Solutions

Multiple choice

Example 1 2004 Question 12, 75%

The total energy at X will be the same as the total energy at Y, since there is no friction acting.
Let's take PE to be zero at Y
At Y
$\therefore$ TE = ½ mv^2

At X
$\therefore$ TE = mgh
$\therefore$ ½mv^2 = mgh
$\therefore$ v^2 = 2gh
$\therefore$ v $\sqrt{2gh}$
$\therefore$ **A (ANS)**

Example 2 1981 Question 20, 77%

At the lowest point the PE it has gained by being raised has transformed into KE.
$\therefore$ mgh = ½mv^2
$\therefore$ gr = ½ v^2
$\therefore$ v^2 = 2gr
$\therefore$ v = $\sqrt{2gr}$
$\therefore$ **C (ANS)**

Example 3 1980 Question 17, 50%

The acceleration is in the direction of the change in velocity.
The change in velocity is given by
FINAL - INITIAL
In this case this will be perpendicularly up.
$\therefore$ **D (ANS)**
The other way of considering this question is to think about is: where is this force coming from. The only force acting (to change the direction of the ball) is the force of the wall on the ball. The wall can only provide a normal reaction force. Hence this force is in a northerly direction.

Example 4 2008 Question 13, 40%

The ball will be stationary (momentarily) at the top and the bottom of the oscillation. Therefore the KE will be zero at these points. The KE will be a maximum at the midpoint.
$\therefore$ **D (ANS)**

Example 5 2008 Question 14, 50%

The gravitational potential energy is measured from the point of release.
$\therefore$ at the bottom, PE = 0.
$\therefore$ **A (ANS)**

Example 6 2000 Question 8, 72%
Steel would have a large k value, A has the largest value for its gradient.
∴ **A (ANS)**

Examiner's comment
Collision with the hard surface of the steering wheel would result in a shorter compression distance. In order for the area under the graph to remain as 900 J, the retarding force would need to be much larger.

Example 7 2001 Question 7, 78%
Gravitational energy is given by mgh.
∴The graph will have the same shape as the track, because 'mg' is constant, with 'h' being the only variable.
∴ **A (ANS)**

Example 8 2001 Question 8, 71%
There isn't any energy being supplied (or lost) by the roller coaster.
∴ the total energy should remain constant. This means that when the roller coaster loses PE it must gain KE.
∴the KE graph must be such that when you add it to the PE graph you get a constant value.
∴ **B (ANS)**

Example 9 2001 Question 9, 77%
See the explanation for Question 8.
∴ **E (ANS)**

Example 10 1982 Question 29, 52%
This question is a little troublesome to answer because the question does not include a graph labelled 'f'.
Using $F = kx$
The graph needs to be a straight line.
∴ **D (ANS)**

Example 11 1982 Question 31, 81%

When the mass first contacts the spring, the mass has KE and the stored energy in the spring = 0.
When the mass comes to rest at Q, its
KE = 0, and the spring has stored energy, given by $\frac{1}{2}kx^2$.

$\therefore \frac{1}{2} mv^2 = \frac{1}{2} kd^2$

$\therefore mv^2 = kd^2$

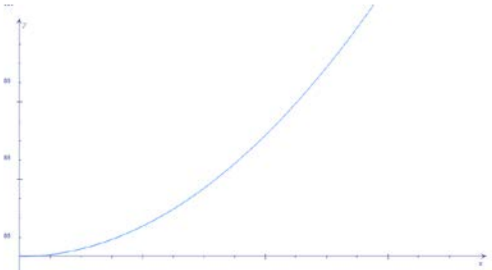
$\therefore v^2 = \frac{kd^2}{m}$

$\therefore v = \sqrt{\frac{k}{m}}d$

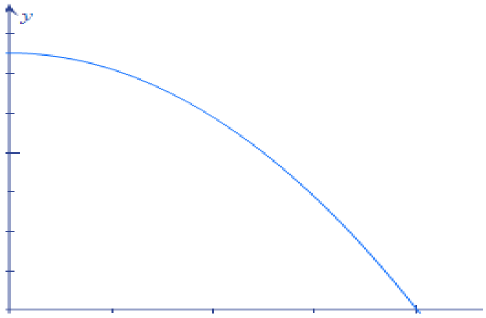
∴ C (ANS)

Example 12 1982 Question 32,

The KE will go from a maximum to a minimum (in this case, 0).
It will not be linear.
The sum of $KE_{mass} + PE_{spring}$ = constant.
The energy stored in the spring is given by
$E = \frac{1}{2}kx^2$.
This will look like



Therefore, the KE graph must look like



∴ F (ANS)

Example 13 1978 Question 32, 83%

The potential energy has been lost overcoming the frictional force.

∴ B (ANS)

Example 14 1977 Question 22, 45%

The potential energy has been lost overcoming the frictional force.

∴ B (ANS)

Example 15 1974 Question 23, 52%

As the acceleration depends on 'x', and since x is decreasing linearly (using f = kx)
The acceleration must be zero after the car leaves the spring.

∴ C (ANS)

Extended questions

Example 16 2004 Question 4, 57%

As the crumple distance is given in the question, you know,
m = 1200 kg, u = 20 m/s, v = 0 m/s, x = 0.6 m and F = ?.
Use WD = F x d = ΔKE.

$\therefore$ F x 0.6 = $\frac{1}{2}mv^2 - \frac{1}{2}mu^2$

$\therefore$ F x 0.6 = $-\frac{1}{2} \times 1200 \times 20^2$

$$\therefore F = \frac{\frac{1}{2}\times 1200\times 20^2}{0.6}$$

$\therefore$ **F = 4 x 10^5 N (ANS)**

Examiner's comment

This question could be addressed by either impulse-momentum or work-energy. The fact that the crumple distance was stated in the question meant that the work-energy approach was simpler.

Example 17 2000 Question 14, 45%

This question is based on the conservation of energy.

$$E_{top} = \frac{1}{2}mv^2 + mgh$$

Subbing in the values we know

$$E_{top} = \frac{1}{2}m\times 10^2 + m\times 10\times h$$

And we do the same for the energy at the bottom

$$E_{bottom} = \frac{1}{2}mv^2$$

Subbing in the values we know

$$E_{bottom} = \frac{1}{2}m\times 24^2$$

The energy is conserved; therefore the energy Jo has at the top will equal the energy Jo has at the bottom. So we can write;

$$E_{bottom} = E_{top}$$

$$\frac{1}{2}m\times 24^2 = \frac{1}{2}m\times 10^2 + m\times 10\times h$$

because m is present in all part of the equation we can take it out as a common factor.

$m\left(\frac{1}{2}\times 24^2\right) = m\left(\frac{1}{2}\times 10^2 + 10\times h\right)$ the mass will now cancel on both sides.

$$\frac{1}{2}\times 24^2 = \frac{1}{2}\times 10^2 + 10\times h$$

$$\therefore h = \frac{\frac{1}{2}\times 24^2 - \frac{1}{2}\times 10^2}{10}$$

$\therefore$ **h = 23.8 m (ANS)**

Examiner's comment

With friction and air resistance forces being ignored, the gain in kinetic energy equals the loss in gravitational potential energy. Thus, when the energy equation was set-up and values for the initial and final speeds substituted, the height was calculated. The average score indicated that most students experienced some difficulty with this concept. The most common error was in neglecting Jo's initial kinetic energy.

Example 18 1998 Question 4, 70%

Momentum is conserved in all collisions.

$\therefore$ $p_f = p_i$. Where p_i - sum of the initial momentums.

$\therefore$ p_i = (4000 × 15) + (1000 × 0) = 60 000 N s.
$\therefore$ p_f = 60 000 = (4000 × 10) + (1000 × v)
$\therefore$ 60 000 = 40 000 + 1 000v
$\therefore$ 20 000 = 1 000v
$\therefore$ v = 20 m s^{-1} (ANS)

Example 19 1998 Question 5, 78%
$KE_{total} = KE_{truck} + KE_{car}$
$= (\frac{1}{2}mv^2)_{truck} + (\frac{1}{2}mv^2)_{car}$
$= \frac{1}{2} \times 4000 \times 15^2 - 0$
= 450 000 J
= 4.5 × 10^5 J (ANS)

Example 20 1998 Question 6, 67%
$KE_{total} = KE_{truck} + KE_{car}$
$= (\frac{1}{2}mv^2)_{truck} + (\frac{1}{2}mv^2)_{car}$
$= \frac{1}{2} \times 4000 \times 10^2 + \frac{1}{2} \times 1000 \times 20^2$
= 400 000 J
= 4.0 × 10^5 J (ANS)

Examiner's comment
The majority of students were able to correctly calculate the final kinetic energy. Any errors were usually due to incorrect calculations, such as omitting to square the velocity or combining the masses in some way. The expected answer was consequential upon the answer to Question 5.

Example 21 1998 Question 7, 67%
The final KE is less than the initial KE. Initial KE was 4.5 × 10^5 J whilst the final KE was 4.0 × 10^{5}J. Therefore, this collision was inelastic, because kinetic energy has been lost.

This kinetic energy has been transformed into other forms, - sound, heat, and energy of deformation.

To get full marks on this question you needed to include your data from questions 5 and 6. Don't assume that the examiner will go back and read this as part of your answer to this question.

Examiner's comment
The most common errors were due to:
• Students who felt that simply identifying it as an inelastic collision would be sufficient to gain the 3 marks.
• Students who treated the terms 'energy' and 'kinetic energy' as identical. Hence, they had energy 'disappearing', rather than energy being transformed. Students need to understand that energy, like momentum, is always conserved. However, energy can be transformed between kinetic energy, potential energy etc.

Example 22 1980 Question 16, 70%
WD = ΔKE.
In this case the final speed is the same as the initial speed.
$\therefore$ ΔV = 0
$\therefore$ ΔKE = 0
$\therefore$ WD = 0 J (ANS)

Example 23 2008 Question 12, 55%
The energy stored in the spring is $\frac{1}{2}kx^2$

$= \frac{1}{2} \times 10 \times (0.2)^2$ (use metres)

= 0.02 J (ANS)

Example 24 2004 Pilot Question 14, 22%

The total energy at the top of the slide must be the same as at the bottom of the slide.

At the top TE = mgh + ½ mv^2

= 30 x 10 x h + 0

The box loses energy due to the frictional force that is acting.

The Work Done = F x d

= 50 x 6

= 300 J

At the bottom TE = mgh + ½ mv^2

= 0 + ½ x 30 x 8^2

= 960 J

So at the top the box had 960 + 300 = 1260 J of energy.

$\therefore$ 1260 = 30 x 10 x h

$\therefore$ h = 4.2 m (ANS)

Examiner's comment

The most straightforward approach was to equate the gravitational potential energy at the top of the ramp to the sum of the kinetic energy at the bottom plus the energy lost to work done against friction on the way down the ramp. Very few students managed to deal with the work done against friction.

Example 25 2004 Pilot Question 15, 53%

The initial kinetic energy of the box is 960 J.

The energy stored in the spring is given by

½ kx^2. At the maximum compression the box is stationary, therefore its KE is zero.

All the energy is stored in the spring. Therefore 960 = ½ kx^2

$$x = \sqrt{\frac{960 \times 2}{30000}}$$

= 0.25 m (ANS)

Examiner's comment

By equating the kinetic energy of the box to the energy stored in the spring students were able to determine the compression of the spring.

Example 26 2000 Question 7, 29%

This question requires you to understand that the kinetic energy of the head has gone into compressing the bag.

Therefore:

$$E_k = E_c$$

$$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$$

at about this point you realise that you need to know the value of k, which is the gradient of the Force Distance graph.

Therefore k is

$$k = \frac{F}{x}$$

$$k = \frac{16000}{0.2}$$

$$k = 8 \times 10^4 \text{Nm}^{-1}$$

Now using the kinetic energy of the head as being the work done on the air bag you get.

$$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$$

$$\therefore \frac{1}{2} \times 8 \times 15^2 = \frac{1}{2} \times 8 \times 10^4 x^2$$

$$\therefore x = \sqrt{\frac{8 \times 15^2}{8 \times 10^4}}$$

$\therefore$ x = 0.15 m (ANS)

Examiner's comment

This question required students to understand that the area under a force-distance graph represented the work done, or the change in kinetic energy of the driver's head.

The average mark for this question was disappointing with the most common error being to interpret this question as relating to impulse-momentum rather than work-energy. It was clear that students were so used to analysing collisions in terms of impulse-momentum, that this change in emphasis caught them quite unawares.

It was disappointing to note that approximately 15% of students showed no working at all, giving only the final answer, which was sometimes correct but often not.

Example 27 2000 Question 9, 35%

The specific reasons for choosing graph A needed to cover:

• A collision with a harder surface would result in a smaller compression distance.

• The material must have 900J of work done on it, and therefore the area under the graph remains constant.

• Hence, the required graph must have a shorter compression distance and a larger force.

Examiner's comment

The specific reasons for choosing graph A needed to cover:

• a collision with a harder surface would result in a smaller compression distance

• the area under the graph remains constant (900 J) no matter whether the collision is with the air bag or steering wheel

• hence, the required graph must have a shorter compression distance and a larger force.

Alternatively, students could have addressed this answer via an understanding that harder surfaces are 'stiffer' and have a steeper force-distance graph gradient. The aspect of the area under the graph remaining at 900 J was essential no matter which method students used.

The average mark here was disappointing, students found this concept to be quite difficult. Very few students noted that the area under the force-compression graph had to be the same (900 J) as in the original problem. Most students attempted to address this via an impulse-momentum approach, which made it difficult for them to gain full marks.

Example 28 1983 Question 27, 89%

F = kx

$\therefore$ F = 250 x 0.04

$\therefore$ F = 10 N (ANS)

Example 29 1983 Question 28, 54%

WD = $\frac{1}{2}kx^2$

= ½ x 250 x 0.04^2

= 0.20 J (ANS)

Example 30 1983 Question 29, 26%

When the ball leaves the plunger,

$KE_{ball} + KE_{plunger} = PE_{stored\ in\ sprng}$

$\therefore 0.20 = \frac{1}{2}(m_{ball} + m_{plunger})v^2$

$\therefore v = \sqrt{\frac{0.20 \times 2}{(0.1+0.1)}}$

$\therefore$ v = 1.41 m s^{-1} (ANS)

Example 31 1981 Question 21, 81%

Using F = kx, the spring constant is the gradient of the graph as the graph is F vs x.

$\therefore k = \frac{50}{0.1}$

$\therefore$ k = 500 N m^{-1} (ANS)

You must remember to include the units as they were specifically asked for in the question.

Example 32 1981 Question 22, 56%

$Energy_{stored} = \frac{1}{2}kx^2$, where k is the spring constant and x is the extension of the spring (not the length of the spring).

Use F = kx to find the extension. The force being applied is the weight of the mass.

$\therefore mg = kx$

$\therefore x = \frac{mg}{500}$

$\therefore x = \frac{10 \times 10}{500}$

$\therefore x = 0.2$

Now use E = ½ x 500 x 0.2^2

$\therefore$ E = 10 J (ANS)

Example 33 1990 Question 25

The loss in gravitational potential energy = gain in kinetic energy.

$\therefore \Delta mgh = \Delta \frac{1}{2}mv^2$

$\therefore gh = \frac{1}{2} v^2$

$\therefore v = \sqrt{2gh}$

$= \sqrt{2 \times 10 \times 13}$

$= \sqrt{260}$

= 16.1 m s^{-1} (ANS)

Example 34 1990 Question 26

The energy stored in the 'bungee' is given by E = $\frac{1}{2}kx^2$

$\therefore$ E = ½ x 17 x 4^2
= 136 J (ANS)

Example 35 1988 Question 6
The KE of the car = ½mv^2
$\therefore$ KE = ½ x 1000 x 20^2
= 2.0 x 10^5 J (ANS)

Example 36 1988 Question 7
Change in potential energy is given by mgh.
$\therefore$PE = mgh
= 1000 x 10 x 10
= 1.0 x 10^5 J (ANS)

Example 37 1988 Question 8
The work done by the braking force is given by WD = F x d, where 'F' is the braking force, and 'd' is the distance it acts.
In this case the work needs to stop the car at B, so it needs to overcome the initial KE as well as the gain in PE (from rolling down the slope).
The total energy the work done needs to overcome is
KE(**2.0 x 10^5**) + PE(**1.0 x 10^5**) = 3.0 x 10^5J
$\therefore$ F x 100 = 3.0 x 10^5
$\therefore$ F = 3.0 x 10^3 N (ANS)

Example 38 1986 Question 1
Use F = ma
The gradient of the v-t graph is the acceleration.
$\therefore$F = ma

$= 4 \times \frac{\Delta v}{\Delta t}$

$= 4 \times \frac{5}{1}$

= 20 N (ANS)

Example 39 1986 Question 4
WD = F x d
= 20 x 2.5
= 50 J (ANS)
WD = ΔKE
= ½ x 4 x 5^2 – ½ x 4 x 0^2
= 50 J (ANS)

Example 40 1986 Question 19
This is a force distance graph, so the work done is the area under the graph.
The best way to do this is to count squares (even though I recommend that you use this method as a last resort).
Each square is 10 x 0.05 = 0.5J.
Count the squares and put a small mark in each one as you count it. Only count a part square if it is greater than 50%.
I count 58 squares

$\therefore$ 58 x 0.5 **= 29.0 J (ANS)**

Example 41 1986 Question 20
The energy stored in the 'spring' is converted into the KE of the arrow.

$\therefore \frac{1}{2}mv^2 = 29.0$

$\therefore v^2 = \frac{29.0 \times 2}{0.6}$

$\therefore$ **v = 9.8 m/s (ANS)**

Example 42 1986 Question 27
The spring constant is 'k' in the equation

F = kx

Here the force extending the spring is the weight.

$\therefore$ mg = kx

$\therefore$ 0.4 x 10 = k x 0.1

$\therefore$ **k = 40 N m^{-1} (ANS)**

Example 43 1986 Question 28
The work done on the spring is the energy stored in the spring.
The stored energy = $\frac{1}{2}kx^2$

= ½ x 40 x 0.1^2

= 20 x 0.01

= 0.2 J (ANS)

Example 44 1985 Question 22, 84%
The simplest way to do this is to read the value straight form the graph.
The girl moves the block to 0.6m, therefore the force required is

10 N (ANS)

Example 45 1985 Question 23, 56%
When the spring returns to its rest length, it doesn't have any energy stored in it. So, all the energy that was stored in it when it was extended to 0.6 has been converted into KE of the block. The work done (energy stored in a spring) = $\frac{1}{2}kx^2$
To use this formula you need to know 'k'.
'k' is the gradient of the graph.
Use two points (as far apart as possible) to calculate the gradient.

Use $\frac{\text{rise}}{\text{run}} = \frac{40 - 0}{0.9 - 0.5}$

$= \frac{40}{0.4}$

= 100.

Substitute

$= ½ \times 100 \times 0.1^2$

= 0.5 J (ANS)

The shape of the graph is very particular. The spring obeys Hooke's Law, hence the straight line. The solid part of the line indicates that the spring can also be compressed by 0.2 m. The dotted line is just the extrapolation back to the axis. It would be impossible for the spring to have zero length under compression.

Example 46 1985 Question 24, 62%

The kinetic energy of the 3.0 kg block will be identical to the KE of the 1.0 kg block. This is because the KE is initially the energy stored in the spring, given by $½kx^2$, which is independent of the mass of the block.

The 3.0 kg block will have less speed, but the same energy.

∴ 0.5 J (ANS)

Example 47 1982 Question 30, 54%

The energy stored in the spring is given by

$E = ½kx^2$.

In this example this is written as

$PE = ½kd^2$ (ANS)

Example 48 1981 Question 11, 70%

The change in KE is the same as the work done on the box.

You must use the 'net force' to calculate the work done.

∴ WD = F x d

= (100 – 30) x 3

= 210 J (ANS)

Example 49 1978 Question 27, 91%

Gravitational PE = mgh.

∴ ΔPE = mgh

= 0.5 x 10 x 2

= 10 J (ANS)

Example 50 1978 Question 28, 63%

WD = F x d

= 1 x 4

= 4 J (ANS)

Example 51 1978 Question 29, 42%

Block X needs to travel 5 m to Block Y.

∴ it will lose 5J of energy overcoming the frictional force.

Block X starts with 10J at P therefore it will have 10 – 5 = 5J at R.

5 J (ANS)

Example 52 1978 Question 30, 78%

If the collision is elastic, then Block X will be stationary and block Y will have all the energy.

∴ 5 J (ANS)

Example 53 1978 Question 31, 62%

The work done is given by WD = Fd, where the force acting is the frictional force (1.0 N).

∴ WD = 5

= f x d

= 1 x d

$\therefore$ **d = 5 m (ANS)**

Example 54 1977 Question 21, 55%

At x_1, the initial KE of the block is stored as PE of the spring.

$\therefore \frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$\therefore \frac{1}{2} \times 0.5 \times 2^2 = \frac{1}{2} \times 200 \times (x_1)^2$

$\therefore x_1 = \sqrt{\frac{1}{100}}$

$\therefore$ **x_1 = 0.1 m (ANS)**

Example 55 1975 Question 10, 71%

If the man slides down with a constant acceleration of 8.0 ms^{-2}, then the net force acting on him is given by

F = ma

= 100 x 8

= 800 N.

The man has a weight of 1000 N, therefore the frictional force is given by

1000 – 800 = 200N

$\therefore$ **200 N (ANS)**

Example 56 1975 Question 11, 39%

The tension in the rope must be the same as the frictional force that is opposing the motion.

$\therefore$ **200 N (ANS)**

Example 57 1975 Question 12, 58%

WD = ΔPE

= mgh

= 100 x 10 x 10

= 1.0 x 10^4 J (ANS)

Example 58 1975 Question 13, 46%

WD = f x d

= Friction force x distance

= 200 x 10

= 2.0 x 10^3 J (ANS)

Example 59 1975 Question 33, 88%

The weight is causing the elastic to extend.

$\therefore$ mg = kx

$\therefore$ mg = 0.05 x 10

= 0.5 N (ANS)

Make sure you include the correct units in your answer.

Example 60 1975 Question 34, 21%

WD = $\frac{1}{2}kx^2$

To find use mg = kx

$\therefore k = \frac{mg}{x}$

$\therefore k = \frac{0.5}{0.04}$

= 12.5 Nm^{-1}

∴ WD = ½kx^2

= ½ x 12.5 x 0.04^2

= 0.01 J (ANS)

Make sure you include the correct units in your answer.

Example 61 1975 Question 35, 17%

The work done is given by WD = ½kx^2, where x is the extension (not the length of the elastic).

∴ WD = ½kx^2

= ½ x 12.5 x 0.08^2

= 0.04 J

Originally it took 0.01 J to extend the elastic the initial 0.04 m, so the difference between 0.04 J and 0.01 J is the work done by the student.

∴ 0.04 -0.01

= 0.03 J (ANS)

Make sure you include the correct units in your answer.

Example 62 1975 Question 36, 41%

If the elastic is twice as long, then the mass will extend the original length by twice as much.

∴ 0.04 x 2

∴ 0.08 m (ANS)

Make sure you include the correct units in your answer.

Example 63 1974 Question 20, 80%

The spring constant is given by the gradient of the graph.

$\therefore k = \dfrac{160}{0.05}$

= 3,200 N m^{-1} (ANS)

Example 64 1974 Question 21, 67%

$E = ½kx^2$

$= ½ \times 3,200 \times 0.05^2$

= 4 J (ANS)

Example 65 1974 Question 22, 66%

The maximum acceleration will occur when the force is a maximum. Since the force = kx, then the maximum force occurs when x is largest.

$\therefore f = kx$

$= 3200 \times 0.01$

$= 32$ N

Since f = ma, with f = 32 and m = 20

$a = \dfrac{32}{20}$

∴ a = 1.6 m s^{-2} (ANS)

Example 66 1973 Question 35, 71%

The spring constant is given by the gradient of the graph.

$\therefore k = \dfrac{5}{0.1}$

= 50 N m^{-1} (ANS)

Example 67 1973 Question 36, 64%

WD = ½ kx^2

Use the graph to find x when the force = 5.0 N.

∴x = 0.1 m

$\therefore ½ kx^2 = ½ \times 50 \times 0.1^2$

= 0.25 J (ANS)

Example 68 1973 Question 37, 83%

Increasing the force to 8 N will not alter the compression.

∴ 0 J (ANS)

Example 69 1973 Question 38, 44%

The graph of the force vs extension graph shows that full compression is when 5N or 0.1 m.

The energy stored in the spring is released as the KE of the ball.

$\therefore 0.25 = ½ mv^2$

$\therefore v^2 = \dfrac{0.25 \times 0.5}{0.250}$

$\therefore v = \sqrt{\dfrac{0.25 \times 0.5}{0.250}}$

∴ v = 1.41 m s^{-1} (ANS)

Example 70 1973 Question 39, 27%

The gain in gravitational PE must equal the loss in KE.
$\therefore$ mgh = ½ mv^2
$\therefore$ gh = ½ v^2
$\therefore h = \frac{v^2}{20}$
The distance the ball travels along the surface is given by 5 x h.
$\therefore d = 5 \times \frac{v^2}{20}$
$= \frac{v^2}{4}$ **(ANS)**

Example 71 1972 Question 1, 74%
From the graph, the speed is constant over the first 2.5 secs.
$\therefore$ acc = 0
$\therefore$ F = 0 (ANS)

Example 72 1972 Question 2, 53%
The work done is equal to the loss of KE of the trolley.
At O, the trolley had a KE = ½ mv^2
= ½ x 2.2 x 3.0^2
= 9.9 J
At point X the trolley came to rest, therefore it had lost all of its KE.
$\therefore$ 9.9 J (ANS)

Example 73 1972 Question 3, 65%
Since friction was negligible all the KE has been converted into $PE_{gravitational}$.
$\therefore$ 9.9 = mgh
$\therefore h = \frac{9.9}{2.2 \times 10}$
= 0.45 m (ANS)

Example 74 1971 Question 1, 78%
WD = ΔKE.
From the graph, initial speed was 4.0 ms^1 and the final speed was 0.
$\therefore$ ΔKE = ½ mv^2
= ½ x 0.2 x 4.0^2
= 1.6 J (ANS)

Example 75 1971 Question 2, 79%

The force is given by F = ma.

From the graph the acceleration is the gradient of the graph = $\frac{4}{0.8}$ = 5

∴ F = 0.2 x 5

= 1.0 N (ANS)

Example 76 1971 Question 3, 92%

Over the 0.8 sec time interval, the block came to rest.

The distance travelled is given by the area under the graph.

∴ d = ½ x 4 x 0.8

= 1.6 m.

This can also be solved using, WD = ΔKE

∴ 1.6 = 1.0 x d

∴ d = 1.6 m (ANS)