Competition for General Science Knowledge 2022

High School Level

Tuesday 9th August 2022

1st round answer

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30 questions for 6 Subjects

1. Which of the following quantum number list could represent the valence electrons of transition metal ion in $[PdCl_4]^{2-}$?

	n	l	m_l	m_s
A)	4	3	0	½
B)	4	1	-2	½
C)	4	2	-2	-½
D)	5	0	0	½

Answer C

2. Which redox reaction is the **non-spontaneous reaction**?

Half-cell reaction	E° (V)
$Ce^{4+} + e^- \rightarrow Ce^{3+}$	+1.45
$Fe^{3+} + 3e^- \rightarrow Fe^{2+}$	+0.77
$Cu^{2+} + 2e^- \rightarrow Cu$	+0.34
$I_2 + 2e^- \rightarrow 2I^-$	+0.62
$O_2 + 2H^+ + 2e^- \rightarrow H_2O_2$	+0.68
$Br_2 + 2e^- \rightarrow 2Br^-$	+1.07

A) $2Fe^{3+} + H_2O_2 \rightarrow 2Fe^{2+} + O_2 + 2H^+$

B) $Cu^{2+} + 2I^- \rightarrow Cu + I_2$

C) $Ce^{4+} + Fe^{2+} \rightarrow Ce^{3+} + Fe^{3+}$

D) $2I^- + Br_2 \rightarrow I_2 + 2Br^-$

Answer B

3. Which statement about products from natural gas is correct?

A) CNG is the same as NGV

B) LPG is liquid and has pentane and butane as main components.

C) CNG is liquid and has methane as a main component.

D) LNG is gas and has methane as a main component.

Answer A

4. 50 mL of 0.130 M aqueous HCl solution is added to 50 mL of 0.130 M aqueous $Ba(OH)_2$ solution. Which reagent is in excess, if any, and what is its molar concentration in the final solution mixture?

$$2HCl + Ba(OH)_2 \longrightarrow BaCl_2 + 2H_2O$$

A) The solution is neutral; no reagent is in excess.

B) HCl is in excess; 0.0650 M.

C) HCl is in excess; 0.0325M.

D) $Ba(OH)_2$ is in excess: 0.0325 M.

Answer D

5. Consider the reaction: C (s) + O_2 (g) -> CO_2 (g)

Which of the following statements are **correct**?

(1) An increase in volume will bring reaction to go backward.

(2) A decrease in pressure results in an increase of C and O_2 concentration.

(3) An increase in pressure results in a decrease of CO_2 concentration.

(4) An increase in pressure will bring reaction to go forward.

(5) A change in pressure has no effect to this reaction.

(6) A change in volume has no effect to this reaction.

A) (1), (2), (3)

B) (1), (2), (3), (4)

C) (2), (3), (4)

D) (5), (6)

Answer D

6. Which cell is not microorganism?

A) Plants
B) Algae
C) Protozoa
D) Fungi

Answer A

7. Which is the most relevant to “Protein translation”

A) TATA box
B) Shine-Dalgarno sequence
C) Chromosomal origin (oriC)
D) Central Dogma

Answer B

8. Which of the following is a type of nucleic acid for SARS-CoV-2?

A) Single stranded DNA viruses
B) Double stranded RNA viruses
C) Positive sense single stranded RNA viruses
D) Negative sense single stranded RNA viruses

Answer C

9. What is simple fruit and aggregate fruit, respectively?

A) Lychee & Rambutan
B) Rambutan & Sugar-apple
C) Strawberry & Lychee
D) Rambutan & Durian

Answer B

10. Which one is match with “Active immunization”?

A) Snake antivenom
B) Serum
C) MMR vaccine
D) Plasma

Answer C

11. A bicycle tire has a pressure of 8.00 × 105 N/m^2 at a temperature of 37.0 °C and contains 2.00 L of gas. How many molecules remain after the gas is released if you let out an amount of air that has a volume of 100 cm^3 at atmospheric pressure? Assume tire temperature and volume remain constant.

A) 3.70×10^{23} molecules
B) B) 3.72×10^{23} molecules
C) 3.74×10^{23} molecules
D) 3.76×10^{23} molecules

Answer B

12. Two point of charges are brought closer together, increasing the force between them by a factor of 36. By what factor was their separation decrease?

A) 3
B) B) 6
C) 12
D) 18

Answer B

13. A proton moves at 8.00×10^7 m/s perpendicular to a magnetic field. The field causes the proton to travel in a circular path of radius 0.800 m. If we put an electron in this path instead. What would be the speed of this electron?

A) 1.27×10^{11} m/s
B) 1.37×10^{11} m/s
C) 1.47×10^{11} m/s
D) 1.57×10^{11} m/s

Answer C

14. How long must a flute be in order to have a fundamental frequency of middle C at 262 Hz on a day when air temperature is 30 °C ? The flute is open at both ends.

A) 33.3 cm

B) B) 44.4 cm

C) 55.5 cm

D) 66.6 cm

Answer D

15. What is the energy level for a hydrogen atom if 0.850 eV of energy can ionize it?

A) 2

B) B) 4

C) 6

D) 8

Answer B

16. Which of the equations has $\sqrt{3}+1$ as one of its roots?

A) A^2-2A+2

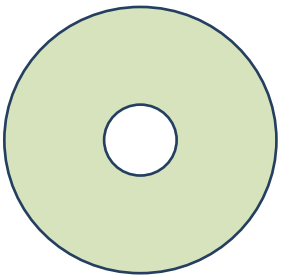
B) A^2+2A-2

C) A^2-2A-2

D) A^2+2A+2

Answer C

17. If the area of the shaded region as shown in the figure is 8 times the area of the smaller circular region, then the circumference of the larger circle is how many times the circumference of the smaller circle?



A) 4
B) $2\sqrt{3}$
C) 3
D) $2\sqrt{2}$

Answer C

18. Which of the following is **not** a factor of $p-r$, where $p=3^8$ and $r=2^8$?

A) 97
B) 65
C) 35
D) 13

Answer C

19. The interior of a rectangular carton is designed by a certain manufacturer to have a volume of x cubic feet and a ratio of length to width to height of 1 : 2 : 6. In terms of x, which of the following equals the width of the carton, in feet?

A) $\sqrt[3]{x}$

B) $\sqrt[3]{\frac{2x}{3}}$

C) $\sqrt[3]{\frac{3x}{2}}$

D) $\frac{2}{3}\sqrt[3]{x}$

Answer B

20. What number is 72 more than three-fourths of itself?

A) 144

B) 162

C) 216

D) 288

Answer D

21. Neera wants to travel abroad. Which application should Neera use while traveling?

A. Google Sites

B. Google Maps

C. Google Jamboard

D. Google Drive

Answer B

22. Given X=5 and Y=12, which of the following statements is correct?

A. X>=Y equals true

B. (X+Y*5) %X equals 1

C. (X+Y) %X equals 1

D. Y%X is equal to 2

Answer D

23. "...Whether the conditions are true or not, every command will always be executed 1 time..."

Which command do as the above statement?

A. if-else

B. while

C. do while

D. switch case

Answer C

24. Which of the following results is different from the others?

A. 2+5*(2*2+1)-2

B. 2+(5*2*2)+1-2

C. 2+5*2*2+1-2

D. 2+5*2*2+(1-2)

Answer A

25. "Hirun buys a new mobile phone for Fa-Rung to replace the old one by using the same phone number of Fa-Rung that has been registered." From this message, which of the following statements is correct according to the Personal Data Protection Act 2019?

A. Hiran is Data Subject.

B. Fa-Rung is Data Controller

C. Hiran can suspend Fa-Rung's phone number.

D. The mobile phone network operator company issues a service invoice specifying the name Fa-Rung as the customer's name.

Answer D

26. Consider the following back-to-back stem plots comparing car battery lives (in months) of samples of two popular brands.

	3	7
7	4	23488
32	5	14567899
8754	6	34668
965330	7	6
6543331	8	

Which of the following are true statements?

I. The distributions have the same median.

II. The distributions have the same mean.

III. The distributions have the same range.

IV. The distributions have the same standard deviation.

A. I

B. II

C. III

D. IV

Answer C

Questions 27 to 28: A survey asked people how often they exceed speed limits. The data are then categorized into the following contingency table of counts showing the relationship between age group and response.

Age	Exceed Limit if Possible?		
	Always	Not Always	Total
Under 30	100	100	200
Over 30	40	160	200
Total	140	260	400

27. Among people with age over 30, what's the "risk" of always exceeding the speed limit?

A. 0.20
B. 0.40
C. 0.33
D. 0.50

Answer A

28 Among people with age under 30 what are the odds that they always exceed the speed limit?

A. 1 to 2
B. 1 to 1
C. 2 to 1
D. 50%

Answer B

29. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

A. $\frac{1}{2}$

B. $\frac{2}{5}$

C. $\frac{8}{15}$

D. $\frac{9}{20}$

Answer D

30. Age (years) of employees are as follows:

23 23 25 25 25 28 29 32 33 35

36 36 37 38 40

How is the 3rd quartile different from the 25th percentile?

A. 11

B. 25

C. 32

D 36

Answer A

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