**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

General Certificate of Education

Advanced Subsidiary Level and Advanced Level

**PHYSICS**

**9702/01**

Paper 1 Multiple Choice

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**Answers**

1. Which pair of units are both SI base units?

A. ampere, degree celsius

B. ampere, kelvin

C. coulomb, degree celsius

D. coulomb, Kelvin

**Solution: B**

2. The prefix ‘centi’ indicates x 10–2.

Which line in the table correctly indicates the prefixes micro, nano and pico?

|  |  |  |  |
| --- | --- | --- | --- |
|  | x 10–12 | x 10–9 | x 10–6 |
| ABCD | nanonanopicopico | micropiconanomicro | picomicromicronano |

 **Solution: C**

3. Which expression involving base units is equivalent to the volt?

A. kg m2s–1A–1 C. kg m2s–1A

B. kg m s–2A D. kg m2s–3A–1

**Solution: D**

V=I R or V= A Ω

J = VA s

J = k g m2 s-2

 k g m2 s-2 = V A s

 V = k g m2 s-3 A-1

4. A steel rule can be read to the nearest millimetre. It is used to measure the length of a bar whose true length is 895 mm. Repeated measurements give the following readings.

Length / mm 892, 891, 892, 891, 891, 892

Are the readings accurate and precise to within 1 mm?

|  |  |  |
| --- | --- | --- |
|  | Results are accurate to within 1 mm | Results are precise to within 1 mm |
| ABCD | nonoyesyes | noyesnoyes |

 **Solution: B**

Because the results are not accurate to within 1mm in fact the true length is 859mm. And the results are precise to within 1mm in fact each of the readings are taken in difference of 1mm.

5. The density of the material of a rectangular block is determined by measuring the mass and linear dimensions of the block. The table shows the results obtained, together with their uncertainties.

Mass = (25.0 ± 0.1) g

Length = (5.00 ± 0.01) cm

Breadth = (2.00 ± 0.01) cm

Height = (1.00 ± 0.01) cm

The density is calculated to be 2.50 g cm–3.

What is the uncertainty in this result?

A ± 0.01 g cm–3 B ± 0.02 g cm–3 C ± 0.05 g cm–3 D ± 0.13 g cm–3

 **Solution: C**

First, we have to find the percentage uncertainties of each measurement
Add these to get the percentage uncertainty for the calculation

Find this percentage of the calculated answer to get the uncertainty for the answer

For mass, [0.1/25] x 100 = ± 0.4%
For length, [0.01/5] x 100 = ± 0.2%
For breadth, [0.01/2] x 100 = ± 0.5%
For height, [0.01/1] x 100 = ± 1%

Total percentage uncertainty = ± 2.1%
Uncertainty for density calculation = ± 2.1% x 2.5 g/cm³ = ± 0.05 g/cm³

6. A football is dropped from the top of a tall building.

Which acceleration-time graph best represents the motion of the football through the air?



 **Solution: C**

Because first, let's briefly review distance-time (or displacement-time) graphs. If we plot distance against time, the slope of the line represents the change in distance (delta-d) divided by the change in time (delta-t). In other words, it's the rate of change of distance, which is velocity. So the slope of distance-time graph represents velocity.

Second, let's look at velocity-time graphs. If you plot velocity against time, the slope of the line represents the change in velocity (delta-v) divided by the change in time (delta-t). In other words, it's the rate of change of velocity, which is acceleration. So the slope of velocity-time graph represents acceleration.

This brings us to the acceleration-time graph. If you plot acceleration against time, the slope of the line represents the change in acceleration (delta-a) divided by the change in time (delta-t). In other words, it's the rate of change of acceleration.

7. Two markers M1 and M2 are set up a vertical distance *h* apart.



A steel ball is released at time zero from a point a distance x above M1.The ball reaches M1 at time t1 and reaches M2 at time t2. The acceleration of the ball is constant.

Which expression gives the acceleration of the ball?

1. B. C. D.

**Solution: D**

**s = ut + ½ at²**

Since the ball is just released from a fixed point, its initial velocity is zero.

So x = 0 + ½ a(t1) ²
and x + h = 0 + ½ a(t2) ²

Combining these equations gives:

½ a(t1)²+ h = ½ a(t2)²

h = ½ a(t2)²- ½ a(t1)²

h = ½ a[(t2)² - (t1)²]

2h = a[(t2)²- (t1)²]

a =

8. A car driver sharply presses down the accelerator when the traffic lights go green. The resultant horizontal force acting on the car varies with time as shown.



Which graph shows the variation with time of the speed of the car?



 **Solution: A**

Because, when the light goes green, the car will gradually increase its speed. And the speed won’t change suddenly to a certain value of m/s, when a car that is not moving and then it moves will always start its speed from 0 m/s and then gradually increase. And no matter how much the speed is, there is force acting on the car. Force is there on every moving object, no matter how much is its speed. And so the force doesn’t need to start from 0, the force is present when the car starts to speed.

9. Which is a statement of the principle of conservation of momentum?

A. A force is equal to the rate of change of momentum of the body upon which it acts.

B. In a perfectly elastic collision, the relative momentum of the bodies before impact is equal to their relative momentum after impact.

C. The momentum of a body is the product of the mass of the body and its velocity.

D. The total momentum of a system of interacting bodies remains constant, providing no external force acts.

 **Solution: D**

10. The gravitational field strength on the surface of planet P is one tenth of that on the surface of planet Q.

On the surface of P, a body has its mass measured to be 1.0 kg and its weight measured to be 1.0 N.

What results are obtained for measurements of the mass and weight of the same body on the surface of planet Q?

|  |  |  |
| --- | --- | --- |
|  | Mass on Q | Weight on Q |
| ABCD | 1. kg
2. kg

10 kg20 kg | 0.1 N10 N10 N100 N |

**Solution: B**

Because, Mass does not depend on gravity, it is simply the amount of matter in a material, whereas Weight is the force exerted by gravity on the material. So, Mass is all the same under all conditions no matter what.
But weight is inversely proportional to gravity, so the weight of the body in a planet having 1/10th of the gravity of another planet where it weighed 1N will be
weight on Planet P multiplied by 10 that is 1 in to 10 =10 N

11. A stone is projected horizontally in a vacuum and moves along a path as shown. X is a point on this path. XV and XH are vertical and horizontal lines respectively through X. XT is the tangent to the path at X.



 Along which direction or directions do forces act on the stone at X?

**Solution : A**

12. A uniform beam of weight 100 N is pivoted at P as shown. Weights of 10 N and 20 N are attached to its ends. The length of the beam is marked off at 0.1 m intervals.



At which point should a further weight of 20 N be attached to achieve equilibrium?

**Solution : D**

On A

 0.6 x 10 + 0.1 x 100 + 0.4 x 20 – 20 x 0.4 = 24-8 = 16

 On B

 0.6 x 10 + 0.1 x 100 + 0.1 x 20 – 20 x 0.4 = 18 – 8 = 10

 On C

 0.6 x 10 + 0.1 x 100 – 20 x 0.1 – 20 x 0.4 = 16 – 10 = 6

 On D

 0.6 x 10 + 0.1 x 100 – 20 x 0.4 – 20 x 0.4 = 16 – 16 = 0 ( IN EQUILIBRIUM )

13. The diagram shows four forces applied to a circular object.



Which of the following describes the resultant force and resultant torque on the object?

|  |  |  |
| --- | --- | --- |
|  | Resultant Force | Resultant Torque |
| ABCD | Non-zeroNon-zeroZeroZero | Non-zeroZeroNon-zeroZero |

**Solution : A**

14. A car with a total mass of 1400 kg is travelling at 30 m s–1.

What is the kinetic energy of the car?

A. 21 kJ B. 42 kJ C. 630 kJ D. 1260 kJ

**Solution : C**

K = ½ . m .v2

 = ½ . 1400 . 302

 = ½ . 1400 . 900

 = 700 . 900

 = 630,000 J = 630 kJ

15. An object is thrown into the air.

Which graph shows how the potential energy Ep of the object varies with height h above the ground?



**Solution : A**

16. The diagram shows a barrel of weight 1.0 x 103 N on a frictionless slope inclined at 30o to the horizontal.

A force is applied to the barrel to move it up the slope at constant speed. The force is parallel to the slope.

What is the work done in moving the barrel a distance of 5.0 m up the slope?

A. 1.0 x 104 J B. 2.5 x 103 J C. 4.3 x 103 J D. 5.0 x 103 J

**Solution : B**

W = F x d

 = ( 1.0 x 103 ) sin 30 x 5

= 2.5 x 103 J

17. Why does the pressure increase when a sealed container of gas is heated?

A. The gas molecules collide more often with each other.

B. The gas molecules expand when they are heated.

C. The gas molecules travel faster and hit the walls of the container more often.

D. There are more gas molecules present to collide with the walls of the container.

**Solution : C**

18. Liquids X and Y are stored in large open tanks. Liquids X and Y have densities of 800 kg m–3 and1200 kg m–3 respectively.

At what depths are the pressures equal?

|  |  |  |
| --- | --- | --- |
|  | depth in liquid X | depth in liquid Y |
| ABCD | 8 m10 m15 m18 m | 12 m10 m10 m8 m |

**Solution : C**

Px = Py

 ρx . g . hx = ρy . g . hy

 800 . 10 . hx = 1,200 . 10 . hy

  =

 =

  =

hx = 15, hy = 10

19. When white sugar granules are heated, they melt. When the melt is cooled quickly, a brittle solid form of toffee is produced.

How does the structure of the sugar change?

A. amorphous to polymeric

B. crystalline to amorphous

C. crystalline to polymeric

D. polymeric to amorphous

**Solution : B**

20. A ductile material is stretched by a tensile force to a point beyond its elastic limit. The tensile force is then reduced to zero. The graph of force against extension is shown below.

 

 Which area represents the net work done on the sample?

**Solution : B**

21. A wire stretches 8 mm under a load of 60 N.

A second wire of the same material, with half the diameter and a quarter of the original length of the first wire, is stretched by the same load.

Assuming that Hooke’s law is obeyed, what is the extension of this wire?

A. 1 mm B. 4 mm C. 8 mm D. 16 mm

**Solution: C**

X1 =

 k =

= = 7500 N m-1

X2 = = = 8 x 10-3 m = 8 mm

22. Polarization is a phenomenon associated with a certain type of wave.

Which condition must be fulfilled if a wave is to be polarized?

A. It must be a light wave.

B. It must be a longitudinal wave.

C. It must be a radio wave.

D. It must be a transverse wave.

**Solution: D**

23. A sound wave has displacement y at distance x from its source at time t.

Which graph correctly shows the amplitude a and the wavelength λ of the wave?

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**Solution: B**

24. The intensity of a progressive wave is proportional to the square of the amplitude of the wave. It is also proportional to the square of the frequency.

The variation with time t of displacement x of particles in a medium, when two progressive waves P and Q pass separately through the medium, are shown on the graphs.



The intensity of wave P is I0.

What is the intensity of wave Q?

A ½ I0 B I0 C 8 I0 D 16 I0

**Solution: B**

I A2 f2 IQ (2XO)2

IO X02 fo2 IQ 4 XO2 ¼ fo2

 =

 = 1

IQ = IO

25. A sound wave of frequency 150 Hz travels in water at a speed of 1500 m s–1. It then travels through the surface of the water and into air, where its speed is 300 m s–1.

Which line in the table gives the correct values for the wavelengths of the sound in water and in air?

|  |  |  |
| --- | --- | --- |
|  | Wavelength in Water / m | Wavelength in air / m |
| ABCD | 0.100.101010 | 0.100.502.050 |

**Solution: C**

In the water… In the air…

 = =

= = 10 m = = 2 m

26. The graph represents a standing wave at two different times.



What does the distance XY represent?

A. half the amplitude

B. half the frequency

C. half the period

D. half the wavelength

**Solution: D**

27. In which situation does diffraction occur?

A. A wave bounces back from a surface.

B. A wave passes from one medium into another.

C. A wave passes through an aperture.

D. Waves from two identical sources are superposed.

**Solution: C**

28. Light of wavelength 700 nm is incident on a pair of slits, forming fringes 3.0 mm apart on a screen.

What is the fringe spacing when light of wavelength 350 nm is used and the slit separation is doubled?

A. 0.75 mm B. 1.5 mm C. 3.0 mm D. 6.0 mm

**Solution: A**

1st Light 2nd light…

x1 = x2 =

3.0 x 10-3 = x2 =

 =

x2 = 7.5 x 10-4 m

 = 0.75 mm

29. A diffraction grating is used to measure the wavelength of monochromatic light.

The spacing of the slits in the grating is 1.15 × 10–6 m. The angle between the first order diffraction maxima is 60.0o, as shown in the diagram.



What is the wavelength of the light?

A. 287 nm B. 498 nm C. 575 nm D. 996 nm

**Solution: C**

d sin = nλ

1.15 x 10-6 sin 30o = 1λ

 λ = 5.75 x 10-7 m

= 575 nm

30. A positively charged particle is projected into a region of uniform electric field E.

Which diagram represents the motion of the particle in the electric field?



**Solution: A**

It moves down to the right.

31.Two large parallel plates X and Z are placed 5.0 mm apart and connected as shown to the terminals of a 200 volt d.c. supply.



A small oil drop at P carries one excess electron.

What is the magnitude of the electrostatic force acting on the oil drop due to the electric field between the plates?

A. 6.4 x 10–15 N B. 6.4 x 10–18 N C. 1.6 x 10–19 N D. 4.0 x 10–24 N

**Solution : A**

d= 5 x 10-3 m

ΔV= 200 V

E= = = 4 x 104 NC-1

F= E . q

 = 4 x 104 x 1.6 x 10-19 N

 = 6.4 x 10-15 N

32. The graphs show the variation with potential difference V of the current I for three circuit components.



The components are a metal wire at constant temperature, a semiconductor diode and a filament lamp.

 Which row of the table correctly identifies these graphs?

|  |  |  |  |
| --- | --- | --- | --- |
|  | Metal Wire at Constant Temperature | Semiconductor diodide | Filament Lamp |
| ABCD | XYYZ | ZXZX | YZXY |

 **Solution : B**

Graph X shows a semiconductor diode. Graph Y shows a metal wire at constant temperature. Graph Z shows a filament lamp.

33. Tensile strain may be measured by the change in electrical resistance of a strain gauge. A strain gauge consists of folded fine metal wire mounted on a flexible insulating backing sheet. The strain gauge is firmly attached to the specimen, so that the strain in the metal wire is always identical to that in the specimen.



When the strain in the specimen is increased, what happens to the resistance of the wire?

A. It decreases, because the length decreases and the cross-sectional area increases.

B. It decreases, because the length increases and the cross-sectional area decreases.

C. It increases, because the length decreases and the cross-sectional area increases.

D. It increases, because the length increases and the cross-sectional area decreases.

**Solution : D**

When the strain in the specimen is increased, the strain in the strain gauge is also increased. That is because the strain gauge is firmly attached to the specimen, so that the strain in the metal wire is always identical to that in the specimen. The resistance of the wire is increased, because the length is increased and the cross-sectional area is decreased.

34. The graph shows how the electric current I through a conducting liquid varies with the potential difference V across it.

At which point on the graph does the liquid have the smallest resistance?

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**Solution : C**

Based on the graph, point C has the smallest resistance. The electric current I and the potential difference V affect the resistance.

35. An electrical component has the following circuit symbol. 

What does this symbol represent?

A. variable resistor (rheostat)

B. fuse

C. light-dependent resistor

D. thermistor

**Solution : B**

36. Three resistors are connected in series with a battery as shown in the diagram. The battery has negligible internal resistance.



What is the potential difference across the 180 Ω resistor?

A. 1.6 V B. 2.4 V C. 3.6 V D. 6.0 V

**Solution : B**

 V180 Ω =

=

=

= 2.4 V

37. In the circuit below, the reading VT on the voltmeter changes from high to low as the temperature of the thermistor changes. The reading VL on the voltmeter changes from high to low as the level of light on the light-dependent resistor (LDR) changes.



The readings on VT and VL are both high.

What are the conditions of temperature and light level?

|  |  |  |
| --- | --- | --- |
|  | Temperature | Light Level |
| ABCD | lowlowhighhigh | lowhighlowhigh |

**Solution : C**

When the reading of VT is high, it means the temperature of the thermistor increases from initial temperature. When the reading of VL is high, it means the light level of the light-dependent resistor (LDR) decreases.

38. An atomic nucleus emits a β-particle.

What change does this cause to the proton and nucleon numbers of the nucleus?

|  |  |  |
| --- | --- | --- |
|  | Proton number | Nucleon number |
| ABCD | -10+1+1 | +1+1-10 |

**Solution : D**

The number of proton in the nucleus is +1, when the number of nucleon in the nucleus is 0.

39. Two α-particles with equal energies are fired towards the nucleus of a gold atom.

Which diagram best represents their paths?



**Solution : B**

The - particles moves away from the gold nucleus. However, the gradients are different.

40. A nuclear reaction is represented by the equation



What is particle X?

A. an α-particle

B. a β-particle

C. a neutron

D. a proton

**Solution : D**

X is a proton. It can be seen from the equation.