

**BOARD OF INTERMEDIATE AND SECONDARY EDUCATION, MULTAN**  
**OBJECTIVE KEY FOR INTERMEDIATE ANNUAL EXAMINATION, 2022**

Name of Subject: physics

Session: A/22

Group: 1st

Group: 2nd

Q. Nos	Paper Code 4471	Paper Code 4473	Paper Code 4475	Paper Code 4477
1	C	B	A	A
2	D	B	A	C
3	D	B	B	B
4	A	D	A	A
5	A	C	D	A
6	C	D	C	B
7	B	D	B	A
8	A	A	B	D
9	A	A	B	C
10	B	C	D	B
11	A	B	C	B
12	D	A	D	B
13	C	A	D	D
14	B	B	A	C
15	B	A	A	D
16	B	D	C	D
17	D	C	B	A
18	/	/	/	/
19	/	/	/	/
20	/	/	/	/

Q. Nos	Paper Code 4472	Paper Code 4474	Paper Code 4476	Paper Code 4478
1	A	B	B	A
2	D	C	C	A
3	D	A	B	D
4	A	D	B	B
5	A	D	C	C
6	D	A	C	B
7	B	A	A	B
8	C	D	D	C
9	B	B	A	C
10	B	C	B	A
11	C	B	C	D
12	C	B	A	A
13	A	C	D	B
14	D	C	D	C
15	A	A	A	A
16	B	D	A	D
17	C	A	D	D
18	/	/	/	/
19	/	/	/	/
20	/	/	/	/

سرٹیفکیٹ بابت صحیح سوالیہ پرچہ امارنگ Key

ہم نے مضمون physics پرچہ II گروپ I and II سکیم New انٹرمیڈیٹ سالانہ امتحان 2022 کا

سوالیہ پرچہ انٹرنیٹ و معروضی (Subjective & Objective) کو بنظر عینت چیک کر لیا ہے یہ پرچہ Syllabus کے عین مطابق Set کیا گیا ہے۔ اس سوالیہ پرچہ میں کسی قسم کی کوئی غلطی نہ ہے۔ ہم نے سوالیہ پرچہ کا اردو اور انگریزی Version بھی چیک کر لیا ہے۔ یہ Version آپس میں مطابقت رکھتے ہیں۔ نیز اس پرچہ کی معروضی (MCQs) Key کی بابت تصدیق کی جاتی ہے کہ اس میں بھی کسی قسم کی کوئی غلطی نہ ہے۔ مزید یہ کہ ہم نے Key بنانے سے متعلق دفتر کی جانب سے تیار کردہ ہدایات وصول کر کے ان کا بغور مطالعہ کر لیا ہے اور ان کی روشنی میں Key بنائی ہے۔ نیز سب ایگزامینرز کیلئے تفصیلی مارکنگ ہدایات / مارکنگ سکیم / Rubrics بھی تیار کر دی گئی ہیں۔

Prepared & Checked By:

Dated: 04.07.22

S.#	Name	Designation	Institution	Mobile No	Signature
1	Shahid Shah	Associate Prof.	Govt. Civil Lines College Multan	03077360030	
2	Kamran Khan	Asstt. Prof.	Govt. A.H.I.A. College Multan	0331-8611722	
3	M. Siddique Abid	Asstt. Prof.	Govt. Graduate College of Sciences Multan	03347184702	
4	Kaleem Ullah	Asstt. Prof.	Govt. Graduate College of Sciences Multan	0301-7400172	
5					

Re-Checked By: ہم نے درج بالا سوالیہ پرچہ (انٹرنیٹ + معروضی) معروضی "Key" اور ہدایات کے حوالہ سے مکمل طور پر تہیہ کر لی ہے۔ کسی قسم کی کوئی غلطی نہ ہے۔

1	افضیاء حسین پراچہ	A/P	گورنمنٹ جلیہ کالج ملتان	03336060855	
2	بشیر احمد المرین پٹوٹو کی طرف سے	A/P	المرین پٹوٹو کی طرف سے ملتان	03006305057	
3					

INTERMEDIATE PART-II (12<sup>th</sup> CLASS)

## PHYSICS PAPER-II GROUP-II

TIME ALLOWED: 2.40 Hours

SUBJECTIVE

MAXIMUM MARKS: 68

NOTE: Write same question number and its part number on answer book,  
as given in the question paper.

SECTION-I

2. Attempt any eight parts.

8 × 2 = 16

- (i) Show that  $\frac{\text{Volt}}{\text{Meter}} = \frac{\text{Newton}}{\text{Coulomb}}$
- (ii) What is the time constant? Prove that its unit for RC series circuit is second.
- (iii) Write down similarities between gravitational force and electrical force.
- (iv) How can you identify that which plate of a capacitor is positively charged?
- (v) Why the voltmeter should have a very high resistance?
- (vi) Is it possible to orient a current loop in a uniform magnetic field such that the loop will not tend to rotate? Explain.
- (vii) State Ampere's Law. Write down its mathematical expression.
- (viii) What is the effect on magnetic field inside solenoid if the length of the solenoid is doubled and number of turns remain the same?
- (ix) Show that  $1U = 931 \text{ MeV}$
- (x) What is B.E curve? In which part of the curve Binding Energy maximum? (xi) What is Chain Reaction?
- (xii) A particle which produces more ionization less penetrating.

3. Attempt any eight parts.

8 × 2 = 16

- (i) Calculate the resistance of a carbon resistor with first bond Red, second bond, Violet, third bond Orange and fourth bond have Silver colour.
- (ii) What are the difficulties in testing whether the filament of a lighted bulb obeys Ohm's Law?
- (iii) How a wheatstone bridge can be used to determine an unknown resistance?
- (iv) Prove that  $V_{rms} = 0.7V_0$ , where  $V_0$  is the peak value.
- (v) What is meant by A.M and F.M.?
- (vi) Explain the conditions under which electromagnetic waves are produced from a source.
- (vii) Explain amorphous solids with an example.
- (viii) Distinguish between intrinsic and extrinsic semi-conductors.
- (ix) Define super conductors. Give their two applications. (x) Write down four applications of Photodiodes.
- (xi) What is the effect of forward and reverse biasing of a diode on the width of depletion region.
- (xii) When the output of an exclusive OR gate is in (a) one state (b) zero state

4. Attempt any six parts.

6 × 2 = 12

- (i) Four unmarked wires emerge from a transformer. What steps would you take to determine the turns ratio?
- (ii) Can a D.C motor be turned into a D.C generator? What changes are required to be done?
- (iii) Define self inductance and also define its unit. (iv) Distinguish between slip rings and split rings.
- (v) Why do we not observe a Compton effect with visible light?
- (vi) What advantages an electron microscope has over an optical microscope?
- (vii) Define threshold frequency and work function. Also give its unit.
- (viii) How can the spectrum of Hydrogen contain so many lines when Hydrogen contains one electron?
- (ix) What is CAT scanner? Explain.

SECTION-II

NOTE: Attempt any three questions.

3 × 8 = 24

- 5.(a) What is electric potential? Derive the relation between electric field and electric potential. 5
- (b) A rectangle bar of iron is 2.0cm by 2.0cm in cross-section and 40cm long.  
Calculate its resistance if the resistivity of iron is  $11 \times 10^{-8} \Omega m$  3
- 6.(a) What is the alternating generator? Explain principle, construction and working of A.C generator. 5
- (b) How fast must be a proton moving in a magnetic field of  $2.50 \times 10^{-3} T$  such that the magnetic force is equal to its weight. 3
- 7.(a) What is operational amplifier? Derive an expression for gain of inverting op-amp. 5
- (b) Find the value of current flowing through a capacitance of  $0.5 \mu F$  when connected to a source of 150V at 50 Hz 3
- 8.(a) Explain de-Broglie hypothesis. How Davisson and Germer experimentally verified the de-Broglie hypothesis? 5
- (b) A 1.0m long copper wire is subjected to stretching force and its length increases by 20cm.  
Calculate the tensile strain and percent elongation which the wire undergoes. 3
- 9.(a) What is a radiation detector? Explain detection principle, construction and working of Geiger-Muller Counter. 5
- (b) An electron jumps from a level  $E_i = -3.5 \times 10^{-19} J$  to  $E_f = -1.20 \times 10^{-18} J$ .  
What is the wavelength of the emitted light? 3

## PHYSICS PAPER-II GROUP-II

TIME ALLOWED: 20 Minutes

MAXIMUM MARKS: 17

OBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) The mass of oil droplet in measuring charge in Millikan method is calculated by:  
 (A) Stokes's law (B) Coulomb's law (C) Newton's gravitational law (D) Faraday's law
- (2) Capacitance of parallel plate capacitor can be increased by:  
 (A) Decreasing area of plates (B) Increasing separation between plates  
 (C) increasing potential (D) Inserting dielectric material
- (3) Thermistors with negative temperature coefficient are very accurate for measuring:  
 (A) Room temperature (B) High temperature  
 (C) Low temperature 100K (D) Low temperature 10K
- (4) Range of voltmeter can be increased by:  
 (A) Increasing high resistance (B) Decreasing high resistance  
 (C) Increasing full scale deflection current (D) Changing resistance of coil
- (5) Principle of galvanometer is same as:  
 (A) D.C motor (B) A.C motor (C) Transformer (D) Generator
- (6) The principle of transformer is:  
 (A) Conservation of energy (B) Conservation of charge  
 (C) Momentum conservation (D) Mutual induction
- (7) For A.C generator  $I = I_0 \sin(2\pi ft)$ , instantaneous current at  $t = T/4$  is:  
 (A) Zero (B)  $I_0$  (C)  $\frac{I_0}{2}$  (D)  $\frac{I_0}{\sqrt{2}}$
- (8) When a capacitor is connected to A.C source. How many times, it will saturate in 5 cycles.  
 (A) 5 (B) Zero (C) 10 (D) 6
- (9) The principle of metal detector is:  
 (A) Resonance (B) Beats (C) Faraday's law (D) Lenz's law
- (10) Technological application of super conductor is:  
 (A) Micro wave oven (B) MRI (C) Logic gates (D) Transistor
- (11) A two input NAND gate with inputs A and B has an input 0 if:  
 (A) A is zero (B) B is zero (C) Both A and B are one (D) Both A and B are zero
- (12) The colour of light emitted by a LED depends on:  
 (A) The reverse bias (B) The amount of forward current  
 (C) Type of semiconductor material (D) The forward bias
- (13) Diffraction of electrons indicates:  
 (A) Wave nature (B) Particle nature (C) Dual nature (D) Crystal nature
- (14) de Broglie wavelength of moving cricket ball is not noticed due to:  
 (A) Low mass (B) High speed (C) Time delay (D) Low speed ?
- (15) Laser beam can be used in:  
 (A) Holography (B) X-ray machine (C) Fission (D) Solid structure study
- (16) Xenon has:  
 (A) 30 isotopes (B) 36 isotopes (C) 10 isotopes (D) 12 isotopes
- (17) Charge on up, down and strange combination of quark is:  
 (A)  $e$  (B)  $-e$  (C) Zero (D)  $2e$

Code

2022 (A)

Roll No. 304

Number:

4474

INTERMEDIATE PART-II (12<sup>th</sup> CLASS)

## PHYSICS PAPER-II GROUP-II

TIME ALLOWED: 20 Minutes

MAXIMUM MARKS: 17

OBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

- (1) Xenon has:  
 (A) 30 isotopes (B) 36 isotopes (C) 10 isotopes (D) 12 isotopes
- (2) Charge on up, down and strange combination of quark is:  
 (A)  $e$  (B)  $-e$  (C) Zero (D)  $2e$
- (3) The mass of oil droplet in measuring charge in Millikan method is calculated by:  
 (A) Stokes's law (B) Coulomb's law (C) Newton's gravitational law (D) Faraday's law
- (4) Capacitance of parallel plate capacitor can be increased by:  
 (A) Decreasing area of plates (B) Increasing separation between plates  
 (C) increasing potential (D) Inserting dielectric material
- (5) Thermistors with negative temperature coefficient are very accurate for measuring:  
 (A) Room temperature (B) High temperature  
 (C) Low temperature 100K (D) Low temperature 10K
- (6) Range of voltmeter can be increased by:  
 (A) Increasing high resistance (B) Decreasing high resistance  
 (C) Increasing full scale deflection current (D) Changing resistance of coil
- (7) Principle of galvanometer is same as:  
 (A) D.C motor (B) A.C motor (C) Transformer (D) Generator
- (8) The principle of transformer is:  
 (A) Conservation of energy (B) Conservation of charge  
 (C) Momentum conservation (D) Mutual induction
- (9) For A.C generator  $I = I_0 \sin(2\pi ft)$ , instantaneous current at  $t = T/4$  is:  
 (A) Zero (B)  $I_0$  (C)  $\frac{I_0}{2}$  (D)  $\frac{I_0}{\sqrt{2}}$
- (10) When a capacitor is connected to A.C source. How many times, it will saturate in 5 cycles.  
 (A) 5 (B) Zero (C) 10 (D) 6
- (11) The principle of metal detector is:  
 (A) Resonance (B) Beats (C) Faraday's law (D) Lenz's law
- (12) Technological application of super conductor is:  
 (A) Micro wave oven (B) MRI (C) Logic gates (D) Transistor
- (13) A two input NAND gate with inputs  $A$  and  $B$  has an input 0 if:  
 (A)  $A$  is zero (B)  $B$  is zero (C) Both  $A$  and  $B$  are one (D) Both  $A$  and  $B$  are zero
- (14) The colour of light emitted by a LED depends on:  
 (A) The reverse bias (B) The amount of forward current  
 (C) Type of semiconductor material (D) The forward bias
- (15) Diffraction of electrons indicates:  
 (A) Wave nature (B) Particle nature (C) Dual nature (D) Crystal nature
- (16) de Broglie wavelength of moving cricket ball is not noticed due to:  
 (A) Low mass (B) High speed (C) Time delay (D) Low speed
- (17) Laser beam can be used in:  
 (A) Holography (B) X-ray machine (C) Fission (D) Solid structure study

## PHYSICS PAPER-II GROUP-II

TIME ALLOWED: 20 Minutes

## OBJECTIVE

MAXIMUM MARKS: 17

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) For A.C generator  $I = I_0 \sin(2\pi ft)$ . instantaneous current at  $t = T/4$  is:  
 (A) Zero (B)  $I_0$  (C)  $\frac{I_0}{2}$  (D)  $\frac{I_0}{\sqrt{2}}$
- (2) When a capacitor is connected to A.C source. How many times, it will saturate in 5 cycles.  
 (A) 5 (B) Zero (C) 10 (D) 6
- (3) The principle of metal detector is:  
 (A) Resonance (B) Beats (C) Faraday's law (D) Lenz's law
- (4) Technological application of super conductor is:  
 (A) Micro wave oven (B) MRI (C) Logic gates (D) Transistor
- (5) A two input NAND gate with inputs A and B has an input 0 if:  
 (A) A is zero (B) B is zero (C) Both A and B are one (D) Both A and B are zero
- (6) The colour of light emitted by a LED depends on:  
 (A) The reverse bias (B) The amount of forward current  
 (C) Type of semiconductor material (D) The forward bias
- (7) Diffraction of electrons indicates:  
 (A) Wave nature (B) Particle nature (C) Dual nature (D) Crystal nature
- (8) de Broglie wavelength of moving cricket ball is not noticed due to:  
 (A) Low mass (B) High speed (C) Time delay (D) Low speed
- (9) Laser beam can be used in:  
 (A) Holography (B) X-ray machine (C) Fission (D) Solid structure study
- (10) Xenon has:  
 (A) 30 isotopes (B) 36 isotopes (C) 10 isotopes (D) 12 isotopes
- (11) Charge on up, down and strange combination of quark is:  
 (A)  $e$  (B)  $-e$  (C) Zero (D)  $2e$
- (12) The mass of oil droplet in measuring charge in Millikan method is calculated by:  
 (A) Stokes's law (B) Coulomb's law (C) Newton's gravitational law (D) Faraday's law
- (13) Capacitance of parallel plate capacitor can be increased by:  
 (A) Decreasing area of plates (B) Increasing separation between plates  
 (C) increasing potential (D) Inserting dielectric material
- (14) Thermistors with negative temperature coefficient are very accurate for measuring:  
 (A) Room temperature (B) High temperature  
 (C) Low temperature 100K (D) Low temperature 10K
- (15) Range of voltmeter can be increased by:  
 (A) Increasing high resistance (B) Decreasing high resistance  
 (C) Increasing full scale deflection current (D) Changing resistance of coil
- (16) Principle of galvanometer is same as:  
 (A) D.C motor (B) A.C motor (C) Transformer (D) Generator
- (17) The principle of transformer is:  
 (A) Conservation of energy (B) Conservation of charge  
 (C) Momentum conservation (D) Mutual induction

## PHYSICS PAPER-II GROUP-II

TIME ALLOWED: 20  
MAXIMUM MARKSOBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use pencil or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero marks for that question. No credit will be awarded in case BUBBLES are not filled. Do not solve questions on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) Range of voltmeter can be increased by:  
 (A) Increasing high resistance (B) Decreasing high resistance  
 (C) Increasing full scale deflection current (D) Changing resistance of coil
- (2) Principle of galvanometer is same as:  
 (A) D.C motor (B) A.C motor (C) Transformer (D) Generator
- (3) The principle of transformer is:  
 (A) Conservation of energy (B) Conservation of charge  
 (C) Momentum conservation (D) Mutual induction
- (4) For A.C generator  $I = I_0 \sin(2\pi ft)$ . instantaneous current at  $t = T/4$  is:  
 (A) Zero (B)  $I_0$  (C)  $\frac{I_0}{2}$  (D)  $\frac{I_0}{\sqrt{2}}$
- (5) When a capacitor is connected to A.C source. How many times, it will saturate in 5 cycles.  
 (A) 5 (B) Zero (C) 10 (D) 6
- (6) The principle of metal detector is:  
 (A) Resonance (B) Beats (C) Faraday's law (D) Lenz's law
- (7) Technological application of super conductor is:  
 (A) Micro wave oven (B) MRI (C) Logic gates (D) Transistor
- (8) A two input NAND gate with inputs A and B has an input 0 if:  
 (A) A is zero (B) B is zero (C) Both A and B are one (D) Both A and B
- (9) The colour of light emitted by a LED depends on:  
 (A) The reverse bias (B) The amount of forward current  
 (C) Type of semiconductor material (D) The forward bias
- (10) Diffraction of electrons indicates:  
 (A) Wave nature (B) Particle nature (C) Dual nature (D) Crystal nature
- (11) de Broglie wavelength of moving cricket ball is not noticed due to:  
 (A) Low mass (B) High speed (C) Time delay (D) Low speed
- (12) Laser beam can be used in:  
 (A) Holography (B) X-ray machine (C) Fission (D) Solid structure
- (13) Xenon has:  
 (A) 30 isotopes (B) 36 isotopes (C) 10 isotopes (D) 12 isotopes
- (14) Charge on up, down and strange combination of quark is:  
 (A)  $e$  (B)  $-e$  (C) Zero (D)  $2e$
- (15) The mass of oil droplet in measuring charge in Millikan method is calculated by:  
 (A) Stokes's law (B) Coulomb's law (C) Newton's gravitational law (D) Faraday's law
- (16) Capacitance of parallel plate capacitor can be increased by:  
 (A) Decreasing area of plates (B) Increasing separation between plates  
 (C) increasing potential (D) Inserting dielectric material
- (17) Thermistors with negative temperature coefficient are very accurate for measuring:  
 (A) Room temperature (B) High temperature  
 (C) Low temperature 100K (D) Low temperature 10K

INTERMEDIATE PART-II (12<sup>th</sup> CLASS)

## PHYSICS PAPER-II GROUP-I

TIME ALLOWED: 2.40 Hours

SUBJECTIVE

MAXIMUM MARKS: 68

**NOTE:** Write same question number and its part number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts.

8 × 2 = 16

- (i) What can you infer for  $R \times C$  in charging and discharging of a capacitor?
- (ii)  $4.8 \times 10^{-19} C$  charge falls through potential difference of  $3.0V$ . Calculate energy acquired by it in electron volt.
- (iii) How can you identify that which plate of the capacitor is positively charged?
- (iv) Do electrons tend to go to region of high potential or of low potential?
- (v) How galvanometer can be made more sensitive?
- (vi) Why Ohm meter gives full deflection on zero resistance?
- (vii) How can you use a magnetic field to separate isotopes of chemical element?
- (viii) If a charged particle moves in a straight line through some region of space. Can you say the magnetic field in the region is zero?
- (ix) A particle which produces more ionization is less penetrating. Why?
- (x) Why are heavy nuclei unstable?
- (xi) What will be resultant nucleus if a neutron is absorbed in  ${}_{92}^{238}U$  and  $\beta$  particle emitted?
- (xii) In Uranium fission reaction, the estimated energy is  $200MeV$  where as in fusion P – P Chain reaction  $25.7MeV$ . Why fusion is more energetic than fission?

3. Attempt any eight parts.

8 × 2 = 16

- (i) Why does The terminal potential difference of a battery decrease when the current drawn from it is increased.
- (ii) A wire of length  $5m$  has resistance  $200\Omega$ . If the wire is stretched to increase its length three times. What will be its new resistance?
- (iii) How many electrons pass through an electric bulb in 2 minutes if the  $100mA$  current passing through it?
- (iv) Explain the conditions under which electromagnetic waves are produced from a source.
- (v) Define Impedance. Give its unit.
- (vi) What is Choke?
- (vii) What is Plasticity and Elasticity?
- (viii) What is the elastic constant and give its unit.
- (ix) What do you understand by the term UTS and fracture stress?
- (x) What is the biasing requirement of the Junctions of a transistor for its normal operation?
- (xi) A transistor has collector current  $10mA$  and Base current  $40\mu A$ . Find the current gain.
- (xii) Why a photo diode is operated in reverse biased state?

4. Attempt any six parts.

6 × 2 = 12

- (i) Does the induced  $emf$  always act to decrease the magnetic flux through a circuit?
- (ii) Can a DC motor be turned into a DC generator? What changes are required to be done?
- (iii) How can we improve the efficiency of a transformer?



(2)

- (iv) State Faraday's Law.
- (v) As a solid is heated and begins to glow, why does it first appear red?
- (vi) Is it possible to create a single electron from energy? Explain.
- (vii) What is the difference between inertial frame of reference and non-inertial frame of reference?
- (viii) What are the advantages of lasers over ordinary light?
- (ix) Define Spectroscopy.

### SECTION-II

**NOTE:** Attempt any three questions.

3 × 8 = 24

- 5.(a) Find electric potential at a point due to a point charge and prove that  $V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$  5
- (b) A platinum wire has resistance of  $10\Omega$  at  $0^\circ C$  and  $20\Omega$  at  $273^\circ C$ . Find the value of temperature coefficient of resistance of platinum. 3
- 6.(a) State the Ampere's Law. Also calculate the magnetic field due to current carrying Solenoid by using Ampere's Law 5
- (b) An ideal step down transformer is connected to main supply of 240V. It is desired to operate a 12V, 30W lamp. Find current in the primary and the transformation ratio? 3
- 7.(a) Derive an expression for impedance and phase angle in RC series and RL – series circuits excited by A.C voltage. 5
- (b) In a certain circuit, the transistor has a collector current of  $10mA$  and a base current of  $40\mu A$ . Calculate the current gain of the transistor. 3
- 8.(a) State and explain Photoelectric effect. Write down its experimental results and failures of classical theory. 5
- (b) A 1.25cm diameter cylinder is subjected to a load of 2500kg. Calculate the stress on the bar in mega pascals. 3
- 9.(a) What is inner shell transitions? Explain the production of X – rays. 5
- (b) The half – life of  ${}_{38}^{91}Sr$  is 9.7 hours. Find its decay constant. 3



## PHYSICS PAPER-II GROUP-I

TIME ALLOWED: 20 Minutes

MAXIMUM MARKS: 17

OBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) The number of electrons in one coulomb charge is equal to:  
 (A)  $1.6 \times 10^{-19}$  (B)  $6.25 \times 10^{-19}$  (C)  $6.25 \times 10^{18}$  (D)  $6.25 \times 10^{19}$
- (2) S.I unit of Electric flux is  
 (A)  $NmC^{-1}$  (B)  $Nm^{-1}C^{-1}$  (C)  $Nm^3C^{-1}$  (D)  $Nm^2C^{-1}$
- (3) Gold band shows a tolerance of colour:  
 (A)  $\pm 50\%$  (B)  $\pm 10\%$  (C)  $\pm 15\%$  (D)  $\pm 5\%$
- (4) The charge moving perpendicular to magnetic field experience force:  
 (A) Maximum (B) Minimum (C) Zero (D) Infinite
- (5) To convert a galvanometer into a voltmeter a high resistance is connected:  
 (A) In series (B) In parallel (C) In perpendicular (D) Along tangent
- (6) The common door bell requires a voltage of about:  
 (A) 7 volts (B) 6 volts (C) 9 volts (D) 10 volts
- (7) The practical application of the phenomenon of mutual induction is:  
 (A) Electric motor (B) Transformer (C) A.C generator (D) D.C generator
- (8) The device which flow of A.C allows is:  
 (A) Capacitor (B) Inductor (C) D.C motor (D) Battery
- (9) The impedance of R - L series circuit is:  
 (A)  $Z = \sqrt{R^2 + X_L^2}$  (B)  $Z = \sqrt{R^2 + X_C^2}$  (C)  $Z = \sqrt{R + X_L}$  (D)  $Z = \sqrt{R + X_C}$
- (10) The crystalline structure of NaCl is:  
 (A) Tetragonal (B) Cubical (C) Hexagonal (D) Trigonal
- (11) The size of base of transistor is of the order of:  
 (A)  $10^{-6} m$  (B)  $10^{-5} m$  (C)  $10^{-4} m$  (D)  $10^{-3} m$
- (12) Two inputs NAND gate with inputs A and B has an output "0" if:  
 (A) A is 0 (B) B is 0 (C) Both A and B are 0 (D) Both A and B are 1
- (13) Compton wavelength is:  
 (A)  $\frac{h}{m_0 C^2}$  (B)  $\frac{hC}{m_0}$  (C)  $\frac{h}{m_0 C}$  (D)  $\frac{hC}{m_0 \lambda}$
- (14) The energy required for pair production is:  
 (A) 0.51 MeV (B) 1.02 MeV (C) 2.04 MeV (D) 3.06 MeV
- (15) Balmer series lies in region of electromagnetic spectrum:  
 (A) Infrared region (B) Visible region (C) Ultraviolet region (D) Frainfrared region
- (16) 1 rem is equal to:  
 (A) 0.1 Sv (B) 0.01 Sv (C) 2.04 Sv (D) 3.06 Sv
- (17) The moderator used in a nuclear reactor is:  
 (A) Aluminium (B) Sodium (C) Calcium (D) Graphite

## PHYSICS PAPER-II GROUP-I

TIME ALLOWED: 20 Minutes

MAXIMUM MARKS: 17

OBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) The energy required for pair production is:  
 (A)  $0.51 \text{ MeV}$  (B)  $1.02 \text{ MeV}$  (C)  $2.04 \text{ MeV}$  (D)  $3.06 \text{ MeV}$
- (2) Balmer series lies in region of electromagnetic spectrum:  
 (A) Infrared region (B) Visible region (C) Ultraviolet region (D) Frainfrared region
- (3)  $1 \text{ rem}$  is equal to:  
 (A)  $0.1 \text{ Sv}$  (B)  $0.01 \text{ Sv}$  (C)  $2.04 \text{ Sv}$  (D)  $3.06 \text{ Sv}$
- (4) The moderator used in a nuclear reactor is:  
 (A) Aluminium (B) Sodium (C) Calcium (D) Graphite
- (5) The number of electrons in one coulomb charge is equal to:  
 (A)  $1.6 \times 10^{-19}$  (B)  $6.25 \times 10^{-19}$  (C)  $6.25 \times 10^{18}$  (D)  $6.25 \times 10^{19}$
- (6) S.I unit of Electric flux is  
 (A)  $\text{NmC}^{-1}$  (B)  $\text{Nm}^{-1}\text{C}^{-1}$  (C)  $\text{Nm}^3\text{C}^{-1}$  (D)  $\text{Nm}^2\text{C}^{-1}$
- (7) Gold band shows a tolerance of colour:  
 (A)  $\pm 50\%$  (B)  $\pm 10\%$  (C)  $\pm 15\%$  (D)  $\pm 5\%$
- (8) The charge moving perpendicular to magnetic field experience force:  
 (A) Maximum (B) Minimum (C) Zero (D) Infinite
- (9) To convert a galvanometer into a voltmeter a high resistance is connected:  
 (A) In series (B) In parallel (C) In perpendicular (D) Along tangent
- (10) The common door bell requires a voltage of about:  
 (A) 7 volts (B) 6 volts (C) 9 volts (D) 10 volts
- (11) The practical application of the phenomenon of mutual induction is:  
 (A) Electric motor (B) Transformer (C) A.C generator (D) D.C generator
- (12) The device which flow of A.C allows is:  
 (A) Capacitor (B) Inductor (C) D.C motor (D) Battery
- (13) The impedance of R - L series circuit is:  
 (A)  $Z = \sqrt{R^2 + X_L^2}$  (B)  $Z = \sqrt{R^2 + X_C^2}$  (C)  $Z = \sqrt{R + X_L}$  (D)  $Z = \sqrt{R + X_C}$
- (14) The crystalline structure of  $\text{NaCl}$  is:  
 (A) Tetragonal (B) Cubical (C) Hexagonal (D) Trigonal
- (15) The size of base of transistor is of the order of:  
 (A)  $10^{-6} \text{ m}$  (B)  $10^{-5} \text{ m}$  (C)  $10^{-4} \text{ m}$  (D)  $10^{-3} \text{ m}$
- (16) Two inputs NAND gate with inputs A and B has an output "0" if:  
 (A) A is 0 (B) B is 0 (C) Both A and B are 0 (D) Both A and B are 1
- (17) Compton wavelength is:  
 (A)  $\frac{h}{m_0 C^2}$  (B)  $\frac{hc}{m_0}$  (C)  $\frac{h}{m_0 C}$  (D)  $\frac{hc}{m_0 \lambda}$

## PHYSICS PAPER-II GROUP-I

TIME ALLOWED: 20 Minutes

MAXIMUM MARKS: 17

**OBJECTIVE**

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) The device which flow of A.C allows is:  
 (A) Capacitor (B) Inductor (C) D.C motor (D) Battery
- (2) The impedance of R - L series circuit is:  
 (A)  $Z = \sqrt{R^2 + X_L^2}$  (B)  $Z = \sqrt{R^2 + X_C^2}$  (C)  $Z = \sqrt{R + X_L}$  (D)  $Z = \sqrt{R + X_C}$
- (3) The crystalline structure of NaCl is:  
 (A) Tetragonal (B) Cubical (C) Hexagonal (D) Trigonal
- (4) The size of base of transistor is of the order of:  
 (A)  $10^{-6} m$  (B)  $10^{-5} m$  (C)  $10^{-4} m$  (D)  $10^{-3} m$
- (5) Two inputs NAND gate with inputs A and B has an output "0" if:  
 (A) A is 0 (B) B is 0 (C) Both A and B are 0 (D) Both A and B are 1
- (6) Compton wavelength is:  
 (A)  $\frac{h}{m_0 C^2}$  (B)  $\frac{hC}{m_0}$  (C)  $\frac{h}{m_0 C}$  (D)  $\frac{hC}{m_0 \lambda}$
- (7) The energy required for pair production is:  
 (A) 0.51 MeV (B) 1.02 MeV (C) 2.04 MeV (D) 3.06 MeV
- (8) Balmer series lies in region of electromagnetic spectrum:  
 (A) Infrared region (B) Visible region (C) Ultraviolet region (D) Frainfrared region
- (9) 1 rem is equal to:  
 (A) 0.1 Sv (B) 0.01 Sv (C) 2.04 Sv (D) 3.06 Sv
- (10) The moderator used in a nuclear reactor is:  
 (A) Aluminium (B) Sodium (C) Calcium (D) Graphite
- (11) The number of electrons in one coulomb charge is equal to:  
 (A)  $1.6 \times 10^{-19}$  (B)  $6.25 \times 10^{-19}$  (C)  $6.25 \times 10^{18}$  (D)  $6.25 \times 10^{19}$
- (12) S.I unit of Electric flux is  
 (A)  $NmC^{-1}$  (B)  $Nm^{-1}C^{-1}$  (C)  $Nm^3C^{-1}$  (D)  $Nm^2C^{-1}$
- (13) Gold band shows a tolerance of colour:  
 (A)  $\pm 50\%$  (B)  $\pm 10\%$  (C)  $\pm 15\%$  (D)  $\pm 5\%$
- (14) The charge moving perpendicular to magnetic field experience force:  
 (A) Maximum (B) Minimum (C) Zero (D) Infinite
- (15) To convert a galvanometer into a voltmeter a high resistance is connected:  
 (A) In series (B) In parallel (C) In perpendicular (D) Along tangent
- (16) The common door bell requires a voltage of about:  
 (A) 7 volts (B) 6 volts (C) 9 volts (D) 10 volts
- (17) The practical application of the phenomenon of mutual induction is:  
 (A) Electric motor (B) Transformer (C) A.C generator (D) D.C generator

## PHYSICS PAPER-II GROUP-I

TIME ALLOWED: 20 Minutes  
MAXIMUM MARKS: 17OBJECTIVE

**Note:** You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) To convert a galvanometer into a voltmeter a high resistance is connected:  
(A) In series (B) In parallel (C) In perpendicular (D) Along tangent
- (2) The common door bell requires a voltage of about:  
(A) 7 volts (B) 6 volts (C) 9 volts (D) 10 volts
- (3) The practical application of the phenomenon of mutual induction is:  
(A) Electric motor (B) Transformer (C) A.C generator (D) D.C generator
- (4) The device which flow of A.C allows is:  
(A) Capacitor (B) Inductor (C) D.C motor (D) Battery
- (5) The impedance of R - L series circuit is:  
(A)  $Z = \sqrt{R^2 + X_L^2}$  (B)  $Z = \sqrt{R^2 + X_C^2}$  (C)  $Z = \sqrt{R + X_L}$  (D)  $Z = \sqrt{R + X_C}$
- (6) The crystalline structure of NaCl is:  
(A) Tetragonal (B) Cubical (C) Hexagonal (D) Trigonal
- (7) The size of base of transistor is of the order of:  
(A)  $10^{-6} m$  (B)  $10^{-5} m$  (C)  $10^{-4} m$  (D)  $10^{-3} m$
- (8) Two inputs NAND gate with inputs A and B has an output "0" if:  
(A) A is 0 (B) B is 0 (C) Both A and B are 0 (D) Both A and B are 1
- (9) Compton wavelength is:  
(A)  $\frac{h}{m_0 C^2}$  (B)  $\frac{hC}{m_0}$  (C)  $\frac{h}{m_0 C}$  (D)  $\frac{hC}{m_0 \lambda}$
- (10) The energy required for pair production is:  
(A) 0.51 MeV (B) 1.02 MeV (C) 2.04 MeV (D) 3.06 MeV
- (11) Balmer series lies in region of electromagnetic spectrum:  
(A) Infrared region (B) Visible region (C) Ultraviolet region (D) Frainfrared region
- (12) 1 rem is equal to:  
(A) 0.1 Sv (B) 0.01 Sv (C) 2.04 Sv (D) 3.06 Sv
- (13) The moderator used in a nuclear reactor is:  
(A) Aluminium (B) Sodium (C) Calcium (D) Graphite
- (14) The number of electrons in one coulomb charge is equal to:  
(A)  $1.6 \times 10^{-19}$  (B)  $6.25 \times 10^{-19}$  (C)  $6.25 \times 10^{18}$  (D)  $6.25 \times 10^{19}$
- (15) S.I unit of Electric flux is  
(A)  $NmC^{-1}$  (B)  $Nm^{-1}C^{-1}$  (C)  $Nm^3C^{-1}$  (D)  $Nm^2C^{-1}$
- (16) Gold band shows a tolerance of colour:  
(A)  $\pm 50\%$  (B)  $\pm 10\%$  (C)  $\pm 15\%$  (D)  $\pm 5\%$
- (17) The charge moving perpendicular to magnetic field experience force:  
(A) Maximum (B) Minimum (C) Zero (D) Infinite

**BOARD OF INTERMEDIATE AND SECONDARY EDUCATION, MULTAN**  
**OBJECTIVE KEY FOR INTERMEDIATE ANNUAL EXAMINATION, 2022**

Name of Subject: Phy

Session: 4/22

Group: 1st

Group: 2nd

(Special paper)

Special paper

30/6

Q. Nos	Paper Code	Paper Code	Paper Code	Paper Code
1	B			
2	B			
3	A			
4	D			
5	A			
6	C			
7	B			
8	A			
9	C			
10	C			
11	B			
12	D			
13	A			
14	B			
15	C			
16	A			
17	B			
18				
19				
20				

Q. Nos	Paper Code	Paper Code	Paper Code	Paper Code
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

سرٹیفکیٹ بابت صحیح سوالیہ پرچہ مارکنگ Key

ہم نے مضمون Physics پرچہ II گروپ I سکیم new انٹرمیڈیٹ سالانہ امتحان 2022 کا سوالیہ پرچہ انشائیہ و معروضی (Subjective & Objective) کو بنظر عینت چیک کر لیا ہے یہ پرچہ Syllabus کے عین مطابق Set کیا گیا ہے۔ اس سوالیہ پرچہ میں کسی قسم کی کوئی غلطی نہ ہے۔ ہم نے سوالیہ پرچہ کا اردو اور انگریزی Version بھی چیک کر لیا ہے۔ یہ Version آپس میں مطابقت رکھتے ہیں۔ نیز اس پرچہ کی معروضی (MCQs) Key کی بابت تصدیق کی جاتی ہے کہ اس میں بھی کسی قسم کی کوئی غلطی نہ ہے۔ مزید یہ کہ ہم نے Key بنانے سے متعلق دفتر کی جانب سے تیار کردہ ہدایات وصول کر کے ان کا بغور مطالعہ کر لیا ہے اور ان کی روشنی میں Key بنائی ہے۔ نیز سب ایگزامینرز کیلئے تفصیلی مارکنگ ہدایات / مارکنگ سکیم / Rubrics بھی تیار کر دی گئی ہیں۔

Prepared & Checked By:

Dated: \_\_\_\_\_

S.#	Name	Designation	Institution	Mobile No	Signature
1	Shahmd Shah	Associate Prof.	Govt. Civil Lines College Multan	0307736003	
2	Kamran Khan	Asstt Prof.	Govt A.H.I.A. College Multan	0331-8611722	
3	M. Siddique Akid	Asstt Prof.	Govt Graduate College of Science Multan	03347184702	
4	Kaleem Ullah	Asstt. Prof.	Govt. Graduate College of Science Multan	0701-7400172	
5					

Re-Checked By: ہم نے درج بالا سوالیہ پرچہ (انشائیہ + معروضی) معروضی "Key" اور ہدایات کے حوالہ سے مکمل طور پر تہیہ کر لی ہے۔ کسی قسم کی کوئی غلطی نہ ہے۔

1	بشیر احمد	A.P	الحسن لوہاری ملتان	03006305057	
2	اعتنا رحمن	A.P	گورنمنٹ ملتان	03336060851	
3					

تاریخ \_\_\_\_\_

Special paper

PAPER CODE - 8471

12<sup>th</sup> CLASS - 12022

543177

321

PHYSICS  
GROUP : FIRST

TIME: 20 MINUTES  
MARKS: 17

OBJECTIVE

NOTE: You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

QUESTION NO. 1

- 1  $\frac{\text{Second}}{\text{Ohm}}$  is equal to.  
(A) Coulomb (B) Farad (C) Joule (D) Ampere
- 2 S.I unit of electric flux is.  
(A)  $\text{N C}^{-1}$  (B)  $\text{N.m}^2.\text{C}^{-1}$  (C)  $\text{N.m.C}^{-1}$  (D)  $\text{N.C}^{-1}.\text{m}^2$
- 3 If there is a single black colour band around the body of a resistor, then the value of its resistance will be.  
(A) Zero ohm (B) 10 ohm (C) 100 ohm (D) Infinity
- 4 If 300 turns of wire are wound on 30cm length, then number of turns per unit length is  
(A) 10 (B) 20 (C) 100 (D) 1000
- 5 Which of the following is not accurate potential measuring device?  
(A) Voltmeter (B) C.R.O (C) Potentiometer (D) Digital multimeter
- 6 The rod of unit length is moving at  $30^\circ$  through a magnetic field of 1T. If the velocity of rod is 1 m/s, then induced emf in the rod will be.  
(A) 1 V (B) 0.25 V (C) 0.5 V (D) 0.6 V
- 7 In alternating current circuit, inductors behave like.  
(A) Semi conductors (B) Resistors (C) Insulators (D) Conductors
- 8 Resistance of pure choke is.  
(A) Zero (B) Large (C) Very small (D) Infinite
- 9 The device which allows only the flow of D.C. is.  
(A) Capacitor (B) Transformer (C) Inductor (D) Generator
- 10 Curie temperature for iron is.  
(A) 1153 K (B) 1023 K (C) 750 K (D) 700 K
- 11 If  $R_1 = 10 \text{ k } \Omega$  and  $R_2 = 100 \text{ k } \Omega$ , the gain of inverting amplifier is  
(A) -11 (B) -10 (C) 10 (D) 11
- 12 The open loop gain of op-amp is of the order of.  
(A)  $10^2$  (B)  $10^3$  (C)  $10^4$  (D)  $10^5$
- 13 0.1 Kg is equivalent to the energy of.  
(A)  $9 \times 10^{15} \text{ J}$  (B)  $9 \times 10^{16} \text{ J}$  (C)  $6 \times 10^{16} \text{ J}$  (D)  $3 \times 10^8 \text{ J}$
- 14 The rest mass energy of an electron positron pair is.  
(A) 0.51 Mev (B) 1.02 Mev (C) 0.2 Mev (D) 1.51 Mev
- 15 First spectral series of hydrogen atom was identified by.  
(A) Lyman (B) Rydberg (C) Balmer (D) Paschen
- 16 Slow neutrons can cause fission in.  
(A) Uranium - 235 (B) Uranium - 238 (C) Neptunium (D) Lithium
- 17 Radio therapy is generally done with  $\gamma$ -rays emitted from.  
(A) Sodium - 24 (B) Cobalt - 60 (C) Iodine - 131 (D) Strontium - 90

**QUESTION NO. 2 Write short answers any Eight (8) parts of the following**

16

- i The potential is constant throughout a given region of space. Is electric field zero or non zero in this region. Explain.
- ii Write any two comparisons of electric force and gravitational force.
- iii Calculate the electric intensity inside a hollow charged sphere.
- iv Electric lines of force never cross. Why ?
- v Write any two uses of C.R.O.
- vi Define current sensitivity of a galvanometer.
- vii Describe the change in magnetic field inside a solenoid carrying a steady current  $I$ , if length of solenoid is doubled and number of turns remains same.
- viii Why the resistance of ammeter should be very low ?
- ix Define nuclear reactor. Also write down its two main types of reactors.
- x Define fluorescence.
- xi Why are heavy nuclei unstable ? Explain briefly.
- xii Discuss the advantages and disadvantages of nuclear power as compared to the use of fossil fuel generated power.

**QUESTION NO. 3 Write short answers any Eight (8) parts of the following**

16

- i Why does the resistance of a conductor rise with temperature ?
- ii Differentiate between ohmic and non-ohmic devices with example.
- iii Give statements of Kirchhoff's, 1st rule and 2nd rule.
- iv A sinusoidal current has rms value of 10A. What is the maximum or peak value ?
- v What is Choke ? Why is it used in A.C. circuit ?
- vi What is impedance ? Give its SI Units.
- vii Distinguish between crystalline and amorphous solids.
- viii What is meant by hysteresis loss ?
- ix Why ordinary silicon diodes do not emit light ?
- x The anode of a diode is 0.2V positive with respect to the cathode. Is it forward biased ?
- xi Differentiate between Forward and Reverse Biasing.
- xii Define elastic limit and yield point.

**QUESTION NO. 4 Write short answers any Six (6) parts of the following**

12

- i Define motional emf and write its formula ?
- ii Explain the factors responsible for power loss in transistor ?
- iii Four unmarked wires emerge from a transformer. What steps would you take to determine the turn ratio ?
- iv Does the induced emf in a circuit depend on the resistance of the circuit ? Does the induced current depend upon the resistance of the circuit ?
- v Give four applications of photocell ?
- vi Define work function and threshold frequency.
- vii Define special theory of relativity and write its postulates ?
- viii Distinguish between stimulated and spontaneous emission ?
- ix What are the advantages of laser over ordinary light ?

**SECTION-II**

**Note: Attempt any Three questions from this section**

8 × 3 = 24

Q.5.(A)	Define capacitance of a capacitor. Derive an expression for the energy stored in the capacitor.	1+4
(B)	The resistance of an iron wire at 0 °C is $1 \times 10^4 \Omega$ . What is resistance at 500 °C of the temperature coefficient of resistance of iron is $5.2 \times 10^{-3} \text{ k}^{-1}$ .	3
Q.6.(A)	For a current carrying solenoid, derive expression for magnetic field. How can you explain the direction of magnetic field by right hand grip rule ?	5
(B)	An ideal step down transformer is connected with main supply of 240 V. It is desired to operate a 12 V, 30 W lamp. Find the current in the primary and the transformer ratio.	3
Q.7.(A)	What is the operational amplifier ? Derive the relation for gain of an inverting amplifier.	1+4
(B)	Find the capacitance required to construct a resonance circuit of frequency 1000 KHz with inductor of 5 mH.	3
Q.8.(A)	What is photoelectric effect ? How its results were explained by Einstein ?	1+4
(B)	A 2.5m long and cross-section area $10^{-5} \text{ m}^2$ is stretched 1.5 mm by a force of 100 N in the elastic region. Calculate (a) Strain (b) Young's modulus.	3
Q.9.(A)	Describe the principle, construction and working of Wilson Cloud Chamber for detection nuclear radiation.	5
(B)	Find the speed of the electron in the first Bohr orbit.	3