Topic 2.2-Forces [30 marks]

**1.**      23M.1.SL.TZ1.7

A ball attached to a string is made to rotate with constant speed along a horizontal circle. The string is attached to the ceiling and makes an angle of *θ*° with the vertical. The tension in the string is *T*.

![](data:image/png;base64;base64,)

What is correct about the horizontal component and vertical component of the net force on the ball?

|  |  |  |
| --- | --- | --- |
|  | **Horizontal component** | **Vertical component** |
| A. |  |  |
| B. |  |  |
| C. |  | 0 |
| D. |  | 0 |

[1]

Markscheme

D

**2.**      23M.1.SL.TZ1.8

A block of mass 2.0 kg accelerates uniformly at a rate of 1.0 m s−2 when a force of 4.0 N acts on it.  
The force is doubled while resistive forces stay the same. What is the block’s acceleration?

A.  4.0 m s−2

B.  3.0 m s−2

C.  2.0 m s−2

D.  1.0 m s−2

[1]

Markscheme

B

**3.**      19N.1.SL.TZ0.28

What are the units of specific energy and energy density?

![](data:image/png;base64;base64,)

[1]

Markscheme

B

**4.**      20N.1.SL.TZ0.1

Which quantity has the same units as those for energy stored per unit volume?

A.  Density

B.  Force

C.  Momentum

D.  Pressure

[1]

Markscheme

D

**5.**      19N.1.SL.TZ0.1

Which quantity has the fundamental SI units of kg m–1 s–2?

A. Energy  
B. Force  
C. Momentum  
D. Pressure

[1]

Markscheme

D

**6.**      23M.1.HL.TZ2.37

Light of frequency is incident on a metallic surface of work function *W*. Photoelectrons with a maximum kinetic energy *E*max are emitted. The frequency of the incident light is changed to 2.

What is true about the maximum kinetic energy and the work function?

|  |  |  |
| --- | --- | --- |
|  | **Maximum kinetic energy** | **Work function** |
| A. | less than 2*E*max | unchanged |
| B. | less than 2*E*max | greater than *W* |
| C. | greater than 2*E*max | unchanged |
| D. | greater than 2*E*max | greater than *W* |

[1]

Markscheme

C

**7.**      22M.1.SL.TZ1.3

A student measures the time for 20 oscillations of a pendulum. The experiment is repeated four times. The measurements are:

10.45 s

10.30 s

10.70 s

10.55 s

What is the best estimate of the uncertainty in the average time for 20 oscillations?

A.  0.01 s

B.  0.05 s

C.  0.2 s

D.  0.5 s

[1]

Markscheme

C

**8.**      21M.1.SL.TZ2.1

A student measures the length *l* and width *w* of a rectangular table top.

What is the absolute uncertainty of the perimeter of the table top?

![](data:image/png;base64;base64,)

A.

B.

C.

D.

[1]

Markscheme

B

**9.**      19M.1.SL.TZ1.1

A student wants to determine the angular speed ω of a rotating object. The period T is 0.50 s ±5 %. The angular speed ω is

What is the percentage uncertainty of ω?

A. 0.2 %

B. 2.5 %

C. 5 %

D. 10 %

[1]

Markscheme

C

**10.**      19M.1.SL.TZ2.1

A student measures the radius *R* of a circular plate to determine its area. The absolute uncertainty in *R* is Δ*R*.

What is the **fractional** uncertainty in the area of the plate?

A.

B.

C.

D.

[1]

Markscheme

A

**11.**      19M.1.HL.TZ2.2

A proton has momentum 10-20 N s and the uncertainty in the position of the proton is 10-10 m. What is the minimum **fractional** uncertainty in the momentum of this proton?

A. 5 × 10-25

B. 5 × 10-15

C. 5 × 10-5

D. 2 × 104

[1]

Markscheme

C

**12.**      22M.1.SL.TZ2.6

An object of mass 2.0 kg rests on a rough surface. A person pushes the object in a straight line with a force of 10 N through a distance *d*.

![](data:image/png;base64;base64,)

The resultant force acting on the object throughout *d* is 6.0 N.

What is the value of the sliding coefficient of friction between the surface and the object and what is the acceleration *a* of the object?

![](data:image/png;base64;base64,)

[1]

Markscheme

A

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