THE OPEN UNIVERSITY OF SRI LANKA

FOUNDATION PROGRAMME IN SCIENCE 2009/2010

FINAL EXAMINATION 2009

PSF2302/PSE2302

PHYSICS PAPER I

DURATION: ONE HOUR (1HR)

INDEX NO: ----------

DATE: 14-05-2010 **TIME: 1.30PM-2.30PM**

INSTRUCTIONS

Answer **ALL** Questions.

For each question there are five suggested answers labeled (a), (b), (c), (d) and (e). When you have selected your answer to a question draw a cross (X) on the number for the answer you have chosen in the separate **ANSWER SHEET provided.**

MARK ONLY ONE ANSWER FOR EACH QUESTION ON THE ANSWER SHEET.

When you have finished answering please attach your answer sheet at the top of this question paper. Only the answers marked in the ANSWER **SHEET** will be considered for the evaluation.

Assume, $g = 10\ m/s^{-2}$.

1. When a resistance of 9.5Ω is connected across a battery, the voltage across the resistance is 11.4 V. If the resistance connected across the same battery is 11.5 Ω the voltage across the resistance is 11.5 V. The emf of the battery and the internal resistance of the battery is

(a) 12.0 V & 0.5 Ω
(b) 11.45 V & 0.5 Ω
(c) 11.5 V & 0.5 Ω
(d) 12.0 V & 0.05 Ω
(e) 11.5 V & 0.05 Ω

2. A cell of emf 1.8 V and internal resistance 0.5 Ω is being charged by means of a supply voltage 2.5 V. The series resistance R used to limit the charging current to appropriate value is 4.5 Ω. Which of the following statements are correct?

A. Potential difference across the cell is 2.5 V
B. Thermal power produced in the cell is 0.0098 W
C. Cell absorbs power equal to 0.252 W

(a) Only **A** is correct (b) Only **B** is correct (c) Only **C** is correct
(d) Only **A** & **B** are correct (e) All **A, B** & **C** are correct

3. Three 2 Ω resistors are connected to form a triangle. The equivalent resistance between any two corners is

(a) 6 Ω (b) 2 Ω (c) 3/4 Ω (d) 4/3 Ω (e) 3 Ω

4. In the network shown the figure, the equivalent resistance between points A and D is

(a) 10 Ω (b) 20 Ω (c) 30 Ω (d) 40 Ω (e) 50 Ω

5. A heating coil is rated 100W, 200V. The coil is cut in to half and the two pieces are joined in parallel to the same source. The energy now liberated per second is

(a) 200J (b) 400J (c) 25J (d) 50J (e) 100J

6. An electrical cable of copper has just one wire of radius 9 mm. Its resistance is 5 Ω. This single copper wire of the cable is replaced by 7 different well insulated copper wires each of radius 3 mm. The total resistance of the cable will now be

(a) 7.5Ω (b) 45Ω (c) 90Ω (d) 270Ω (e) 75Ω

7. A conducting square loop of side **L** and resistance **R** moves in its plane with a uniform velocity ***v*** perpendicular to one of its sides. A magnetic induction **B**, constant in time and space, pointing perpendicular to and into the plane of the loop exists everywhere. The current in the loop is

(a) BLv/R clockwise
(b) BLv/R anticlockwise
(c) 2BLv/R anticlockwise
(d) 2BLv/R clockwise
(e) zero

8. A conductor is placed in a magnetic field as shown in the figure. The voltage will be induced if the conductor moves in the direction

(a) P (b) Q (c) R (d) S (e) None of the above

9. A conductor of length **l** is bent into the shape of a semicircle. The conductor is moved with constant velocity **v** in a magnetic field **B** acting perpendicular to the plane of the bent conductor as shown in the figure. Which of the following statements are correct?

A. The end **M** of the conductor will be at higher potential
B. The end **N** of the conductor will be at higher potential
C. The emf induced in the conductor is $2vBl/\pi$

(a) Only **A** is correct (b) Only **B** is correct (c) Only **C** is correct
(d) Only **A** & **B** are correct (e) All **A, B** & **C** are correct

10. According to the Faradays' law of induction, which of the following statements are correct?

A. A changing electric field produces changing magnetic field
B. A changing magnetic field produces changing electric field
C. A changing magnetic field produces static electric field

(a) Only **A** is correct (b) Only **B** is correct (c) Only **C** is correct
(d) Only **A** & **B** are correct (e) All **A, B** & **C** are correct

11. Na^+ and Cl^- attract each other with force **F** in vacuum. If the ions are immersed in Water (dielectric constant **K**= 80), the force of attraction between them will be

(a) F (b)80 F (c) F/80 (d) F/8 (e) 8 F

12. A solid sphere of radius **R** has uniform charge distribution throughout its volume, the charge density being **ρ** . The electric field outside the sphere at a distance **r** from the center is

(a) $\rho R^3/3\varepsilon_0 r^2$ (b) $\rho/3\varepsilon_0 r^2$ (c) $3\varepsilon_{0/}\,\rho\, r^2$ (d) $3\rho R^3/\varepsilon_0 r^2$ (e) $\rho R^3/3\varepsilon_0 r^3$

13. A circle of radius **R** is drawn in a uniform electric field **E** as shown in the figure. $\mathbf{V_A}$, $\mathbf{V_B}$, $\mathbf{V_C}$ and $\mathbf{V_D}$ are respectively the potentials of points A, B, C, and D at the periphery of the circle.

(a) $V_A = V_C$; $V_B = V_D$ (b) $V_A = V_C$; $V_B < V_D$ (c) $V_A > V_C$; $V_B = V_D$
(d) $V_A < V_C$; $V_B = V_D$ (e) $V_A > V_C$; $V_B > V_D$

14. A parallel plate capacitor of area **A**, plate separation **d** , and capacitance **C** is filled with three different dielectric materials having dielectric constants $\mathbf{K_1}$, $\mathbf{K_2}$, and $\mathbf{K_3}$ as shown. If a single dielectric material is to be used to have the same Capacitance **C** in this capacitor, then the dielectric constant **K** is given by

(a) $1/\mathbf{K}=1/\mathbf{K_1}+1/\mathbf{K_2}+1/2\mathbf{K_3}$ (b) $1/\mathbf{K}=(1/\mathbf{K_1}+\mathbf{K_2})+1/2\mathbf{K_3}$
(c) $\mathbf{K}= (\mathbf{K_1}+\mathbf{K_2})/ (\mathbf{K_1}+\mathbf{K_2}) +2\mathbf{K_3}$ (d) $\mathbf{K}=\mathbf{K_1}+\mathbf{K_2}+2\mathbf{K_3}$
(e) $1/\mathbf{K}=1/\mathbf{K_1}+1/\mathbf{K_2}+1/\mathbf{K_3}$

15. Figure shows the lines of constant potential in a region in which an electric field is present. The values of potentials are written in brackets. At which point **A**, **B** or **C**, the magnitude of the electric field is greatest at the point

(a) **A** (a) **B** (a) **C** (a) **A** and **B** (a) **A** and **C**

16. Two infinitely long straight thin conductors carrying equal current are at a distance **d** apart. If the currents in them are in the same direction, the figure describing the correct variation of the magnetic field between them with distance is

17. Two identical circular coils carry equal currents. They are so arranged that they have a common centre and their planes are at right angles to each other. If **B** is the magnetic field at the centre due to one coil then the resultant magnetic field at the common centre is

(a) **2B** (b) zero (c) **B**/√ **2** (d) √**2B** (e) **B**

18. A rectangular loop carrying a current **I** is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and is in the plane of the loop. If a steady current **I** is established in the wire as shown in the figure. The loop will

(a) rotate about an axis parallel to the wire
(b) move away from the wire
(c) move towards the wire
(d) remains un changed
(e) none of the above

19. A solenoid of 1.5 m length and 4.0 cm diameter possesses 10 turns per cm. A current of 5A is flowing through it. The magnetic induction at the centre of the solenoid is ($\mu_0 = 4\pi \times 10^{-7} Hm^{-1}$)

(a) $2\pi \times 10^{-3}$ T (b) $2\pi \times 10^{-4}$ T (c) $2\pi \times 10^{-5}$ T
(d) $4\pi \times 10^{-3}$ T (e) $4\pi \times 10^{-4}$ T

20. Two particles **X** and **Y** having equal charges after being accelerated through the same potential difference enter a region of uniform magnetic field and describe circular paths of radii $\mathbf{R_1}$ and $\mathbf{R_2}$ respectively. The ratio of their masses is

(a) $\sqrt{\frac{R_1}{R_2}}$ (b) $\sqrt{\frac{R_2}{R_1}}$ (c) $\left(\frac{R_1}{R_2}\right)^2$ (d) $\left(\frac{R_2}{R_1}\right)^2$ (e) $\frac{R_2}{R_1}$

21. Expansion during heating

(a) Occurs at the same rate for all materials
(b) Occurs at different rates for different materials
(c) Increases the weight of a material
(d) Decreases the density of a material
(e) None of the above

22. An iron tyre is to be fitted on a wooden wheel 1.0m in diameter. The diameter of the tyre is 6.0mm smaller than that of the wheel. The tyre should be heated by a temperature of (coefficient of volume expansion of iron is $3.6 \times 10^{-5}\ ^{o}C^{-1}$)

(a) 167^0C
(b) 334^0C
(c) 500^0C
(d) 1000^0C
(e) 750^0C

23. Which of the following will make volume of an ideal gas four times?

(a) Double the absolute temperature and double the pressure
(b) Halve the absolute temperature and double the pressure
(c) Quarter the absolute temperature and constant pressure
(d) Quarter the pressure and constant temperature
(e) None of the above

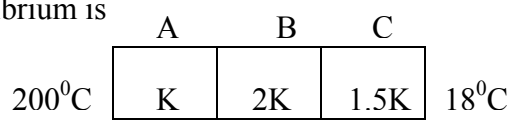
24. According to the kinetic theory of gasses

(a) the pressure of a gas is proportional to the rms speed of the molecules.
(b) The rms speed of the molecules of a gas is proportional to the absolute temperature
(c) The rms speed of the molecules of a gas is proportional to the square root of the absolute temperature
(d) The pressure of a gas is proportional to the square of the rms speed of the molecules
(e) the pressure of a gas is inversely proportional to the rms speed of the molecules.

25. Two vessels A and B of different materials are similar in shape and size. The same quantity of ice filled in them melts in times t_1 and t_2 respectively. The ratio of the thermal conductivities of A and B is

(a) $t_1 : t_2$
(b) $t_2 : t_1$
(c) $t_1^2 : t_2^2$
(d) $t_2^2 : t_1^2$
(e) $t_2^4 : t_1^4$

26. Three rods A, B and C of the same length and cross-sectional area are joined in series as shown below. Their thermal conductivities are in the ratio 1:2:1.5. If the open ends of A and C are at 200^0C and 18^0C respectively. The temperature at the junction of A and B in equilibrium is



(a) 74^0C (b) 116^0C (c) 156^0C (d) 148^0C (e) None of the above

27. If the temperature of a hot body is increased by 50%, the amount of radiation emitted by it increases approximately by

(a) 225%
(b) 250%
(c) 400%
(d) 300%
(e) 500%

28. A metal ball of surface area $200cm^2$ and temperature 527^0C is surrounded by a vessel at 27^0C. If the emissivity of the metal is 0.4 then the rate of loss of heat from the ball is (Stefan's constant = $5.67 \times 10^{-8} J/m^2K$)

(a) 108J
(b) 168J
(c) 182J
(d) 192J
(e) 172J

29. A 100g bullet, moving with a speed of 500m/s, enters a block of ice. The mass of ice that melts is (specific latent heat of ice $=3.36 \times 10^5$ J Kg^{-1})

(a) 111.6g
(b) 74.4g
(c) 37.2g
(d) 18.6g
(e) 68.5g

30. How much steam at 100^0C should be passed into a vessel containing 10g of ice and 100g of water at 0^0C so that all the ice is melted and the temperature is raised to 5^0C? Neglect heat absorbed by the vessel.
(specific latent heat of ice $=3.36 \times 10^5$ J Kg^{-1}
specific latent heat of steam $=2.25 \times 10^6$ J Kg^{-1}
specific heat of water $=4200$ J $Kg^{-1}K^{-1}$)

(a) 2.1g (b) 3.2g (c) 4.2g (d) 6.3g (e) 6.5g

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FINAL EXAMINATION 2010
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PHYSICS PAPER II
DURATION: TWO HOURS

INDEX NO: ----------

DATE: 14-05-2010 **TIME: 10.30AM-12.30PM**

INSTRUCTIONS

This paper consists of two structured type questions in **PART A**, which are compulsory and six essay type questions in **PART B**.

Answer to the first two questions in the **PART A** must be written in the space provided in the question paper.

Questions in the **PART B** are essay type questions of which four to be answered. Answers to these questions must be written on the writing papers provided.

Attach the **PART A** of this paper on the top of your answers for the **PART B** of this paper and hand over both together.
Assume g =10ms^{-2}