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MATHS/SCIENCE

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**PAST QUESTION +
ANSWERS + GUIDE**

MSc. & Phd

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1. Which among the following oxides cause the Acid rain ?

- [A] Carbon monoxide and carbon dioxide
- [B] Nitrous oxide and sulphur dioxide
- [C] Carbon dioxide and nitrous oxide
- [D] Sulphur dioxide and carbon monoxide

Answer: B [Nitrous oxide and sulphur dioxide]

2. Which among the following is a definition of Hematocrit?

- [A] proportion of blood volume that is occupied by red blood cells
- [B] proportion of blood volume that is occupied by white blood cells
- [C] proportion of blood volume that is occupied by Leucocytes and Thromobocytes
- [D] proportion of blood volume that is occupied by plasma

Answer: A [proportion of blood volume that is occupied by red blood cells]

Explanation:

Hematocrit levels are used in doping tests of Athletes , (the RBCs are carriers of Oxygen). hematocrit levels also denotes the blood iron. hematocrit levels of 38 or higher are normally suitable for the donors to donate their blood. Here please note that sometimes its is asked in exams about the ion which can help better in blood coagulation and normally options given are Ca, Na, K & Fe⁺³. The obvious answer is Fe⁺³.

3. As per the Kepler's third law, the square of the time period of revolution of a planet is directly proportional to which of the following?

- [A] semi-major axis of its elliptical orbit
- [B] cube root of semi-major axis of its elliptical orbit
- [C] square of semi-major axis of its elliptical orbit
- [D] cube of semi-major axis of its elliptical orbit

Answer: D [cube of semi-major axis of its elliptical orbit]

Explanation:

Kepler's third law: the square of the time period of revolution of a planet is directly proportional to the cube of semi-major axis of its elliptical orbit. It is also known as the Law of periods.

4. Two satellites, A having mass of 500 kgs and B having mass of 1200 kgs, are launched from earth. Which of these will have a greater orbital velocity if the radius of orbit is same for both?

- [A] Satellite A
- [B] Satellite B
- [C] Both satellites will have the same orbital velocity
- [D] Cant be determined

Answer: C [Both satellites will have the same orbital velocity]

Explanation:

Both satellites will have the same orbital velocity as the orbital velocity of a satellite is independent of mass of satellite.

5. An earth satellite S has an orbit radius which is 2 times that of a communication satellite C. What will be the period of revolution of S?

- [A] 1 day
- [B] 2 days
- [C] 4 days
- [D] 8 days

Answer: C [4 days]

Explanation:

As per Kepler's third law, the square of the period of any planet is proportional to the cube of the semimajor axis of its orbit. $T_s/T_c = 2^{3/2} = 4$ days

6. What will be the change in the height of water in a capillary tube in stationary condition on earth if the same tube is taken in a lift going downward with acceleration?

- [A] height increases
- [B] height decreases
- [C] Remains same
- [D] can decrease or increase

Answer: A [height increases]

Explanation:

In a lift going downward with acceleration, the effective acceleration decreases. So height increases as height is inversely proportional to the acceleration due to gravity.

7. What is the density of whole blood at STP?

[A] $3.57 \times 10^3 \text{ kg m}^{-3}$

[B] $1.06 \times 10^3 \text{ kg m}^{-3}$

[C] $5.55 \times 10^3 \text{ kg m}^{-3}$

[D] 2

Answer: B [$1.06 \times 10^3 \text{ kg m}^{-3}$]

Explanation:

The densities of some common fluids: 1. Whole blood: $1.06 \times 10^3 \text{ kg m}^{-3}$

2. Mercury: $13.6 \times 10^3 \text{ kg m}^{-3}$ 3. Ethyl alcohol: $0.86 \times 10^3 \text{ kg m}^{-3}$

8. What kinds of waves are the ultrasonic waves in air produced by a vibrating quartz crystal?

[A] Transverse

[B] Longitudinal

[C] Transverse and longitudinal

[D] None of the above

Answer: B [Longitudinal]

Explanation:

The ultrasonic waves in air produced by a vibrating quartz crystal are longitudinal waves.

9. Which of the following sound waves are used in echocardiography?

[A] Infrasonic

[B] Ultrasonic

[C] Between 20 Hz and 2000 Hz

[D] None of the above

Answer: B [Ultrasonic]

Explanation:

Ultrasonic waves are made to reflect from various parts of the heart and form the image of the heart. This technique is called 'echocardiography'.

10. Which of the following is NOT about inert electrodes?

- [A] They serve as source of electrons
- [B] They take part in the chemical reaction
- [C] Both a and b
- [D] None of the above

Answer: B [They take part in the chemical reaction]

Explanation:

An inert electrode is a metal submerged in an aqueous solution of ion compounds that transfers electrons rather than exchanging ions with the aqueous solution. It does not participate or interfere in the chemical reaction but serves as a source of electrons.

11. What is the limit as x approaches 0 of $(\sin x) / x$?

- [A] 0
- [B] 1
- [C] π
- [D] Undefined

Answer: [B] 1

12. In a sequence of numbers, if each term is the sum of the two preceding terms, and the first two terms are 1 and 1, what is the 10th term in the sequence?

[A] 55

[B] 89

[C] 144

[D] 233

Answer: [D] 233

13. What is the derivative of $\ln(x)$ with respect to x ?

[A] $1/x$

[B] x

[C] e^x

[D] 0

Answer: [A] $1/x$

14. How many positive integers less than 100 are relatively prime (have no common factors other than 1) to 100?

[A] 20

[B] 40

[C] 60

[D] 80

Answer: [C] 60

15. What is the value of the integral $\int (2x^2 + 3x + 1) dx$ from 1 to 4?

[A] 50

[B] 60

[C] 70

[D] 80

Answer: [B] 60

16. If a circle has a radius of 5 cm, what is the length of an arc that subtends a central angle of 120 degrees?

[A] 10π cm

[B] 5π cm

[C] $5\sqrt{3}$ cm

[D] 10 cm

Answer: [C] $5\sqrt{3}$ cm

17. How many real solutions does the equation $2x^3 - 5x^2 + 3x - 7 = 0$ have?

[A] 1

[B] 2

[C] 3

[D] 0

Answer: [A] 1

18. If a box contains 6 red balls, 4 green balls, and 5 blue balls, what is the minimum number of balls you must draw to ensure you have at least one ball of each color?

[A] 6

[B] 8

[C] 11

[D] 15

Answer: [C] 11

19. A right triangle has a hypotenuse of length 17 and one side of length 8. What is the length of the other side?

[A] 7

[B] 12

[C] 15

[D] 10

Answer: [D] 10

20. The sum of an infinite geometric series is 20, and the common ratio is $\frac{1}{3}$. What is the first term of the series?