



JEE | NEET | Foundation

NSEJS 2020-21

Student Question Paper

RE-TYPED STUDENT QUESTION PAPER

TIME

60 minutes

QUESTIONS

32

MAX. MARKS

120

PAPER CODE 51

A clean, searchable copy of the original Paper Code 51.

Student name: _____

Class: _____

Date: _____

ORIGINAL EXAMINATION INSTRUCTIONS

Retyped and arranged for easy reading.

- Write Paper Code 51 on the OMR answer sheet. An incorrect or missing paper code may prevent evaluation.
- Mobile phones, smart watches and tablets were prohibited during the examination.
- Use only a blue or black ball-point pen for OMR entries. Fill candidate details carefully in block capitals and darken the appropriate bubbles.
- Part A-1: Questions 1-24 have one correct option. A correct answer carries 3 marks and a wrong answer has a penalty of 1 mark.
- Part A-2: Questions 25-32 may have one, two, three or four correct options. Six marks are awarded only when all correct alternatives and no incorrect alternative are marked. There is no negative marking in this part.
- A non-programmable scientific calculator was allowed in the original examination.
- Do not scratch, overwrite or change an OMR entry. Machine evaluation may treat such changes as wrong.
- The original examination was held on 17 January 2021 from 2:30 PM to 3:30 PM and was titled IOQJS 2020-21 Part I.

Physical constants provided in the paper

Gravitational constant, G	$6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
Solar mass, M_{Sun}	$2 \times 10^{30} \text{ kg}$
Acceleration due to gravity on Earth, g	9.8 m s^{-2}
Magnitude of electron charge, e	$1.6 \times 10^{-19} \text{ C}$
Mass of electron, m_e	$9.1 \times 10^{-31} \text{ kg}$
Energy conversion	$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$
Alpha particle	A doubly ionised helium atom

SECTION A-1

Questions 1-24 | Only one of the four options is correct.

- 1** Gravitational collapse is the contraction of an astronomical object under its own gravity. This draws the matter inwards towards the centre of gravity. A neutron star is an example of the collapsed core of a giant star. A certain neutron star of radius 10 km is of mass $1.5 M_{\text{Sun}}$. The acceleration due to gravity on the surface of the neutron star is nearly:

- (a) $2.0 \times 10^8 \text{ m s}^{-2}$ (b) $2.0 \times 10^{12} \text{ m s}^{-2}$
(c) $2.6 \times 10^{16} \text{ m s}^{-2}$ (d) $2.6 \times 10^{20} \text{ m s}^{-2}$

- 2** The tympanic membrane (ear drum) is a very delicate component of the human ear. Typically, its diameter is 1 cm. The maximum force the ear can withstand is 2.5 N. In case a diver has to enter sea water of density $1.05 \times 10^3 \text{ kg m}^{-3}$ without any protective gear, the maximum safe depth for the diver to go into water is about:

- (a) 12 m (b) 9 m
(c) 3 m (d) 1.5 m

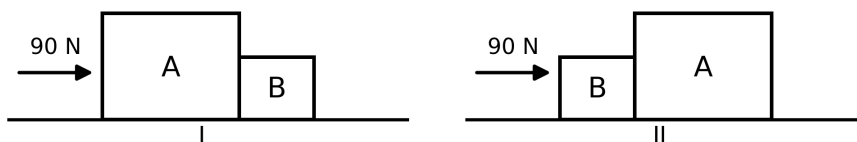
- 3** Two illuminated point objects O_1 and O_2 are placed at a distance 24 cm from each other along the principal axis of a thin convex lens of focal length 9 cm such that images of both the objects are formed at the same position. Then the respective distances of the lens from O_1 and O_2 (in cm) are:

- (a) 12 and 12 (b) 18 and 6
(c) 14 and 10 (d) 16 and 8

- 4** A nuclear reactor is working at 30% efficiency (i.e. conversion of nuclear energy to electrical energy). In this reactor $^{235}_{92}\text{U}$ nucleus undergoes fission and releases 200 MeV energy per atom. If 1000 kW of electrical power is obtained in this reactor, then the number of atoms disintegrated (undergone fission) per second in the reactor is:

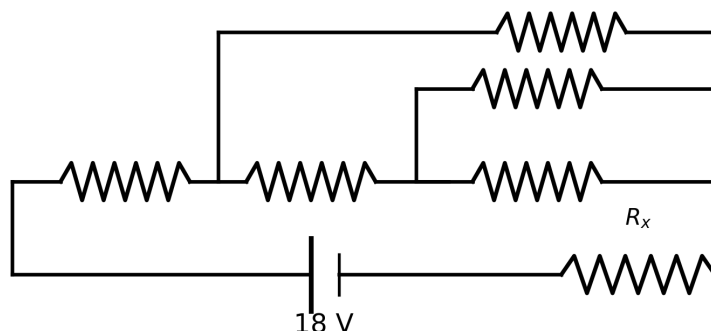
- (a) 1.04×10^{17} (b) 6.5×10^{12}
(c) 3.125×10^{12} (d) 3.25×10^{32}

- 5** Two blocks A and B are in contact with each other and are placed on a frictionless horizontal surface. A force of 90 N is applied horizontally on block A (situation I) and the same force is applied horizontally on block B (situation II). Mass of A is 20 kg and B is 10 kg. Then the correct statement is:



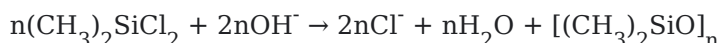
- (a) Since both blocks are in contact, the force by A on B is 90 N in situation I and the force by B on A is 90 N in situation II.
(b) The force by A on B is 30 N in situation I and the force by B on A is 60 N in situation II.
(c) The force by A on B is 60 N in situation I and the force by B on A is 30 N in situation II.
(d) The 90 N force will produce accelerations of different magnitudes in A and B.

- 6** In the adjoining circuit, $R = 5\ \Omega$. It is desired that the voltage across R_x should be 6 V, then the value of R_x should be:



- (a) $4\ \Omega$ (b) $12\ \Omega$
(c) $16\ \Omega$ (d) $20\ \Omega$

- 7** In one process for waterproofing, a fabric is exposed to $(\text{CH}_3)_2\text{SiCl}_2$ vapours. The vapours react with the hydroxyl groups on the surface of the fabric or with traces of water to form the waterproofing film $[(\text{CH}_3)_2\text{SiO}]_n$, by the reaction:



where n stands for a larger integer. The waterproofing film is deposited on the fabric layer upon layer. Each layer is $6\ \text{\AA}$ thick [the thickness of the $(\text{CH}_3)_2\text{SiO}$ group]. How much $(\text{CH}_3)_2\text{SiCl}_2$ is needed to waterproof one side of a piece of fabric, 1 m by 2 m, with a film 300 layers thick? The density of the film is $1.0\ \text{g cm}^{-3}$.

- (a) 0.63 g (b) 0.36 g
(c) 6.3 g (d) 3.6 g

- 8** Given that at a certain temperature, in a 1.5 L vessel, 5.0 mole of A, 7.0 mole of B and 0.1 mole of C are present. Then the value of equilibrium constant for the reaction $\text{A} + \text{B} \rightleftharpoons 2\text{C} + \text{heat}$ is about:

- (a) 7.22×10^{-4} (b) 2.31×10^{-4}
(c) 7.22×10^{-5} (d) 6.11×10^{-4}

- 9** An alcohol (A) on dehydration with concentrated H_2SO_4 at a high temperature yields compound (B). On ozonolysis every molecule of compound (B) yields two molecules of acetaldehyde. Which of the following is the starting alcohol (A)?

- (a) 1-butanol
(b) 2-butanol
(c) Propanal
(d) 2-propanol

10 In an experiment with 100 mL 0.1 M solution of Copper Chloride, by mistake 5 g of a mixture containing equal weights of Tin, Silver, Lead and Calcium was added. Finally, after some time, the solution gets completely decolourised. This is mainly due to:

- (a) Silver reacts with copper chloride.
- (b) Calcium reacts with copper chloride.
- (c) All the metals react with copper chloride.
- (d) Only lead reacts with copper chloride, forming white precipitate of lead chloride.

11 Triclosan ($C_{12}H_7Cl_3O_2$) is an antibacterial and antifungal agent. It is a polychloro phenoxy phenol. It is widely used as a preservative and antimicrobial agent in personal care products such as soaps, skin creams, and deodorants etc. A label on a 200 mL hand-sanitizer bottle claims that it contains Triclosan 0.2% w/v. What will be the number of molecules of Triclosan present in the bottle? (N_A is Avogadro's Number.)

- (a) $1.4 \times 10^{25} N_A$
- (b) $1.4 \times 10^{24} N_A$
- (c) $1.4 \times 10^{23} N_A$
- (d) $1.4 \times 10^{22} N_A$

12 Suppose that A and B form compounds B_2A_3 and B_2A . If 0.05 mole of B_2A_3 weighs 12 g and 0.1 mole of B_2A weighs 10 g, what are the atomic weights of A and B respectively?

- (a) 70 and 25
- (b) 50 and 20
- (c) 40 and 30
- (d) 30 and 40

13 If in a wheat mutant, the length of chromosome 1B was found to be 6.7 μm instead of 5.0 μm , approximately how many additional base pairs are incorporated in the mutant chromosome?

- (a) 0.5×10^4 bp
- (b) 5×10^4 bp
- (c) 1.7×10^4 bp
- (d) 5.78×10^4 bp

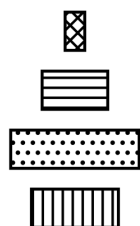
14 Considering the following characteristics, identify the correct inheritance pattern from the given options.

- Most affected individuals are male.
- Affected sons result from female parents who are either affected or who are known to be carriers because they have affected brothers, fathers, or maternal uncles.
- Affected daughters are born to affected fathers and either affected or carrier mothers.
- The sons of affected mothers should be affected.
- Approximately half the sons of carrier mothers should be affected.

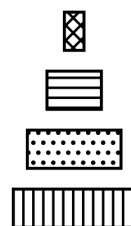
- (a) Autosomal recessive inheritance
- (b) Autosomal dominant inheritance
- (c) Sex-linked recessive inheritance
- (d) Sex-linked dominant inheritance

- 15** In a marine ecosystem with rich diversity of fauna, which of the following images would be a correct representation of the pyramid of biomass?

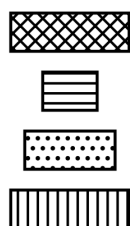
(a)



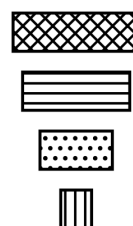
(b)



(c)



(d)



(a) Diagram (a)

(b) Diagram (b)

(c) Diagram (c)

(d) Diagram (d)

- 16** The transpiration pull is maximum under which of the following conditions?

(a) Closed stomata, low light intensity and humid air

(b) Open stomata, dry air and moist soil

(c) Open stomata, dry air and dry soil

(d) Open stomata, high humidity in air and moist soil

- 17** *Curcuma longa*, *Azadirachta indica*, Basmati Rice and Indian Ginseng are all related to which of the following concepts?

(a) Bioterrorism

(b) Biomagnification

(c) Biopiracy

(d) Biodegradation

- 18** Read the following criteria carefully.

- Slow evolutionary change relative to similar entities.
- Gross similarity to an ancestral fossil.
- Very low taxonomic richness today compared to the past.
- Phylogenetic inference of specific characters as plesiomorphic.
- Phylogenetic inference of a genealogical divergence between other groups that diverged in the distant past.
- Known in the fossil record before being discovered alive.

These criteria can be used to categorise a group of organisms most probably into:

(a) Connecting links

(b) Living fossils

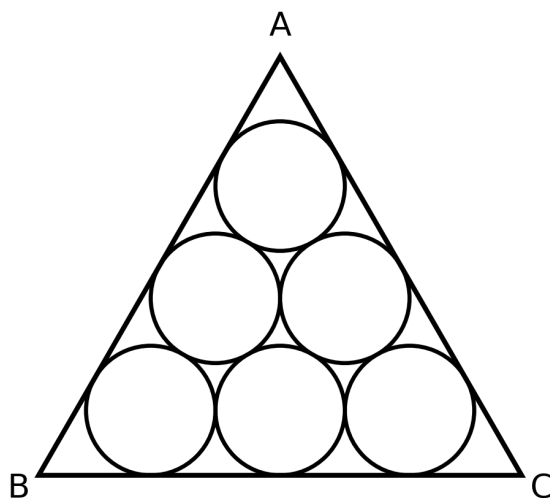
(c) Endangered species

(d) Extinct species

19 If $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have one common root, then:

- (a) $a + b = 0$ (b) $a + b = 1$
(c) $a + b = -1$ (d) $a^2 + b^2 = 1$

20 Six circles each of radius 3 cm are inscribed in an equilateral triangle ABC such that they touch each other and also touch the sides of the triangle as shown in the adjacent figure. Then the height of triangle ABC is:



- (a) $6(2\sqrt{3} + 3)$ (b) $3(2\sqrt{3} + 6)$
(c) $3(2\sqrt{3} + 3)$ (d) $6(2 + \sqrt{3})$

21 Find the remainder when x^{51} is divided by $x^2 - 3x + 2$.

- (a) x (b) $(2^{51} - 2)x + 2 - 2^{51}$
(c) $(2^{51} - 1)x + 2 - 2^{51}$ (d) 0

22 If $3/(x - 2) < 1$, where x is a real number, then:

- (a) $2 < x < 5$ (b) $x < 2$ or $5 < x$
(c) $x < -2$ or $x > 5$ (d) None of these

23 If $100^{25} - 25$ is written in decimal notation, then the sum of its digits is:

- (a) 444 (b) 442
(c) 424 (d) 422

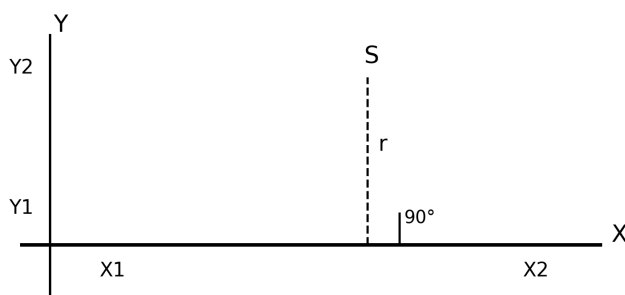
24 ABC is a triangle, the bisector of angle A meets BC in D. The relation between AD, AB and AC is:

- (a) $AD > \sqrt{AB \cdot AC}$ (b) $AD > AB \cdot AC$
(c) $AD = \sqrt{AB \cdot AC}$ (d) $AD < \sqrt{AB \cdot AC}$

SECTION A-2

Questions 25-32 | Any number of options may be correct. Select every correct option and no incorrect option.

- 25** An infinitely long conductor carrying current I produces a magnetic field B around it. If such a conductor is placed along the X-axis, then the magnitude of B at a distance r is given by $B = (\mu_0/4\pi)(2I/r)$, where $\mu_0/4\pi = 10^{-7} \text{ N A}^{-2}$ is a constant. The adjoining figure shows such an infinitely long conductor placed along the X-axis carrying current I . At S, $B = 2 \times 10^{-4} \text{ T}$, directed into the plane of the paper. Given $r = 1 \text{ cm}$, the correct statements are:



- (a) $I = 10 \text{ A}$
 (b) The number of electrons transported across the conductor cross-section in 1 s is 6.25×10^{19} .
 (c) The direction of conventional current I is from $X2$ to $X1$.
 (d) The electrons flow in the direction $X2$ to $X1$.

- 26** The ratio of the charge of an ion or subatomic particle to its mass (q/m) is called specific charge. Then the correct options are:

- (a) SI unit of specific charge can be written as $\text{A}\cdot\text{s kg}^{-1}$.
 (b) If all the isotopes of hydrogen are ionised, tritium has the least specific charge among them.
 (c) Specific charge of an alpha particle is greater than that of an electron.
 (d) Specific charge of an electron is $1.75 \times 10^{11} \text{ C kg}^{-1}$.

- 27** Acetylene torches and burners used by glassblowers produce intense ultraviolet light. Glassblowers wear special glasses that contain which of the following elements to absorb the UV?

- (a) Neodymium
 (b) Praseodymium
 (c) Cerium
 (d) Didymium

- 28** Equal lengths of magnesium ribbons are taken in four test tubes A, B, C and D. In test tube A, 1 M acetic acid is added; in test tube B, 1 M HCl is added; in test tube C, 1 M HNO_3 is added; and in test tube D, 1 M NaOH is added. The observed results will be:

- (a) Fizzing occurs more vigorously in A.
 (b) Fizzing occurs more vigorously in B.
 (c) Fizzing occurs more vigorously in C.
 (d) Fizzing occurs more vigorously in D.

29 Choose the correct statements from the following options.

- (a) A robust adaptive immune response is initiated using weakened forms of the bacterium known as live attenuated vaccines.
- (b) Administration of a killed or chemically inactivated virus can trigger a weaker adaptive immune response, but it can be strengthened with booster doses.
- (c) A conjugate or multivalent component always reduces immunogenicity of the vaccine.
- (d) Inclusion of alum, cytokines and/or lipids always reduces the immune response to a vaccine.

30 The minimum energy required to exist, that is, the energy required to perform chemical reactions even when a person is at rest, is called the basal metabolic rate (BMR), which accounts for about 50 to 70 per cent of the daily energy expenditure in most sedentary individuals. It is influenced by many factors. Some statements are made about these factors. Choose the correct statements from the following options.

- (a) Thyroid hormone decreases metabolic rate.
- (b) Growth hormone increases metabolic rate.
- (c) Fever decreases metabolic rate.
- (d) Malnutrition decreases metabolic rate.

31 If $0 \leq x \leq \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$, then $x =$

[Useful information: π radians = 180° , $\sin(180^\circ - \theta) = \sin \theta$, and $\sin \theta \geq 0$ for $0^\circ \leq \theta \leq 180^\circ$.]

- (a) $\pi/6$
- (b) $\pi/3$
- (c) $5\pi/6$
- (d) $2\pi/3$

32 Given $(a - b)^2 + (a - c)^2 = (b - c)^2$, which of the following statements are true?

- (a) The equation is valid when $b = c$ and $a \neq c$.
- (b) The equation is valid when $a = b$.
- (c) The equation is valid when $a = c$.
- (d) The equation is not valid when a , b and c are distinct.

