gas as	well as a gas that causes
	(a) $CO_2$	(b) SO <sub>2</sub>	(c)	CH <sub>4</sub>	(d) CFCs
22.	What is not a character	istic of invasive alien spe	cies (	(IAS), out of those gi	ven below?
	(a) High dispersal abi	lity.	(b)	Ability to adapt to n	new conditions.
	(c) Survival on only li	mited food types.	(d)	Rapid reproduction.	
23.	What is the intensive p	roperty of matter given b	elowʻ	?	
	(a). Density.	(b). Mass.	(c).	Volume.	(d). Weight.
24.	Out of those given belo (a). PbCl <sub>2</sub>	w, what is the compound (b). PbSO <sub>4</sub>	l solu (c).	ble in water? PbCO <sub>3</sub>	(d). Pb(NO <sub>3</sub> ) <sub>2</sub>
25. Out of the following, what is the answer containing true statements on gamma ( $\gamma$ ) electromagnetic spectrum?					on gamma $(\gamma)$ rays in the
	(a). Shortest wave leng	th maximum frequency,	prop	agation even inrough	a particulate medium
	(c). Shortest wave leng	gth, maximum frequency,	prop	agation even through	n vacuum.
	(d). Longest wave leng	gth, minimum frequency,	prop	agation only through	a particulate medium.
26.	What is the volume of $0.1 \text{ mol dm}^{-3} \text{H}_2\text{SO}_4$ so	of concentrated $H_2SO_4$ blution?	of 10	0 mol dm <sup>-3</sup> necessar	ry to prepare 250 cm <sup>3</sup> of
	(a). $0.25 \text{ cm}^3$	(b). $2.5 \text{ cm}^3$	(c).	$25 \text{ cm}^3$	(d). $250 \text{ cm}^3$
27.	Figure given shows ho	w a conducting rod is p	ositic	oned	
	instance mentioned bel	ow, that an electromotive	at 1s e forc	the ce is	N
	(a). When the rod is mo	oved horizontally left.			
	(b). When the rod is mo	oved horizontally right.			
	(c). When the horizonta	I rod is moved vertically	up.	to the meanet	
	(u). when the norizonta	n ioù is moveu norizonta	iiy in	to the magnet.	, , ,

- \* Write the answers for questions 28 to 35 on the dotted line given.
- 28. Middle part of the human sperms contain a large number of mitochondria. Mention the importance of this.

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- 29. Human testes are located in a scrotum out side the body. What is the importance of this?
- 30. Human red blood cells do not have nuclei. Give two reasons for this.
  (i).
  (ii).
- 31. Though a body builder has well developed muscles, this characteristic is not inherited by his offsprings. Briefly give reasons for this.

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32. Figure below shows two convex lenses used to prepare a compound light microscope. Focus of objective lens is F<sub>o</sub> and focus of eye-piece lens is F<sub>e</sub>. How two light rays emitted from the object O, kept in front of objective lens, incede on the eye-piece lens after refracting is shown in the figure. Magnified image of O, made by the objective, acts as the object for eye-piece and a further magnified image is formed.



- (i) Complete the above ray diagram to show how the image is formed by the two light rays inceded on the eye-piece, after refracting through it.
- (ii) Here, what is the range of the objective lens, that the object O, should be kept? What is the reason for that?

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(iii) What is the nature of the final image with respect to the object O?

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- 33. Find the relative molecular mass and the molar mass of ammonium dihydrogen phosphate.
  - (P = 31, N = 14, O = 16, H = 1)
  - (i). Relative molecular mass:
  - (ii). Molar mass: .....
- 34. Calculate the mass percentage of nitrogen in ammonium sulphate.
  (S = 32, N = 14, O = 16, H = 1)
- 35. A labourer working in a building construction site, throws bricks to reach the hands of another labourer position at a vertical height of 2 m from him. Mass of a brick is 4 kg. He throws 30 bricks per minute.
  - (a). What should be the potential energy given to the bricks in one minute, to throw them to the height of 2 m? ( $g = 10 \text{ m s}^{-2}$ )

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(b). If the velocity of a brick is 2 m s<sup>-1</sup>, when it reaches the labourer at the higher level, calculate the percentage efficiency of the labourer on the ground, with relation to the work done by him.

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