GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

0780 PHYSICS 1

JUNE 2022 ADVANCED LEVEL

Centre Number	
Centre Name	
Candidate Number	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

One and half hours (1 ½ hours)

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the questions in this paper. Make sure you have a soft HB pencil and an eraser for this examination.

1. USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
2. DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Before the examination begins:

3. Check that this question booklet is headed "**Advanced Level – 0780 PHYSICS 1**"
4. Fill in the information required in the spaces above.
5. Fill in the information required in the spaces provided on the answer sheet using your HB pencil: **Candidate Number and Name, Centre Number and Name.** Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.

How to answer the questions in this examination

6. Answer **ALL** the **50** questions in this Examination. All questions carry equal marks.
7. Each question has FOUR suggested answers: **A, B, C** and **D**. Decide on which answer is correct. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square brackets for the answer you have chosen.

   For example, if **C** is your selected answer, mark **C** as shown below:

   [A] [B] [~~C~~] [D]

8. Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about an answer, erase the first mark carefully, then mark your new answer.
9. Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
10. Do all rough work in this booklet, using, where necessary, the blank spaces in the question booklet.
11. **At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet after. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**
12. The use of calculator and Formulae book are allowed.

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SECTION I (Thirty five questions)
Question: 1- 35

1. Which of the following is a pair of scalar quantities?
   A Electric field strength and pressure.
   B Torque and time.
   C Pressure and energy.
   D Volume and weight.

2. The accuracy of a potentiometer depends on the
   A thickness of the wire.
   B accuracy of the galvanometer.
   C uniformity of the wire.
   D sensitivity of the galvanometer.

3. Two balls M and N are projected horizontally off the edge of a table. The velocity with which M is projected is twice that of N. Which of the following is true about M and N?
   A M and N touch the ground at the same time.
   B M touches the ground first.
   C N travels further from the base of the table than M.
   D N touches the ground first.

4. An insulated metal bar whose ends are maintained at different temperatures transmits thermal energy along its length from one end to the other. Which of the following is true at steady state?
   A The temperature of all points along the bar remains constant and equal.
   B The rate of heat flow along the metal bar is constant.
   C The bar is in thermal equilibrium.
   D Heat is transmitted from the hot end to the cold end only by atoms vibrating about their mean positions.

5. A gun which is buried in the ground fires a bullet vertically into the air. If the bullet emerged from the ground with a velocity of 400 $m\,s^{-1}$, for how long was the bullet in air?
   A 81.6 s
   B 40.8 s
   C 20.3 s
   D 92.2 s

6. In an experiment to determine the temperature coefficient of resistance of a certain metal wire, the resistance R of the wire was made to vary with its temperature as shown in figure 1.

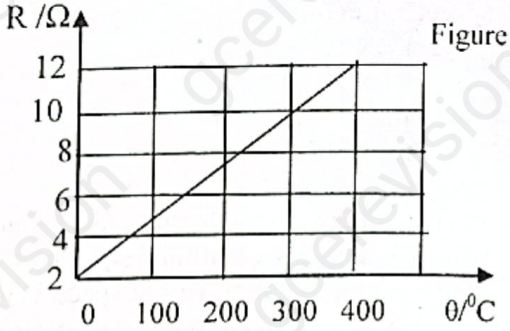

Figure 1

The temperature coefficient of resistance of the wire is;
   A $2 \times 10^{-2}\ K^{-1}$
   B $8 \times 10^{-2}\ K^{-1}$
   C $5 \times 10^{-3}\ K^{-1}$
   D $20\ K^{-1}$

7. Two identical spheres each of mass m, travelling with speed v towards each other collide head-on. If the collision is elastic then which of the following is correct?
   A The total K.E after impact is mv^2.
   B Total K.E before impact is zero.
   C Spheres stick together after collision.
   D The total momentum before impact is 2mv.

8. Which of the following is **NOT** conserved in nuclear processes?
   A Charge.
   B Mass.
   C Neutron number.
   D Nucleon number.

9. A uniform sphere of mass 5.0 kg is kept in position as shown in figure 2 by two strings P and Q.

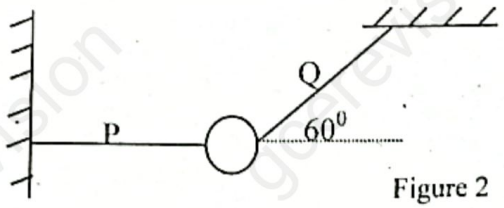

Figure 2

If the system is in equilibrium, the tension in Q is;
   A 98.1 N
   B 85.0 N
   C 28.3 N
   D 56.6 N

10. A space craft of mass 150 kg is launched into an orbit at a height of 800 km above the earth's surface. What is the kinetic energy of the spacecraft in orbit?
    A 1.2×10^9 J
    B 1.1×10^{10} J
    C 4.2×10^9 J
    D 1.2×10^8 J

11. During a football match, the referee sounds a whistle which has a natural frequency f_s. If the note from the sound travels at speed v_s, a player running away from the referee at speed, u, hears the frequency f_p given by;
    A $(\frac{v_s}{v_s+u})f_s$
    B $(\frac{v_s}{v_s-u})f_s$
    C $(\frac{v_s-u}{v_s})f_s$
    D $(\frac{v_s+u}{v_s})f_s$

12. The graph in figure 3 shows the stress - strain curve for an elastic material of length l and area of cross section, A.

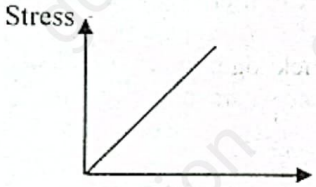

Figure 3

Which of the pairs of information best describes the gradient of the graph and the area under the graph?

	Gradient of graph	Area under the graph
A	Young's modulus of elasticity.	Energy per unit volume.
B	Young's modulus of elasticity	Energy per unit cross–sectional area.
C	Elastic constant.	Energy per Unit cross–sectional area.
D	Elastic constant.	Energy per unit volume.

13. An aeroplane which is moving due east at 100 ms^{-1} changes direction and starts to move due south at 50 m s^{-1}. What will be the magnitude and direction of the change in velocity?
    A 111.8 m s^{-1} at 26.6 ° S of W
    B 111.8 m s^{-1} at 26.6 ° S of E
    C 75 m s^{-1} at 26.6 ° S of E
    D 75 m s^{-1} at 63.4 ° S of E

14. A metal has a work function of 2.1 eV. What is the threshold wavelength of the metal?
    A 2.5×10^{-7} m
    B 1.9×10^{-7} m
    C 6.5×10^{-7} m
    D 5.9×10^{-7} m

15. Which of the following is **NOT** true about electromagnetic waves?
    A They are affected by electric and magnetic fields.
    B Within the limits set by diffraction, they travel in straight lines
    C They can be caused to produce interference effects.
    D They are capable of being polarized.

16. Monochromatic light illuminates two narrow parallel slits. The interference pattern which results is observed on a screen some distance beyond the slits. Which change increases the separation between the dark lines of the interference pattern?
    A Decreasing the distance between the screen and the slits.
    B Using monochromatic light of shorter wave length.
    C Using monochromatic light of higher frequency.
    D Decreasing the distance between the slit.

17. In a damped oscillatory motion;
    A period decreases with time.
    B frequency decreases with time.
    C amplitude decreases with time.
    D there are no resistive forces.

18. Figure 4 shows a stationary wave in a string fixed at both ends.

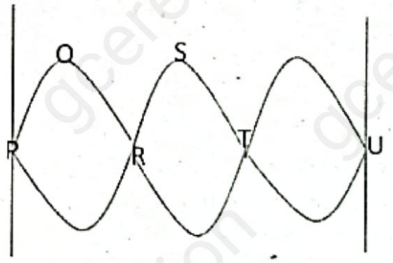

Figure 4

Which of the points have a phase difference of $\frac{\pi}{2}$?
    A P and S
    B R and S
    C P and R
    D Q and U

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19. Given that the speed of sound in air is 340m s^{-1}, what is the frequency of the sound at resonance in an open-ended pipe 1.2 m long when it is sounding its fundamental frequency?
    A 142 Hz
    B 170 Hz
    C 204 Hz
    D 283 Hz

20. Depending on their mode of transmission through space, waves are classified as being;
    A Transverse or longitudinal.
    B Mechanical or electromagnetic.
    C Progressive or stationary.
    D Short waves or long waves.

21. A ruler of length 30.0 cm is pivoted at its center. Equal and opposite forces of magnitude 30 N are applied to the ends of the ruler, creating a couple as shown in figure 5. The torque by the forces on the ruler is;

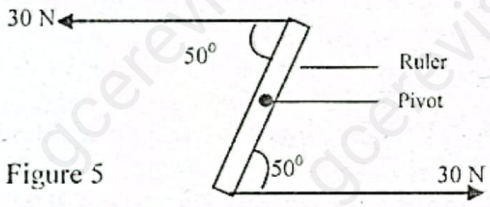

Figure 5

    A 3.0 N m
    B 6.0 N m
    C 7.2 N m
    D 4.6 N m

22. Figure 6 shows a network of capacitors connected to a 6 V cell.

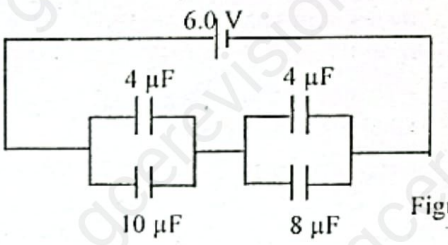

Figure 6

What is the effective capacitance of the combination of capacitors?
    A 18 μF
    B 5.6 μF
    C 6.5 μF
    D 36 μF

23. A girl whirls an object in a vertical circular path. If suddenly the string cuts, then the object will subsequently;
    A continue to move in its orbit with the same speed.
    B move tangentially with the same speed.
    C accelerate to the earth.
    D become stationary in its path.

24. Figure 7 shows a connection of three identical resistors R_1, R_2 and R_3.

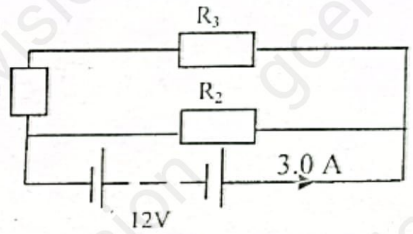

Figure 7

The current flowing through R_2 is;
    A 1.0 A
    B 3.0 A
    C 1.5 A
    D 2.0 A

25. Which of the following set are all base units of the S.I?
    A ampere, kilogram, joule.
    B ampere, kelvin, newton.
    C kelvin, second, ampere.
    D second, coulomb, ampere.

26. An aeroplane in flight sends radar waves to an airport tower and receives reflected signals registered on a cathode ray oscilloscope (CRO) screen. The trace on the CRO screen in the aeroplane is shown in figure 8.

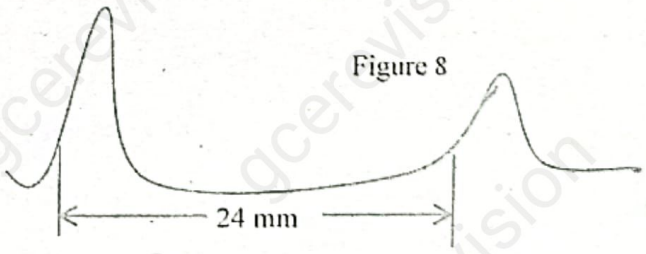

Figure 8

If the time base setting of the CRO is 10^{-6} second per millimeter (10^{-6} s mm^{-1}), how far is the plane from the airport?
    A 7.2 km
    B 3.6 km
    C 14.4 km
    D 1.8 km

27. Which of the following statement is true when a satellite of mass m, orbiting the earth at a distance r, from its centre encounters air resistance?
    A Its kinetic energy will increase.
    B Its potential energy will increase.
    C Its kinetic energy will decrease.
    D Its total energy will increase.

28. Figure 9 shows an LCR series circuit with ω=500 rad s^{-1} and L=20.0 mH.

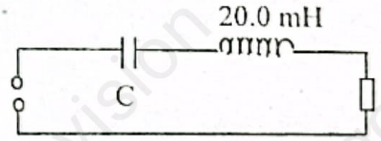

Figure 9

The value of the capacitance C for which the current I is maximum is;
2.00 μF
20.0 μF
0.2 μF
200 μF

29. A rocket is fired upward. As it accelerates upwards after leaving the launch path, which forms of energy are changing?
    A Chemical energy, gravitational potential energy and kinetic energy.
    B Chemical energy and gravitational potential energy only.
    C Chemical energy, kinetic energy and elastic potential energy.
    D Gravitational potential energy and kinetic energy only.

30. A bag hangs from a spring balance which is suspended from the ceiling of a lift. What is the mass of the bag if the reading on the spring balance is 160 N when the lift is moving upward with an acceleration of 3.0 m s^{-2}?
    A 16.3 kg
    B 12.5 kg
    C 23.5 kg
    D 53.2 kg

31. At a certain instant, four molecules in a gas have the following speeds measured in m s^{-1}:10, 10, 15 and 25. The root mean square speed of the molecules in m s^{-1} would be
    A 15
    B 225
    C 32.4
    D 7.5

32. X-rays can be produced by;
    A decelerating electrons.
    B electrons cutting electric field lines.
    C oscillating electrons.
    D electrons moving from higher to lower energy level.

33. A particle with a charge of 60 μC moving with a velocity v enters a magnetic field of strength 1.25 x 10^{-2} T at an angle of 60^0 to it. If the magnetic force exerted on the particle is 0.5 N, the value of v is;
    A 1.3 x 10^{6} m s^{-1}
    B 6.5 x 10^{-6} m s^{-1}
    C 7.7 x 10^{-5} m s^{-1}
    D 7.7 x 10^{5} m s^{-1}

34. The helium nucleus is represented as $^{4}_{2}He$. The unified atomic mass unit, U, of the helium nucleus is 4.0015 U, that of a proton is 1.0073 U and that of a neutron is 1.0087 U. What is the binding energy of helium in the atomic mass unit?
    A 8.0335 U
    B 0.0285 U
    C 16.0060 U
    D 0.0305 U

35. A resistance thermometer has a resistance of 80.0 Ω at the steam point, 68.0 Ω at the ice point and 70.1 Ω when immersed in a liquid. What is the temperature of the liquid?
    A 100 °C
    B 17.5 °C
    C 16.6 °C
    D 17.0 °C

SECTION II (Ten questions)
Multiple Selection

Questions 36- 45

Directions: For each group of questions below ONE or TWO of the responses given is/are correct. Then choose
A. If 1 and 2 are correct
B. If 2 and 3 are correct
C. If 1 only is correct
D. If 3 only is correct

Directions summarized			
A	B	C	D
1,2 correct	2,3 correct	1 only	3 only

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36. When two molecules X and Y are at a separation, r_o, where r_o is the equilibrium separation, an increase in the separation r, such that $r > r_o$, will imply that the;
    1 net force is repulsive.
    2 P.E of the molecules will increase.
    3 net force is attractive.

37. Figure 10 shows some energy levels of the hydrogen atom

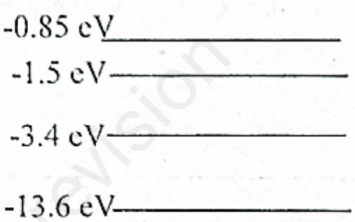


Figure 10

The energy levels are labelled with negative values of energy because;
    1 Work has to be done to take the electrons to higher energy level.
    2 The electron is bound to the atom.
    3 It is the minimum energy of the unbound electron.

38. Which of the following statement(s) is/are correct about eddy currents of the core of a transformer?
    1 It has no effect on the efficiency.
    2 Its effect can be minimized by lamination.
    3 It causes heating in the system.

39. The wave particle duality explains;
    1 deflection of an electron beam by an electric field.
    2 thermionic emission .
    3 electron diffraction patterns in crystals.

40. The graphs in figure 11 illustrate the distribution of molecular speeds in nitrogen at two different temperatures.

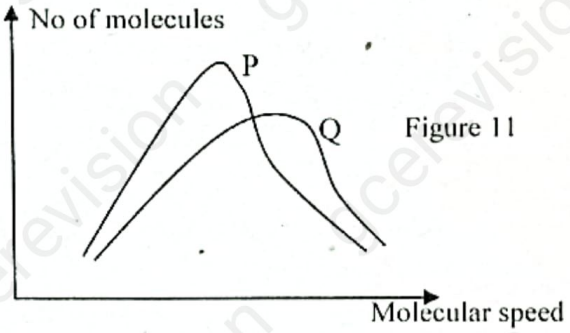


Figure 11

    1 Q is at higher temperature than P.
    2 More molecules lie within the range of most probable speed in P than in Q
    3 Molecules in P possess the greatest kinetic energy.

41. The pulsating Pd across a load can be rectified using diodes. In order to achieve a more steady output, a suitable capacitor is connected in
    1 parallel with the load.
    2 series with the load.
    3 parallel with the load only for full rectification.

42. Which of the statement(s) below do(es) **NOT** define the second law of thermodynamics?
    1 Heat always flows from a body at high temperature to a body at lower temperature.
    2 Heat cannot be completely converted to work in a complete cycle.
    3 The second law of thermodynamics is concerned with energy.

43. A domestic kettle rated 250 V, 2.3 kW, caused the temperature of 2.5 kg of water to increase by 50 ^{0}C. For how long was the heating done?
    1 3.4 minutes.
    2 228 minutes.
    3 2.88 minutes.

44. Figure 12 shows two wires carrying current.

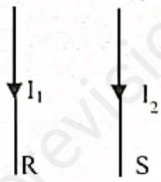


Figure 12

Which statement(s) is/are correct? The
    1 wires will attract each other.
    2 magnetic flux density between the wires is less than the magnetic flux density on the other side of the wires.
    3 wires will repel each other.

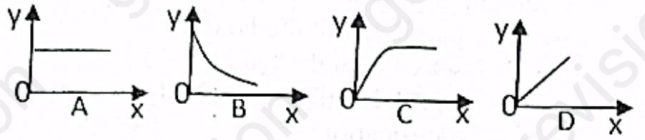
45. The angle of incidence in a crystal is 25^0 when the angle of refraction in air is 90^0. We can conclude that:
    1 Light will travel faster in the crystal than in water.
    2 The speed of light in the crystal would be about 1.3×10^8 m s^{-1}.
    3 If the angle of incidence in air to the crystal is 38^0, the angle of refraction in the crystal will be 15^0.

Questions 46-50

Directions: Each of the questions in this section has four sets of graphs A-D. Which of the graphs in each question best fits the relationship between x and y?

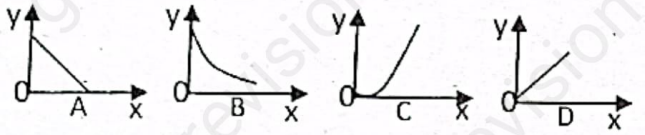
46.

Y	X
Half- life of a radioactive sample.	Number of radioactive atoms in a sample.



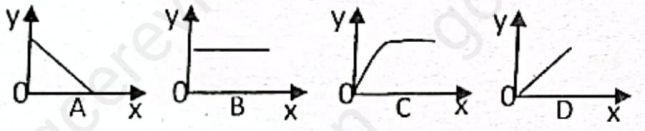
47.

Y	X
Current across a p–n junction.	Applied pd.



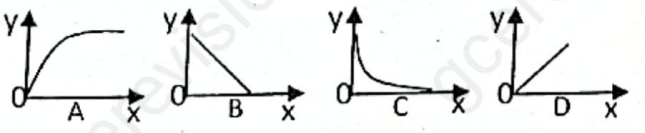
48.

Y	X
Resistance of a copper wire.	Temperature of the wire.



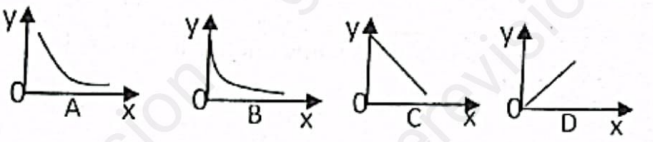
49.

Y	X
The charge on the plates of a parallel plate capacitor which is being charged.	Time of charging.



50.

Y	X
Electric field outside a charged sphere.	Distance from the surface of the charge.



GO BACK AND CHECK YOUR WORK