UNIVERSITAS INDONESIA

Veritas, Probitas, Iustitia

NATURAL SCIENCES TEST

- Mathematics for Natural Sciences
- Biology
- Physics
- Chemistry

SIMAK UI

ENTRANCE TEST
UNIVERSITAS INDONESIA
2016

GENERAL INSTRUCTIONS

1. Before you begin work on the test, check the number of questions and the page numbers in the test booklet. The booklet consists of a front page, a general instructions page, an answer sheet, and 10 question pages.
2. The answer sheet attached to this booklet can only be used for this test booklet. If you need a new answer sheet, you should use the test booklet which the answer sheet was attached.
3. You have to take the answer sheet from the test booklet. If the top left of the answer sheet is damaged or torn, the answer sheet still can be processed.
4. Write your student test number on the space provided in the answer sheet.
5. Read carefully each and every instruction on how to answer the questions.
6. Think carefully before answering every question, because an incorrect answer will deduct 1 point from your total score (scoring system: correct +4, blank 0, incorrect -1).
7. Work on questions you find easy first, then continue with harder questions.
8. Write your answers on the answer sheet provided.
9. Since scrap paper is not provided, you can make use of the empty space in your test booklet to do calculations. **Do not use the empty space on your answer sheet**.
10. During the test, you are not allowed to ask or seek explanation about the questions being tested to anyone including the test supervisor.
11. When you have finished doing the test, you are required to stay in your seat until the test supervisor approaches you to collect the answer sheet.
12. Make sure the answer sheet is not dirty, wet, folded, and torn.

SPECIFIC INSTRUCTIONS

INSTRUCTION A:

Choose the best answer.

INSTRUCTION B:

Each question consists of 3 parts, i.e. STATEMENT, CAUSE, and REASON that are arranged in sequence.
Choose:

(A) If the statement is correct, the reason is correct, and both show a cause and effect relationship.

(B) If the statement is correct, the reason is correct, but both do not show a cause and effect relationship.

(C) If the statement is correct and the reason is incorrect.

(D) If the statement is incorrect and the reason is correct.

(E) If the statement and the reason are both incorrect.

INSTRUCTION C:

Choose:

(A) If (1), (2), and (3) are correct.

(B) If (1) and (3) are correct.

(C) If (2) and (4) are correct.

(D) If only (4) is correct.

(E) If all of them are correct.

Answer Sheet
University of Indonesia's Entrance Test (SIMAK UI)

D3 S1

Testee's Name

Testee's Number

Answer Sheet's Number

	1	8							
0	○	○	○	○	○	○	○	○	○
1	●	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○	○	○
8	○	●	○	○	○	○	○	○	○
9	○	○	○	○	○	○	○	○	○

Date of Birth

0	○	○	○	○	○	○	○	○
1	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○	○
8	○	○	○	○	○	○	○	○
9	○	○	○	○	○	○	○	○

Hereby I declare that the data provided in this form are correct. I agree that if I violate the above statement, this answer sheet will not be processed.

Signature

First **Second**

This answer sheet can only be used with its paired test book. Use 2B pencil to answer the questions and use a pen when you write your signature.

01	A○B○C○D○E○	21	A○B○C○D○E○	41	A○B○C○D○E○	61	A○B○C○D○E○	81	A○B○C○D○E○
02	○ ○ ○ ○ ○	22	○ ○ ○ ○ ○	42	○ ○ ○ ○ ○	62	○ ○ ○ ○ ○	82	○ ○ ○ ○ ○
03	○ ○ ○ ○ ○	23	○ ○ ○ ○ ○	43	○ ○ ○ ○ ○	63	○ ○ ○ ○ ○	83	○ ○ ○ ○ ○
04	○ ○ ○ ○ ○	24	○ ○ ○ ○ ○	44	○ ○ ○ ○ ○	64	○ ○ ○ ○ ○	84	○ ○ ○ ○ ○
05	○ ○ ○ ○ ○	25	○ ○ ○ ○ ○	45	○ ○ ○ ○ ○	65	○ ○ ○ ○ ○	85	○ ○ ○ ○ ○
06	○ ○ ○ ○ ○	26	○ ○ ○ ○ ○	46	○ ○ ○ ○ ○	66	○ ○ ○ ○ ○	86	○ ○ ○ ○ ○
07	○ ○ ○ ○ ○	27	○ ○ ○ ○ ○	47	○ ○ ○ ○ ○	67	○ ○ ○ ○ ○	87	○ ○ ○ ○ ○
08	○ ○ ○ ○ ○	28	○ ○ ○ ○ ○	48	○ ○ ○ ○ ○	68	○ ○ ○ ○ ○	88	○ ○ ○ ○ ○
09	○ ○ ○ ○ ○	29	○ ○ ○ ○ ○	49	○ ○ ○ ○ ○	69	○ ○ ○ ○ ○	89	○ ○ ○ ○ ○
10	○ ○ ○ ○ ○	30	○ ○ ○ ○ ○	50	○ ○ ○ ○ ○	70	○ ○ ○ ○ ○	90	○ ○ ○ ○ ○
11	○ ○ ○ ○ ○	31	○ ○ ○ ○ ○	51	○ ○ ○ ○ ○	71	○ ○ ○ ○ ○	91	○ ○ ○ ○ ○
12	○ ○ ○ ○ ○	32	○ ○ ○ ○ ○	52	○ ○ ○ ○ ○	72	○ ○ ○ ○ ○	92	○ ○ ○ ○ ○
13	○ ○ ○ ○ ○	33	○ ○ ○ ○ ○	53	○ ○ ○ ○ ○	73	○ ○ ○ ○ ○	93	○ ○ ○ ○ ○
14	○ ○ ○ ○ ○	34	○ ○ ○ ○ ○	54	○ ○ ○ ○ ○	74	○ ○ ○ ○ ○	94	○ ○ ○ ○ ○
15	○ ○ ○ ○ ○	35	○ ○ ○ ○ ○	55	○ ○ ○ ○ ○	75	○ ○ ○ ○ ○	95	○ ○ ○ ○ ○
16	○ ○ ○ ○ ○	36	○ ○ ○ ○ ○	56	○ ○ ○ ○ ○	76	○ ○ ○ ○ ○	96	○ ○ ○ ○ ○
17	○ ○ ○ ○ ○	37	○ ○ ○ ○ ○	57	○ ○ ○ ○ ○	77	○ ○ ○ ○ ○	97	○ ○ ○ ○ ○
18	○ ○ ○ ○ ○	38	○ ○ ○ ○ ○	58	○ ○ ○ ○ ○	78	○ ○ ○ ○ ○	98	○ ○ ○ ○ ○
19	○ ○ ○ ○ ○	39	○ ○ ○ ○ ○	59	○ ○ ○ ○ ○	79	○ ○ ○ ○ ○	99	○ ○ ○ ○ ○
20	A○B○C○D○E○	40	A○B○C○D○E○	60	A○B○C○D○E○	80	A○B○C○D○E○	100	A○B○C○D○E○

SIMAK UI

V(D3) S1R S1P Pro Sp. S2 S3

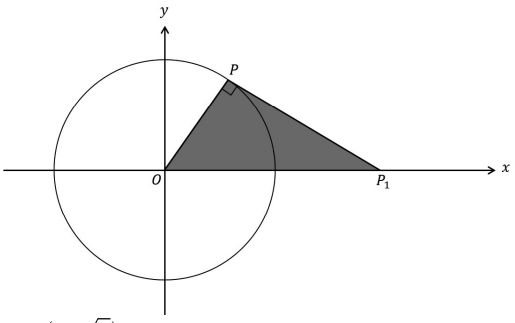
S2 S3

SUBJECTS	:	Mathematics for Natural Sciences, Biology, Physics, and Chemistry
EXAM DATE	:	29 MAY 2016
TIME	:	120 MINUTES
NO. OF QUESTIONS	:	60

Notes	:	Questions on MATHEMATICS FOR NATURAL SCIENCES numbers 1 to 15
		Questions on BIOLOGY numbers 16 to 30
		Questions on PHYSICS numbers 31 to 45
		Questions on CHEMISTRY numbers 46 to 60

MATHEMATICS FOR NATURAL SCIENCES

*Use **Instruction A** to answer questions number 1 to 12.*

1. 

If $P(3,\sqrt{7})$ and $OP = 4$, then the area of OPP_1 is ....

(A) $\frac{2}{6}\sqrt{7}$

(B) $\frac{4}{6}\sqrt{7}$

(C) $\frac{8}{6}\sqrt{7}$

(D) $\frac{12}{6}\sqrt{7}$

(E) $\frac{16}{6}\sqrt{7}$

2. If x_1 and x_2 are roots of $x^2 + x - 3 = 0$, then $x_1^3 - 4x_2^2 + 5 =$ ....

(A) -28

(B) -14

(C) 0

(D) 14

(E) 28

3. If (x,y) are the solution for the following system:
$\begin{cases} 4|xy| - y^2 - 2 = 0 \\ (2x+y)^2 + 4x^2 = 2, \end{cases}$
then the maximum value of $4x + y$ is ....

(A) 1

(B) $\sqrt{2}$

(C) 2

(D) $\sqrt{3}$

(E) 4

4. Suppose we divide $f(x)$ with $x^2 + 2x - 3$ and we get $Ax + B$ as the remainder. If $f(1) - f(3) = 4$, then $A =$ ....

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

5. The number of solutions for the following equation: $|x+1| + |x-2| = 4$ is ....

(A) 6

(B) 5

(C) 4

(D) 3

(E) 2

6. Find the value of x which satisfies the following equation $x + \frac{x}{2} + \frac{x}{4} + \frac{x}{8} + \ldots = x^2 - 2x$

(A) 5

(B) 4

(C) 3

(D) 2

(E) 1

7. Given the function $f(x) = 2\sqrt{2} + 2\sin x + 2\cos x$, where $0 < x < 2\pi$ will cross $x-$axis at $x = ...$

(A) $-\frac{3\pi}{4}$

(B) $-\frac{\pi}{2}$

(C) $-\frac{\pi}{4}$

(D) 0

(E) $\frac{\pi}{4}$

8. $\lim_{x\to\infty} \sin^2 2x \cot^2 4x = ...$

(A) $-\infty$

(B) $-\frac{1}{4}$

(C) $\frac{1}{4}$

(D) 4

(E) ∞

9. The area bounded by $y = -x^2 + 3x$ and $y = 2$ is equal to ....

(A) $\frac{5}{6}$

(B) $\frac{4}{6}$

(C) $\frac{3}{6}$

(D) $\frac{2}{6}$

(E) $\frac{1}{6}$

10. Given a cube $ABCD.EFGH$ and 4 points, O, P, R, Q where $OH = OG$, $DP = PC$, $ER : RF = 1 : x$, $AQ : QB = 1 : x$. If the ratio of volume $QBCP.RFGO$ and volume $ABCD.EFGH$ is 5 : 8, then $x = ...$

(A) 1

(B) 2

(C) 3

(D) 4

(E) 5

11. Given a cube $ABCD.EFGH$ with length of sides is equal to a, point Q is in the middle of EF. The distance between Q and $BCDG$ plane is ....

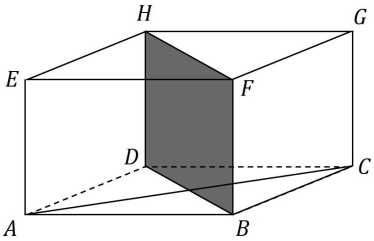
(A) $\sqrt{\frac{1}{6}}a$

(B) $\sqrt{\frac{1}{5}}a$

(C) $\sqrt{\frac{1}{4}}a$

(D) $\sqrt{\frac{1}{3}}a$

(E) $\sqrt{\frac{1}{2}}a$

12. 

A regular four sided prism $ABCD.EFGH$ has a rhombus based with area of $\frac{2}{3}k^2$, $k > 0$. If square $BFHD$ has area k^2, then the ratio of rectangular area $ACGE$ and the square area $BFHD$ is ....

(A) $1 : \sqrt{3}$

(B) $2 : \sqrt{3}$

(C) $3 : 3\sqrt{3}$

(D) $\sqrt{3} : 2$

(E) $\sqrt{3} : 1$

*Use **Instruction C** to answer questions number 13 to 15.*

13. Given $f(x) = (x^2 - 2x + 1)(x^3 - 3x)$, choose the following statement which is true,

(1) maximum of $f(x)$ is 0

(2) minimum of $f(x)$ is -27

(3) $f(1) = 0$

(4) Maximum at $x = 1$

14. From the following trigonometry identities, which statement is true?

    (1) $6(1-2\sin^2 42,5^\circ)\cos 5^\circ = 3\sin 10^\circ$

    (2) $6(2\cos 42,5^\circ - 1)\sin 5^\circ = 3\sin 10^\circ$

    (3) $\sin 42,5^\circ \sin 2,5^\circ \cos 42,5^\circ = \dfrac{\sin 10^\circ}{8\cos 2,5^\circ}$

    (4) $\sin 42,5^\circ \cos 2,5^\circ \cos 42,5^\circ = \dfrac{\sin 10^\circ}{4\sin 2,5^\circ}$

15. Given vectors $\mathbf{a} = \left(1,1,\sqrt{3}\right)$, $\mathbf{b} = (2,-1,0)$ and $\mathbf{c}$ is the orthognal projection $\mathbf{a}$ on $\mathbf{b}$, and $\mathbf{c}+\mathbf{d} = \mathbf{a}$, then ....

    (1) $||\mathbf{c}|| = \dfrac{\mathbf{1}}{\mathbf{5}}|\mathbf{b}||$

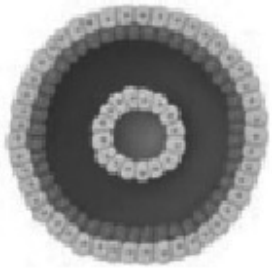
    (2) $||\mathbf{d}|| = \dfrac{\mathbf{4}}{\mathbf{5}}|\mathbf{a}||$

    (3) The area, which is bounded by $\mathbf{a}$ and $\mathbf{c}$ is equal to $\dfrac{\sqrt{14}}{2}$

    (4) $||\mathbf{c}|| + ||\mathbf{d}|| = ||\mathbf{a}||$

BIOLOGY

*Use **Instruction A** to answer questions number 16 to 24.*

16. 

If the picture above was taken from the x-section of a roundworm, which feature of roundworm is illustrated in the picture?

(A) pseudocoelom
(B) flame-cells
(C) nervous system
(D) circulatory system
(E) nephridia

17. During transcription, which enzyme moves along the exposed strands and adds complementary nucleotides?

(A) Helicase
(B) DNA Polymerase
(C) RNA Polymerase
(D) Ligase
(E) Topoisomerase

18. In which of the following taxa does the mature sporophyte depend completely on the gametophyte for nutrition?

(A) Fern
(B) Bryophyte
(C) *Equisetum* sp.
(D) *Cycas rumphii*
(E) *Gnetum gnemon*

19. The Hardy-Weinberg principle can not apply only if ...

(A) there are no net mutations that change the allele frequencies
(B) individuals do not migrate between populations
(C) mating is random in the population
(D) natural selection occurs
(E) the population is large

20. What is the function of trichomes?

(A) To generate secretory products to cause sting.
(B) To provide nutrition.
(C) To increase water loss from the epidermis.
(D) To produce attracting/alluring glucose.
(E) To increase herbivory.

21. What is the name of the interaction, if two species of birds may fight over the tree holes that they both use as nest sites?

(A) Interference competition
(B) Physical competition
(C) Unstable competition
(D) Exploitation competition
(E) Mutualism

22. Which term below refers to symbiotic relationships that involve fungi living between the cells in plant leaves?

(A) pathogens
(B) endosymbioses
(C) endophytes
(D) lichens
(E) mycorrhizae

23. When iodine solution is used to stain a cell in the laboratory, which cell structure is most readily seen?

(A) vacuole
(B) cytoplasm
(C) golgi complex
(D) lysosome
(E) nucleus

24. Which of the followings uses light energy to generate ATP, but do not release oxygen?

(A) photoautotrophs
(B) photoheterotrophs
(C) chemoautotrophs
(D) chemoheterotrophs that perform decomposition
(E) parasitic chemoheterotrophs

*Use **Instruction B** to answer questions number 25 to 27.*

25. A genomic library can be made using a restriction enzyme and DNA ligase only

    BECAUSE

    cDNA library requires both of these as well as reverse transcriptase and DNA polymerase.

26. Seed production by apomixis is a form of sexual reproduction

    BECAUSE

    there is fusion of gametes, the embryo is virtually genetically identical to the maternal genotype.

27. Cats can survive falls better than humans

    BECAUSE

    cats benefit from their apparent ability to prepare for landing on all four feet.

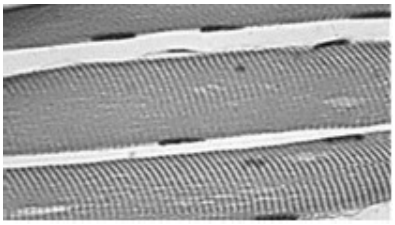
*Use **Instruction C** to answer questions number 28 to 30.*

28. Which of the following is TRUE of homologous chromosomes?

    (1) They are usually the same size and shape
    (2) They are inherited from different parents
    (3) They contain the same set of genes
    (4) They contain identical DNA sequences

29. Plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What colors of visible light are being absorbed by this pigment?

    (1) red
    (2) blue
    (3) green
    (4) violet

30. 

    Choose characteristics of the muscle tissue below:

    (1) located in walls of heart
    (2) involuntary
    (3) one or two nuclei per fiber
    (4) resistance to fatigue is least

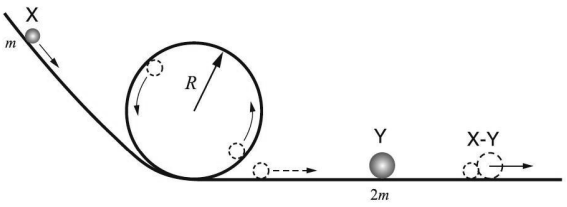
PHYSICS

*Use **Instruction A** to answer questions number 31 to 39.*

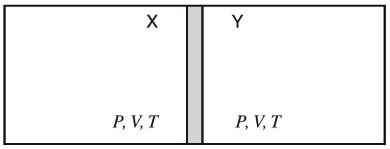
31. The concentration of oxygen O_2 at the atmospheric pressure is 20.9 %v/v. The partial pressure of this concentration is 21.2 kPa. At an altitude of 6962 m above sea level (approximately 7000 m), the partial pressure of oxygen at the altitude is ....
    (A) 0.21 kPa
    (B) 0.44 kPa
    (C) 9.33 kPa
    (D) 21.00 kPa
    (E) 44.00 kPa

32. The distance between the sun and Jupiter is 7.78 x 10^{11} m and the distance between Earth and the sun is 1.496 x 10^{11} m. The time for Jupiter to make one complete revolution around the sun in earth years is ....
    (A) 11.86 earth years
    (B) 12.86 earth years
    (C) 13.86 earth years
    (D) 14.86 earth years
    (E) 15.86 earth years

33. The image formation of thin optical lense have some properties. The correct property is ....
    (A) if the lens is divergent, as an object approaches the focal point from the center of the lens, the formed image is virtual, inverted and bigger than the object
    (B) if the lens is divergent, as an object approaches the focal point from far away, the formed image is real, upright and bigger than the object
    (C) If the lens is divergent, as an object approaches the focal point from far away, the formed image is real, upright and smaller than the object
    (D) if the lens is convergent, as an object approaches the focal point from far away, the formed image is real, upright and smaller than the object
    (E) if the lens is divergent, as an object approaches the focal point from far away, the formed image is real, inverted and more distant

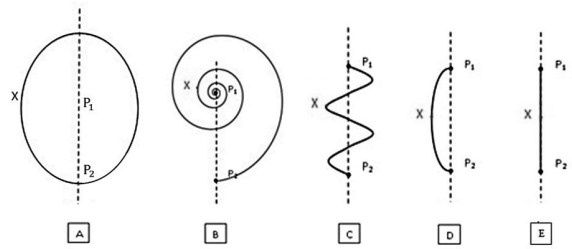
34. 

There is a frictionless track with a combination of line and circular track with radius R as shown in the figure. A small ball X with a mass m slides down and then enters a circular track. After rotating in the circular track, the small ball X collides with another ball Y with a mass of 2 m. The ball Y is at rest. After colliding, X and Y embed together and move. The ratio of kinetic energy of X and Y just before and after the collision is ....
    (A) 1
    (B) 2
    (C) 3
    (D) 4
    (E) 5

35. 

A vessel (see the figure) comprises of into two chambers X and Y with an adiabatic wall. The adiabatic wall can move freely. The chambers X and Y contain an ideal gas under the condition that pressure P, volume V, and temperature T are all same, respectively. The system gains an equilibrium tate after heating when the temperature of chamber X becomes 3T, while the temperature of chamber Y is always constant at T. The gas pressure of chamber Y at the equilibrium after the heating is ....
    (A) P
    (B) 1.5 P
    (C) 2P
    (D) 3P
    (E) 4P

36.



On the tables, we located two points, P_1 and P_2, respectively. A particle moves from P_1 to P_2 without acceleration along five different paths. The duration is the same for all paths. If we put a point X, the suitable path with the lowest kinetic energy is ....

(A) A

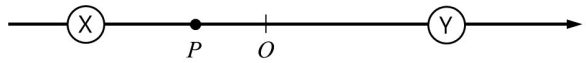
(B) B

(C) C

(D) D

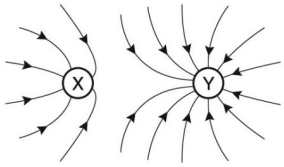
(E) E

37.

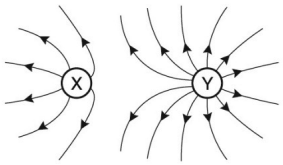


X is a positive point charge. Y is a point charge that is placed at a point that has the same length from origin O with X, but on opposite sides. A negative charge is located at point P. Since the negative charge is still at rest, the suitable electric field lines sketched before locating the negative charge at P is ....

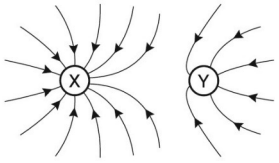
(A)



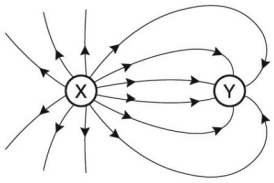
(B)



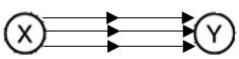
(C)



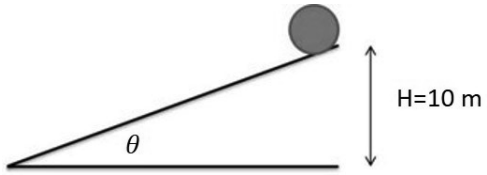
(D)



(E)



38.



A sphere starting from rest is rolling down a10 m height (see figure), 37° inclined plane. If I_{sphere} = 2/5 MR^2 and g = 10 m/s^2 , the speed of the sphere at the bottom is ....

(A) 9.25 m/s

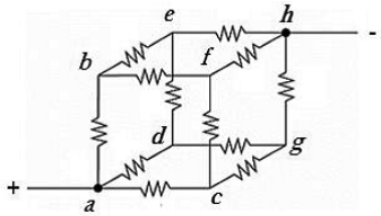
(B) 10.25 m/s

(C) 11.25 m/s

(D) 12.25 m/s

(E) 13.25 m/s

39.



The 12 identic resistors networks with resistance of R is shown in the figure. The resistance between points *a* and *b* is ....

(A) 12 R

(B) 5 R

(C) (5/6) R

(D) (3/2) R

(E) R

*Use **Instruction B** to answer questions number 40 to 42.*

40. The image of an object as formed by a plane mirror is located behind the mirror surface.

BECAUSE

the location of an image is different for different observers.

41. Using certain radioactive elements, the age of rocks and other geological features (even some man-made objects) can be determined; this is called Radiometric dating.

BECAUSE

Other forms of radiation such as radio waves, microwaves, and light waves are called non-ionizing.

42. Faraday's law states that whenever the magnetic flux crossing a loop changes, an induced magnetic field is produced in the loop which is equal to the negative rate of change of flux with time.

BECAUSE

Magnetic flux crossing a loop is defined as the product of its area and the component of the magnetic field crossing the loop parallel to the plane of the loop.

*Use **Instruction C** to answer questions number 43 to 45.*

43. An x-ray beam with a wave length 0.16 nm is incident on a set of planes of certain crystal. The first Bragg reflection is observed for an incidence angle of 30°. The reflection satisfies the relation $2d \sin q = nl$. The possible planes separation d for the reflection is ....

    (1) 0.136 nm and 0.272 nm
    (2) 0.136 nm and 1.36 nm
    (3) 0.136 nm and 13.6 nm
    (4) 0.136 nm only

44. The zeroth law of thermodynamics states that ....

    (1) the entropy of an isolated system can only increase
    (2) total internal energy is a state function
    (3) the efficiency of heat engine can never be 100%
    (4) if system A and system B are in thermodynamic equilibrium and if system B is in thermodynamic equilibrium with system C, then system A and C are also in thermodynamic equilibrium

45. The unit of measurement for intensity of sound is ....

    (1) Watt/m^3
    (2) Joule/s.m^2
    (3) Watt
    (4) Watt/m^2

CHEMISTRY

*Use **Instruction A** to answer questions number 46 to 54.*

46. Boron naturally occurs in two isotopic forms, ^{11}B and ^{10}B with atomic mass 11.01 and 10.01 amu respectively. If the average mass of boron is 10.81, the composition of boron isotopes are ....
    (A) ^{11}B = 50% and ^{10}B = 50%
    (B) ^{11}B = 77% and ^{10}B = 23%
    (C) ^{11}B = 80% and ^{10}B = 20%
    (D) ^{11}B = 85% and ^{10}B = 15%
    (E) ^{11}B = 92% and ^{10}B = 8%

47. An amino acid contains C, H, N and O with percentage 36.09%, 5.3 %, 10.52% and 48.08% respectively. Its relative molecular mass is 133 (Ar C=12, H=1, N=14 and O=16). The amount of N atoms in 0.1 mole of this compound is ....
    (A) 3.01×10^{22}
    (B) 6.02×10^{22}
    (C) 3.01×10^{23}
    (D) 6.02×10^{23}
    (E) 9.03×10^{23}

48. The reaction of silver metal and dilute nitric acid proceeds according to the equation below.
    $3Ag(s) + 4HNO_3 \rightarrow 3AgNO_3 + NO(g) + 2H_2O$
    If 0.10 mole of powdered silver is added to 10.0 mL of 6.0 molar nitric acid, the number of moles of NO gas released is ....
    (A) 0.015 mole
    (B) 0.020 mole
    (C) 0.030 mole
    (D) 0.045 mole
    (E) 0.090 mole

49. Given the enthalpy of the following reactions:
    $2ClF(g) + O_2(g) \rightarrow ClO_2(g) + F_2O(g) \quad \Delta H^o = 167.4$ kJ
    $2ClF_3(g) + 2O_2(g) \rightarrow Cl_2O(g) + 3F_2O(g) \quad \Delta H^o = 341.4$ kJ
    $2F_2(g) + O_2(g) \rightarrow 2F_2O(g) \quad \Delta H^o = -43.4$ kJ
    The enthalpy of following reaction:
    $ClF(g) + F_2(g) \rightarrow ClF_3(g)$
    is ....
    (A) -217.5 kJ
    (B) -130.2 kJ
    (C) -108.7 kJ
    (D) 120.2 kJ
    (E) 217.5 kJ

50. The following two half reactions are used to make an electrochemical (galvanic) cell:
    $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s) \quad E^o = +0.34$ V
    $Al^{3+}(aq) + 3e^- \rightarrow Al(s) \quad E^o = -1.66$ V
    $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s) \quad E^o = -0.45$ V
    $Fe^{3+}(aq) + 2e^- \rightarrow Fe^{2+}(aq) \quad E^o = +0.77$ V
    Using the standard reduction potentials for these reactions, we can predict that the spontaneous reaction is ....
    (A) $Cu(s) + Fe^{2+}(aq) \rightarrow Cu^{2+}(aq) + Fe(s)$
    (B) $2Al(s) + 3Fe^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Fe(s)$
    (C) $2Al^{3+}(aq) + 3Fe(s) \rightarrow 2Al(s) + 3Fe^{2+}(aq)$
    (D) $2Al^{3+}(aq) + 3Cu(s) \rightarrow 2Al(s) + 3Cu^{2+}(aq)$
    (E) $2Fe^{2+}(aq) + Cu^{2+}(aq) \rightarrow 2Fe^{3+}(aq) + Cu(s)$

51. Given the initial rate data for the reaction A + B $\rightarrow$ C ,

Exp.	[A] M	[B] M	$\Delta[C]/\Delta$t (initial) M/s
1	0.25	0.15	1.23×10^{-3}
2	0.25	0.25	3.42×10^{-3}
3	0.50	0.15	2.46×10^{-3}

    The rate of C formation for the reaction is ....
    (A) $\frac{\Delta[C]}{\Delta t} = 0.0328[A][B]$
    (B) $\frac{\Delta[C]}{\Delta t} = 0.0547[A][B]$
    (C) $\frac{\Delta[C]}{\Delta t} = 0.0547[A][B]$
    (D) $\frac{\Delta[C]}{\Delta t} = 0.0547[A][B]^2$
    (E) $\frac{\Delta[C]}{\Delta t} = 0.0219[A]^2[B]$

52. Given solutions, containing 0.20 molal of ethyl alcohol and 0.10 molal of magnesium sulphate in water, both are soluble in water. The freezing point of the mixture is .... (freezing point of water = 0°C, K_f water = 1.86 m $kg^{-1}K^{-1}$)
    (A) 0.744°C
    (B) 0.558°C
    (C) 0.372°C
    (D) -0.372°C
    (E) -0.744°C

53. The solubility of magnesium flouride (ionic compound), MgF_2 (Mr = 62.3) is 3.115×10^{-3} in 100 mL pure water. The solubility product of MgF_2 is ....

(A) 5×10^{-11}

(B) 1×10^{-11}

(C) 8×10^{-10}

(D) 5×10^{-10}

(E) 1×10^{-10}

54. The maximum number of stereoisomers for CH_2=CClCHClCH$_3$ are ....

(A) 0

(B) 2

(C) 4

(D) 6

(E) 8

*Use **Instruction B** to answer questions number 55 to 57.*

55. The second ionization energy of magnesium is expressed by the following equation:
$Mg(g) \rightarrow Mg^{2+}(g) + 2e$

BECAUSE

The second ionization energy is an energy required to release two electrons in gas phase.

56. The following equilibrium reaction:
$4A(s) + 2B(g) \leftrightharpoons 2C(g) \quad \Delta H_{rxn}$ = -60 kJ
After the equilibrium is achieved, at certain volume the system contains A, B and C, with amount of 1 mole, 0.5 mole and 2 moles respectively. The equilibrium constant of the reaction is 16. Increasing the pressure, the equilibrium system will shift to the left.

BECAUSE

In that mixture, the value K_p of the reaction is greater than K_c.

57. In the same concentration, natrium benzoic will produce more acid than natrium formic when dissolved in water. (K_a Benzoid acid = 6.5×10^{-5} and formic acid = 1.8×10^{-4})

BECAUSE

Benzoic ion is stronger base than former ion.

*Use **Instruction C** to answer questions number 58 to 60.*

58. In the following reaction, which reaction will generate hydrogen gas?

(1) Hidrochloride solution is added by Zinc metal.

(2) Carbon is reacted with steam (water at 1000°C).

(3) Potassium metal is immersed to the water.

(4) Copper is immersed to the concentrated nitric acid solution.

59. Suppose $Na_2SO_4(aq)$ is electrolyzed using inert electrodes which are exposed to the air. The following, which statement(s) is(are) true?

(1) Oxidation of H_2O will produce H_2 in anode.

(2) Na(s) will be precipitated at cathode.

(3) H^+ will be produced in cathode.

(4) After electrolysis, pH of the solution is unchanged.

60. Given following reaction
$H_3CCH_2Li + H_2O \rightarrow CH_3CH_3 + LiOH$
Which of the following statement(s) is(are) correct?

(1) It is acid-base reaction.

(2) It is substitution reaction.

(3) $CH_3CH_2^-$ is a base species.

(4) H_2O is an acid species.