

Answer all the questions.

Each question is followed by four options lettered A to D. Find the correct option for each question and shade in pencil on your answer sheet, the answer space which bears the same letter as the option you have chosen. Give only one answer to each question.

An example is given below.

One important application of the bimetallic strip is in the

- A. pressure cooker.
- B. thermostat.
- C. thermos flask.
- D. fuse.

The correct answer is thermostat which is lettered B and therefore, answer space B would be shaded.

[A]

[C]

[D]

Think carefully before you shade the answer spaces; erase completely any answer(s) you wish to change.

Do all rough work on this question paper.

Now answer the following questions.

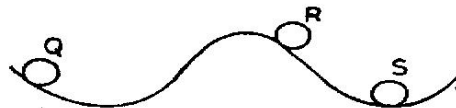
1. The area under a force-time graph represents

- A. change in kinetic energy.
- B. change in momentum.
- C. work done.
- D. change in internal energy.

2. From the principle of flotation, a body sinks in a fluid until it displaces a quantity of fluid equal to its own

- A. density.
- B. mass.
- C. weight.
- D. volume.

3.



Suppose three identical steel balls Q, R and S are placed on an undulating ground as illustrated in the diagram above. Which of the balls is/are in neutral equilibrium?

- A. S only
- B. Q only
- C. R only
- D. Q and S only

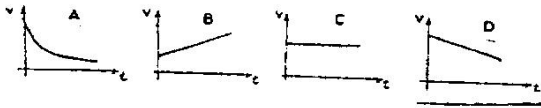
4. The length of a simple pendulum is increased by a factor of four. By what factor is its period increased?

- A. 0.5π
- B. 2
- C. 2π
- D. 4

5. The linear expansivity, α , and cubic expansivity, γ , of a material are related by the equation

- A. $\gamma = \alpha$.
 B. $\gamma = 3\alpha$.
 C. $\gamma = 2\alpha$.
 D. $\gamma = \frac{1}{3}\alpha$

6. Which of the illustrated graphs below represents a body moving with uniform retardation?



7. The **correct** relationship between the displacement, s , of a particle initially at rest in a linear motion and the time, t , is

- A. $s \propto t^{-2}$.
 B. $s \propto t^{-1}$.
 C. $s \propto t$.
 D. $s \propto t^2$.

8. The *Joule* is equivalent to

- A. $kg\ m^2\ s^{-1}$.
 B. $kg^2\ m\ s^{-2}$.
 C. $kg\ m^2\ s^{-2}$.
 D. $kg\ m\ s^{-1}$.

9. Which of the following statement(s) is/are **correct** about a fixed mass of gas compressed in an inexpandible container?

- I. The average speed of the molecules increases.
 II. The temperature of the gas increases.
 III. The molecules hit the walls of the container more often than before the compression.

- A. I only
 B. I and II only
 C. I and III only
 D. I, II and III

10. An example of a mechanical wave is

- A. water waves.
 B. radio waves.
 C. x-rays.
 D. light rays.

11. Which of the following descriptions of the image formed by a plane mirror is **not correct**?
 The image is

- A. erect and of the same size as the object.
 B. laterally inverted and of the same size as the object.
 C. erect and bigger than the object.
 D. virtual and of the same size as the object.

12. The efficiency of a wheel and axle is 100 % and the ratio of their radii is 5:1. Calculate the effort required to lift a load of mass 20 kg using this machine. [$g = 10\ m\ s^{-2}$]

- A. 20 N
 B. 25 N
 C. 40 N
 D. 100 N

13. A freely suspended compass needle on the earth's surface settles in a plane called

- A. geographic meridian.
 B. magnetic meridian.
 C. magnetic declination.
 D. isogonals.

14. An object is placed at different distances, u , from a converging lens of focal length, 15.0 cm. For what value of u does the lens act as a simple microscope?

- A. $u = 15\ cm$ only
 B. $u = 30\ cm$ only
 C. $u < 15\ cm$ only
 D. $u > 30\ cm$ only

15. The periodic rise and fall in the intensity of sound produced when **two** notes of nearly equal frequencies are sounded together is called
- doppler effect.
 - beat.
 - interference.
 - resonance.
16. The power of a lens is $+2.5 D$. What is its radius of curvature?
- 2.5 cm
 - 25.0 cm
 - 40.0 cm
 - 80.0 cm
17. The reason for having a large number of turns in the coil of a moving coil galvanometer is to
- make the deflection of the needle proportional to the current.
 - increase the sensitivity of the galvanometer.
 - decrease the magnetic flux produced by the magnet.
 - make the permanent magnet stronger.
18. Current is passed through **two** parallel conductors in the same direction. If the conductors are placed near **each** other, they will
- move in a circle.
 - repel each other.
 - remain stationary.
 - attract each other.
19. The period of a 10 kHz radio wave travelling at $3.0 \times 10^8 \text{ m s}^{-1}$ is
- $3.0 \times 10^{-5} \text{ s}$.
 - $1.0 \times 10^{-4} \text{ s}$.
 - $1.0 \times 10^4 \text{ s}$.
 - $3.0 \times 10^4 \text{ s}$.
20. The magnetic material produced from the chemical combination of metal oxides and has a very high resistance to electric current is called a
- ferrite substance.
 - paramagnetic substance.
 - ferromagnetic substance.
 - diamagnetic substance.
21. A body of mass, M , moving with velocity, V , has a wavelength, λ , associated with it. This phenomenon is called
- photoelectric effect.
 - Heisenberg's uncertainty principle.
 - Compton effect.
 - wave-particle paradox.
22. Which of the following statements about a straight current-carrying wire placed in a uniform magnetic field is **correct**? The wire experiences
- maximum motor force if the current reverses its direction.
 - no motor force if it is parallel to the field.
 - no motor force if it is perpendicular to the field.
 - a motor force with constant direction if either the current or the magnetic field is reversed.
23. **Three** cells each of emf , $1.1 V$, and internal resistance, 2Ω , are connected in parallel across a 3Ω resistor. Determine the current in the resistor.
- $0.90 A$
 - $0.39 A$
 - $0.30 A$
 - $0.01 A$

24. Which of the following statements about electric potential energy is **not correct**?
- The electric potential energy of a positively charged particle increases when it moves to a point of higher potential.
 - The electric potential energy of a negatively charged particle increases when it moves to a point of lower potential.
 - The electric potential energy of a positively charged particle decreases when it moves to a point of higher potential.
 - The work done in taking a charged particle around a closed path in an electric field is zero.
25. A galvanometer with a full scale deflection of 20 mA is converted to read 8 V by connecting a $395\ \Omega$ resistor in series with it. Determine the internal resistance of the galvanometer.
- $2.5\ \Omega$
 - $5.0\ \Omega$
 - $8.0\ \Omega$
 - $10.0\ \Omega$
26. An inductor of inductance 10 H is connected across an *a.c.* circuit source of 50 V , 100 Hz . What is the current in the circuit? [$\pi = 3.14$]
- 0.200 A
 - 0.070 A
 - 0.050 A
 - 0.008 A
27. The speed of **fast moving** neutrons in a nuclear reactor can be reduced by using
- graphite rods.
 - concrete shield.
 - iron rods.
 - boron rods.
28. In a series *R-L-C* circuit at resonance, impedance is
- maximum.
 - minimum.
 - capacitive.
 - inductive.
29. A lamp is rated 240 V , 60 W . Determine the resistance of the lamp when lit.
- $120\ \Omega$
 - $240\ \Omega$
 - $540\ \Omega$
 - $960\ \Omega$
30. One **major** reason why electrical appliances in homes are normally earthed is that the
- person touching the appliance is safe from electric shock.
 - appliances are maintained at a higher *p.d.* than the earth.
 - appliances are maintained at a lower *p.d.* than the earth.
 - appliances are maintained at the same *p.d.* with that of the earth.
31. In doping an intrinsic semiconductor to produce a *p*-type semiconductor,
- the semiconductor is heated up.
 - a donor element is added.
 - an acceptor element is added.
 - the semiconductor is connected to a battery.
32. Arrange the following radiations in order of increasing ionization of air.
- Alpha
 - Gamma
 - Beta
- $I < III < II$
 - $II < I < III$
 - $II < III < I$
 - $I < II < III$

33. If the kinetic energy of an electron is 100 eV , what is the wavelength of the de-Broglie wave associated with it?
 [$h = 6.6 \times 10^{-34} \text{ J s}$, $e = 1.6 \times 10^{-19} \text{ C}$,
 $m_e = 9.1 \times 10^{-31} \text{ kg}$]
- A. $1.22 \times 10^{-10} \text{ m}$
 B. $4.10 \times 10^{-10} \text{ m}$
 C. $3.90 \times 10^{-10} \text{ m}$
 D. $5.50 \times 10^{-14} \text{ m}$
34. Gamma rays are produced when
- A. high velocity electrons are abruptly stopped in metals.
 B. energy changes occur within the nuclei of atoms.
 C. energy changes occur within the electronic structure of atoms.
 D. electrons are deflected in very strong magnetic fields.
35. The half-life of a radioactive substance is 15 hours. If at some instance, the sample has a mass of 512 g, calculate the time it will take $\frac{7}{8}$ of the sample to decay.
- A. 15 hours
 B. 30 hours
 C. 45 hours
 D. 60 hours
36. When the direction of vibration of the particles of a medium is perpendicular to the direction of propagation of a wave, the wave is said to be
- A. longitudinal.
 B. transverse.
 C. mechanical.
 D. a sound wave.
37. A hunter fires a gun at a point 408 m away from a cliff. If he hears an echo 2.4 s later, determine the speed of the sound wave.
- A. 340 m s^{-1}
 B. 380 m s^{-1}
 C. 400 m s^{-1}
 D. 680 m s^{-1}
38. The distance between the fixed points of a mercury-in-glass thermometer is 30 cm. Determine the temperature when the mercury level is 10.5 cm above the lower fixed point.
- A. $28.6 \text{ }^\circ\text{C}$
 B. $30.0 \text{ }^\circ\text{C}$
 C. $35.0 \text{ }^\circ\text{C}$
 D. $40.5 \text{ }^\circ\text{C}$
39. Which of the following statements about electromagnetic waves is **not correct**?
- A. They carry energy as they travel through space.
 B. They travel with the speed of light.
 C. They are longitudinal.
 D. The electric and magnetic fields are at right angles to each other.
40. The diameter of a brass ring at $30 \text{ }^\circ\text{C}$ is 50.0 cm. To what temperature **must** this ring be heated to increase its diameter to 50.29 cm?
 [linear expansivity of brass = $1.9 \times 10^{-5} \text{ K}^{-1}$]
- A. $152.6 \text{ }^\circ\text{C}$
 B. $182.6 \text{ }^\circ\text{C}$
 C. $306.1 \text{ }^\circ\text{C}$
 D. $335.3 \text{ }^\circ\text{C}$
41. Which of the following concepts is a method of heat transfer that does **not** require a material medium?
- A. Conduction
 B. Diffusion
 C. Convection
 D. Radiation

42. Which of the following statements about light travelling from one material medium to another is **not correct**?
- The refracted angle is less than the incident angle if the speed is higher in the first material.
 - It bends away from the normal if the speed is lower in the first material.
 - Its wavelength does not change.
 - Its frequency changes.
43. The engine of a car provides a forward force of 1240 N and the total resistive force on the car is 800 N . If the mass of the car is 1220 kg , determine the distance the car has to travel from the rest before acquiring a speed of 4 m s^{-1} .
- 44.0 m
 - 22.2 m
 - 11.1 m
 - 5.5 m
44. A quantity of water at $0\text{ }^\circ\text{C}$ is heated to $30\text{ }^\circ\text{C}$. For **each degree rise in temperature**, its density will
- rise steadily.
 - fall steadily.
 - fall and then rises.
 - rise and then falls.
45. A small object of mass 50 g is released from a point **A**. Determine the velocity of the object when it reaches a point **B**, a vertical distance of 30 m below **A**. [$g = 10\text{ m s}^{-2}$]
- 1.5 m s^{-1}
 - 6.0 m s^{-1}
 - 17.3 m s^{-1}
 - 24.5 m s^{-1}
46. Molecules move in random motion within a liquid. The total internal energy of the liquid depends on all of the following **except** its
- temperature.
 - mass.
 - specific heat capacity.
 - melting point.
47. The viscosity of a fluid depends on the following factors **except** the
- relative motion between the layers of the fluid.
 - nature of the material of the fluid.
 - surface area of the fluid in contact.
 - normal reaction in the fluid.
48. Using vernier calipers, which of the following readings gives the **correct** measurement for the length of a rod?
- 4.1 cm
 - 4.13 cm
 - 4.125 cm
 - 4.1254 cm
49. The **basic** principle of operation of a beam balance is
- Archimedes principle.
 - law of flotation.
 - Hooke's law.
 - principle of moments.
50. In which of the following situations is friction **not** useful?
- Operation of a grinding machine
 - Walking
 - Application of brakes
 - Moving piston in a sleeve