FIITJEE Phase Test (JEE-Advanced)

BATCH – SANKALAP2324PA1B-6B - PHASE-II

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern – (CPT-1) **QP Code: 100880.1** **PAPER - 1**

Time Allotted: 3 Hours **Maximum Marks: 183**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **SECTION–I** is Physics, **SECTION–II** is Chemistry and **SECTION–III** is Mathematics.
4. Each part is further divided into **two parts**: **Part – A & C**
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with HB pencil for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

(i) Part–A (01 – 07) contains 07 multiple choice questions which have one or more than one correct answer. Each question will be evaluated according to the following marking scheme.

Full Marks	:	**+4**	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	**+3**	If all the four options are correct but ONLY three options are chosen;
Partial Marks	:	**+2**	If three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	**+1**	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	**0**	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	**–2**	In all other cases.

Part–A (08 – 13) contains 06 Multiple Choice Questions which have Only One Correct answer. Each question will be evaluated according to the following marking scheme.

Full Marks	:	**+3**	If only (all) the correct option(s) is (are) chosen;
Zero Marks	:	**0**	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	**–1**	In all other cases.

(ii) PART–C (01-05) contains (05) Numerical based questions with single digit integer as answer, ranging from 0 to 9 (both inclusive) and each question carries **+3 marks** for correct answer. **There is no negative marking.**

Name of the Candidate :_____

Batch :_____ **Date of Examination :**_____

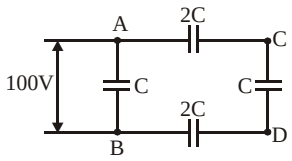
Enrolment Number :_____

SECTION – I : PHYSICS

PART – A: (Multi Correct Answer Type)

*This section contains **07 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.*

1. In the circuit shown, a potential difference of 100 V is applied across AB. Then



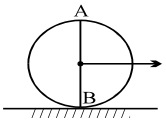
(A) the potential difference between points C and D is 50 V

(B) the potential difference between A and C is 25 V

(C) the potential difference between B and D is 25 V

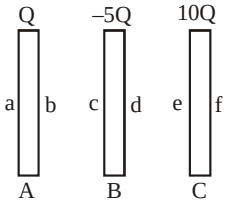
(D) all the capacitors have equal charge

2. A uniform disc is rolling on a horizontal surface. At a certain instant B is the point of contact and A is at height 2R from ground, where R is radius of disc.



(A) The magnitude of the angular momentum of the disc about B is thrice that about A.
(B) The angular momentum of the disc about A is anticlockwise.
(C) The angular momentum of the disc about B is clockwise
(D) The angular momentum of the disc about A is equal to that about B.

3. Three very large plates are given charges as shown in the figure. If the cross-sectional area of each plate is the same, then the final charge distribution on the surface of the plates a, b, c, d, e, f is



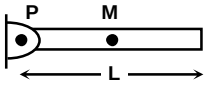
(A) 7Q on surface e and 3Q on surface f

(B) -2Q on surface b and 3Q on surface a

(C) -7Q on surface d and 2Q on surface c

(D) the magnitude of charges at surfaces b, c, d, e is equal .

4. A uniform rod of mass M is released from horizontal position as shown in the figure. The rod is free to rotate about a horizontal frictionless axis passing through hinge P

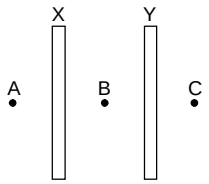


(A) The angular acceleration just after the release is 3g/2L.
(B) The angular acceleration just after the release is 3g/4L.
(C) The reaction force on the hinge just after the release is Mg/4.
(D) The reaction force on the hinge just after the release is Mg/2.

Space for rough work

5. If a person sitting on a rotating stool with his hands outstretched, suddenly lowers his hand. Then his :
(A) Kinetic energy will decrease
(B) Moment of inertial will decrease
(C) Angular momentum will increase
(D) Angular velocity will increase.

6. X and Y are large parallel conducting plates close to each other. Each face has an area A. X is given a charge Q, Y is without any charge. Point A, B and C are shown.



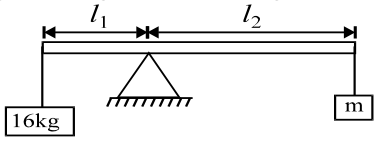
(A) Electric field at B is $\frac{Q}{2\varepsilon_0 A}$
(B) Electric field at B is $\frac{Q}{\varepsilon_0 A}$
(C) The fields at A, B and C are of same magnitude
(D) The fields at A and C are in opposite direction.

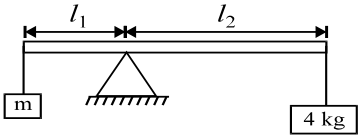
7. Two free point charges +4Q and +Q are placed at a distance r. A third charge q is so placed that all the three are in equilibrium.
(A) q is placed at a distance $\frac{1}{3}r$ from 4Q
(B) q is placed at a distance $\frac{1}{3}r$ from Q
(C) $q = \frac{4Q}{9}$
(D) $q = -\frac{4Q}{9}$

PART – A: (Single Correct Answer Type)

*This section contains **06 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. In an experiment with a beam balance an unknown mass m is balanced by two known masses of 16 kg and 4 kg as shown in figure.

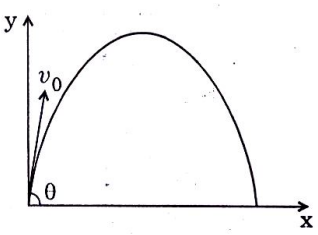




The value of the unknown mass m is
(A) 10 kg
(B) 6 kg
(C) 8 kg
(D) 12 kg

Space for rough work

9. A small particle of mass m is projected at an angle θ with the x-axis with an initial velocity v_0 in the x-y plane as shown in the figure. At a time $t < \frac{v_0 \sin\theta}{g}$, the angular momentum of the particle about point of projection is



(A) $-mgv_0t^2\cos\theta\hat{j}$

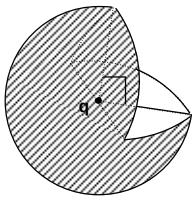
(B) $mgv_0t\cos\theta\hat{k}$

(C) $-\frac{1}{2}mgv_0t^2\cos\theta\hat{k}$

(D) $\frac{1}{2}mgv_0t^2\cos\theta\hat{i}$

where $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z–axis respectively.

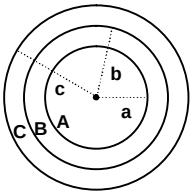
10. Find flux through the given surface.



(A) $\frac{q}{2\varepsilon_0}$ (B) $\frac{q}{4\varepsilon_0}$

(C) $\frac{3q}{4\varepsilon_0}$ (D) $\frac{q}{\varepsilon_0}$

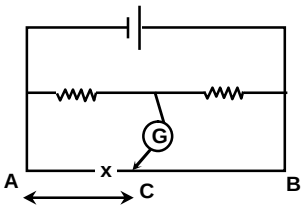
11. Three concentric charged metallic spherical shells A, B and C have radii a, b and c; charge densities σ, $-\sigma$ and σ; and potentials V_A, V_B and V_C respectively. Then which of the following relations is correct?



(A) $V_A = \frac{(a+b+c)\sigma}{\varepsilon_0}$ (B) $V_B = \frac{[(a^2/b)-b+c]\sigma}{\varepsilon_0}$

(C) $V_C = \frac{[(a^2+b^2)/c+c]\sigma}{\varepsilon_0}$ (D) $V_A = V_B = V_C = \frac{(a-b+c)\sigma}{\varepsilon_0}$

12. In the meter bridge circuit shown, the null point is obtained at C (AC = x) on the wire AB. If the diameter of the wire AB is doubled, the position of the new null point C′ will correspond to



(A) AC′=x/2 (B) AC′=x/4

(C) AC′=4x (D) AC′=x

13. A capacitor is charged and then made to discharge through a resistance. The time constant is τ. In what time will the potential difference across the capacitor decrease by 10%?

(A) τ ln (0.1) (B) τ ln (0.9)

(C) τ ln (10/9) (D) τ ln (11/10)

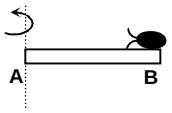
Space for rough work

PART – C: (Integer Answer Type)

*This section contains **05 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the OMR is to be bubbled.*

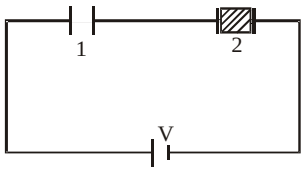
1. An electric dipole has a fixed dipole moment $\vec{p}$, which makes angle θ with respect to x-axis. When subjected to an electric field $\vec{E}_1 = E\hat{i}$, it experiences a torque $\vec{T}_1 = \tau\hat{k}$. When subjected to another electric field $\vec{E}_2 = \sqrt{3}E_1\hat{j}$ it experiences a torque $\vec{T}_2 = -\vec{T}_1$. The angle θ is 15 n degree. Find the value of n.

2. A uniform rod of mass M and length ℓ with an insect of mass M/3 initially placed at right end B is rotated with an angular velocity ω_0 = 5 rad/sec about an axis perpendicular to the rod and passing through end A. The insect starts crawling along the rod towards end A. Find the angular velocity of the rod, when the insect reaches the mid point of the rod.

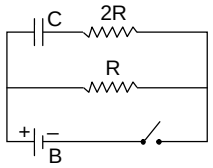


3. Assume that an electric field $\vec{E} = 30x^2\hat{i}$ exists in space. Then the potential difference $V_A - V_O$, where V_O is the potential at the origin and V_A the potential at x = 2 m is –20 k. Find the value of k.

4. Two identical capacitors 1 and 2 are connected in series to a battery as shown in figure. Capacitor 2 contains a dielectric slab of dielectric constant k as shown E_1 and E_2 are the energies stored in the capacitors. Now the dielectric slab is removed and another dielectric which can completely fill capacitor 1 (having dielectric constant 2K) is placed inside it and the corresponding energies are E'_1 and E'_2 [k = 2].The ratio $\frac{E_1}{E'_1} = \frac{4n^2}{9}$. The value of n is :



5. In the circuit shown, when the switch is closed, the capacitor charges with a time constant nRC. Find the value of n.



Space for rough work

SECTION – II: CHEMISTRY

PART – A: (Multi Correct Answer Type)

*This section contains **07 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.*

1. Which of the following compounds show keto-enol formation?
   (A) CH_3CN (B) CH_3CHO
   (C) $CH_3COCH_2COOCH_2CH_3$ (D) CH_3NO_2

2. Which of the following on treatment with $NaNH_2$ in liquid NH_3 will give m-anisidine?
   (A) o-Bromoanisole (B) m-Bromoanisole
   (C) p-Bromoanisole (D) All of the above

3. Which statements are correct for reaction to occur?
   $R{-}\overset{}{\underset{}{C}}{-}L + Nu^- \rightarrow R{-}\overset{}{\underset{}{C}}{-}Nu + L^-$
   (A) Basicity of Nu^- should be more than L^-
   (B) Basicity of Nu^- should be less than L^-
   (C) α carbon should be electrophilic
   (D) α carbon should be nucleophilic

4. Select the correct statement about diborane (B_2H_6).
   (A) B_2H_6 has 3C, $2e^-$ bond (B) Each B is in sp^3 hybridised state
   (C) All 6H atoms are equivalent in B_2H_6 (D) All 6H are in the same plane

5. Aryl halides are less reactive towards nucleophilic substitution reactions as compared to alkyl halides due to
   (A) sp^2-Hybridized carbon attached to halogen
   (B) resonance stabilization
   (C) longer carbon – halogen bond
   (D) All of these

6. Which of the following reactions would generate an electrophile?
   (A) $CH_3 – CH_2 – Cl$ + anhydrous $AlCl_3$
   (B) $C_6H_5Br + CuBr_2$
   (C) $C_6H_5COOH + H_3O^+$
   (D) conc. HNO_3 + conc. H_2SO_4

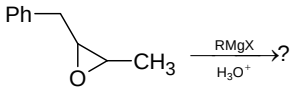
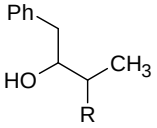
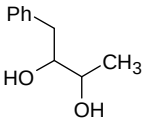
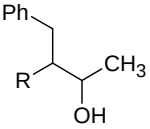
7. The correct statement among the following is
   (A) Alkene is more reactive than alkyne for electrophilic addition reaction
   (B) Alkynes gives nucleophilic as well as electrophilic addition reaction
   (C) Alkynes is more reactive then alkene for nucleophilic addition reaction
   (D) For electrophilic addition reaction the intermediate is carbanion

Space for rough work

PART – A: (Single Correct Answer Type)

*This section contains **06 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. Egyptian blue, $CaCu.Si_4O_{10}$, is an example of :
   (A) sheet silicate (B) pyrosilicate
   (C) cyclic silicate (D) chain silicate

9. 
   (A) 
   (B) 
   (C) 
   (D) None of these

10. Attacking species in the nitration of benzene is
   (A) NO_2^+ (B) NO_2^-
   (C) NO_3^- (D) HNO_3

11. The maximum number of stereoisomers possible for 3-hydroxy-2-methyl butanoic acid is
   (A) 1 (B) 2
   (C) 3 (D) 4

12. Which of the following methods is/are not suitable for preparation of alcohol?
   (A) $CH_3COOC_2H_5 + NaBH_4 \longrightarrow$ (B) $CH_3COOC_2H_5 + Na/EtOH \longrightarrow$
   (C) $CH_3CH_2COCl + LiAlH_4 \longrightarrow$ (D) $CH_3COOH + H_2 \xrightarrow{Ni}$

13. The compound that reacts with ammonical $AgNO_3$
   (A) 1-Butyne (B) 2-Butyne
   (C) benzene (D) Ethene

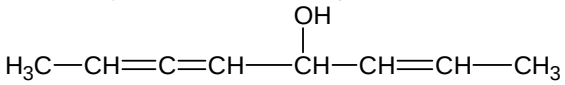
Space for rough work

PART – C: (Integer Answer Type)

*This section contains **05 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the OMR is to be bubbled*

1. What is maximum number of O atoms bounded with each Si in SiO_2?

2. How many stereoisomers are possible for the following compound?



3. The total number of monobromo substituted derivatives of O-xylene in presence of Lewis acid or light are?

4. n-butane on monobromination gives three isomers. The number of product(s) obtained when the major product is heated with KOH in CH_3CH_2OH is/are……..

5. How many isomeric dienes with a six membered ring are possible of the compound with the molecular formula C_7H_{10}, while two consecutive double bonds are not possible in six membered ring.

Space for rough work

SECTION – III : MATHEMATICS

PART – A: (Multi Correct Answer Type)

*This section contains **07 multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.*

1. If $y = f(x) = x^4 - 2x^3 + x^2 + 3$, and α, β are two minima of f(x) and A represents the area bounded by y = f(x), the x-axis and the ordinates corresponding to the minimum of function f(x) is
   (A) $\alpha = 0, \beta = 1$ (B) $\alpha = 1, \beta = 1/2$
   (C) $A = 3\frac{1}{30}$ (D) $A = 3\frac{2}{30}$

2. The differential equation for the family of curves y = c sin x can be given by
   (A) $\left(\frac{dy}{dx}\right)^2 = y^2 \cot^2 x$ (B) $\left(\frac{dy}{dx}\right)^2 - \left(\sec x \frac{dy}{dx}\right)^2 + y^2 = 0$
   (C) $\left(\frac{dy}{dx}\right)^2 = \tan^2 x$ (D) $\frac{dy}{dx} = y \cot x$

3. If $a^2 + b^2 - c^2 - 2ab = 0$, then the family of straight lines ax + by + c = 0 is concurrent at the points
   (A) (–1, 1) (B) (1, –1)
   (C) (1, 1) (D) (–1, –1)

4. If tangent of any member of family of hyperbola $xy = 4\sin^2\theta$, $\theta \in (0, 2\pi) - \{\pi\}$ is not a normal to member of family of circles $x^2 + y^2 - 2x - 2y + \mu = 0$, where μ is any real parameter then θ belongs to
   (A) $\left(\frac{5\pi}{6}, \frac{7\pi}{6}\right)$ (B) $\left(0, \frac{\pi}{6}\right)$
   (C) $\left(\frac{11\pi}{6}, 2\pi\right)$ (D) $\left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$

Space for rough work

5. Suppose that a normal drawn at a point P(at^2, 2at) to parabola $y^2 = 4ax$ meets it again at Q. If the length of PQ is minimum, then

(A) $t = \sqrt{2}$ (B) $t = -\sqrt{2}$

(C) $PQ = 6\sqrt{3}\,a$ (D) Q is $(2a, -2\sqrt{2}\,a)$

6. Let α and $f(\alpha)$ be the eccentricity of the ellipse $\frac{x^2}{3b^2-2a^2}+\frac{y^2}{2b^2-a^2}=1,\ (3b^2>2a^2)$ and $\frac{x^2}{2b^2-a^2}+\frac{y^2}{b^2}=1\,(2b^2>a^2)$ respectively, then

(A) $f(\alpha)=\frac{\alpha}{\sqrt{1-\alpha^2}}, b\in R-\{0\}$ (B) $f(\alpha)=\frac{\alpha}{2\sqrt{1-\alpha^2}}, b\in R-\{0\}$

(C) $\int e^{\alpha}(f(\alpha)-f''(\alpha))\,d\alpha = e^{\alpha}\left[\frac{1}{(1-\alpha)^{3/2}}+\frac{\alpha}{\sqrt{1-\alpha^2}}\right]+c$

(D) none of these

7. The director circle of a hyperbola is $x^2 + y^2 - 4y = 0$. One end of the major axis is (2, 0) then a focus is

(A) $(\sqrt{3}, 2-\sqrt{3})$ (B) $(-\sqrt{3}, 2+\sqrt{3})$

(C) $(\sqrt{6}, 2-\sqrt{6})$ (D) $(-\sqrt{6}, 2+\sqrt{6})$

PART – A: (Single Correct Answer Type)

*This section contains **06 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.***

8. A curve passing through the point (1, 1) is such that the intercept made by a tangent to it on x-axis is three times the x-coordinate of the point of tangency, then the equation of the curve is

(A) $y=\frac{1}{x^2}$ (B) $y=\sqrt{x}$

(C) $y=\frac{1}{\sqrt{x}}$ (D) none of these

Space for rough work

9. The angle between the lines represented by the equation $6x^2 - 7xy - 3y^2 = 0$ is

(A) $\tan^{-1}\left(\frac{11}{3}\right)$ (B) $\tan^{-1}\left(\frac{4}{3}\right)$

(C) $\tan^{-1}\left(\frac{21}{5}\right)$ (D) none of these

10. The point C divides AB internally in the ratio 3 : 1 and two circles are drawn on AC and CB as diameters. The common tangent meet AB at D. If r_1 and r_2 ($r_1 > r_2$) are radii of circles, then BD is equal to

(A) r_2 (B) r_1

(C) $r_1 + r_2$ (D) $r_1 - r_2$

11. The equation of parabola is given by $y^2 + 8x - 12y + 20 = 0$. Tick the correct option given below

(A) vertex (2, 4) (B) focus (0, 6)

(C) latus rectum 4 (D) axis $y = 8$

12. The focal chord of $y^2 = 16x$ is tangent to $(x - 6)^2 + y^2 = 2$, then the possible values of the slope of this chord, are

(A) 1, –1 (B) –1/2, 2

(C) –2, 1/2 (D) 1/2, 2

13. $2x + \sqrt{6}y = 2$ touches the hyperbola $x^2 - 2y^2 = 4$, then the point of contact is

(A) $\left(\frac{1}{2}, \frac{1}{\sqrt{6}}\right)$ (B) $(4, -\sqrt{6})$

(C) $(4, \sqrt{6})$ (D) $(-2, \sqrt{6})$

Space for rough work

PART – C: (Integer Answer Type)

*This section contains **05 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the OMR is to be bubbled.*

1. Number of common tangents to the circles $x^2 + y^2 – 4x + 2y – 4 = 0$ and $x^2 + y^2 + 2x – 6y + 6 = 0$

2. The shortest distance from the line $3x + 4y = 25$ to the circle $x^2 + y^2 + 6x + 8y = 0$ is k, then k is

3. Distinct normals are drawn from a point to a parabola $y^2 = 4ax$. The coordinates of the foot of two normals are $\left(at_1^2, 2at_1\right)$, $t_1 = –1$ and $\left(at_2^2, 2at_2\right)$, $t_2 = 3$ on the parabola. The coordinate of the foot of the third normal is $\left(ak^2, 2ak\right)$, then –k is

4. If the equation of the curve on reflection of the ellipse $\frac{(x-4)^2}{16}+\frac{(y-3)^2}{9}=1$ about the line $x – y – 2 = 0$ is $16x^2 + 9y^2 + k_1x – 36y + k_2 = 0$, then $(k_1 + k_2)/66$ is equal to

5. If the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide, then the value of b^2 is equal to

Space for rough work

FIITJEE INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

CPT–1 | **PHASE-II** | **CODE: 100880.1** | **PAPER–1**

ANSWERS

PHYSICS (SECTION–I)

1.	**A, B, C**	2.	**A, B, C**	3.	**A, B, C**	4.	**A, C**
5.	**B, D**	6.	**A, C, D**	7.	**B, D**	8.	**C**
9.	**C**	10.	**C**	11.	**B**	12,	**D**
13.	**C**	1.	**4**	2.	**8**	3.	**4**
4.	**5**	5.	**2**				

CHEMISTRY (SECTION–II)

1.	**B, C**	2.	**A, B**	3.	**A, C**	4.	**A, B**
5.	**A, B**	6.	**A, C, D**	7.	**A, B, C**	8.	**A**
9.	**A**	10.	**A**	11.	**D**	12.	**A**
13.	**A**	1.	**4**	2.	**8**	3.	**3**
4.	**3**	5.	**7**				

MATHEMATICS (SECTION–III)

1.	**A, C**	2.	**A, B, D**	3.	**A, B**	4.	**A, B, C**
5.	**A, B, C**	6.	**A**	7.	**C, D**	8.	**C**
9.	**A**	10.	**A**	11.	**B**	12.	**A**
13.	**B**	1.	**3**	2.	**5**	3.	**2**
4.	**2**	5.	**7**				