**MULTIPLE-CHOICE QUESTIONS**

1. C 2. C 3. B 4. B 5. D 6. D

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| **STRUCTURED QUESTIONS** QUESTION 1/*VRAAG 1* |  |  |

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| 1.1.1  **Option 1/*Opsie 1*:**  (U + K)bottom + Wtruck – Wf = (U + K)top ✓  (0 + (10 000)(5,56)2) ✓+ 7 x 105 ✓– 8,5 x 104 ✓ = (10 000)(9,8)hf + (10 000)(5,562) ✓  hf = 6,28 m ✓ | **Option 2/*Opsie 2*:**  Useful work done = gain in U ✓ = mgh ✓  *Bruikbare arbeid verrig = wins aan U* = mgh  7 x 105 ✓– 8,5 x 104 ✓ = 10 000(9,8)hf ✓  6,15 x 105 = 10 000(9,8)hf  hf = 6,28 m ✓  **Option 3/*Opsie 3*:**  Wnet = Ek✓  Wg + Wf + Wtruck = 0  -10 000(9,8)hf ✓– 8,5 x 104 ✓+ 7 x 105 ✓ = 0 ✓  hf = 6,275 = 6,28 m ✓  **Option 4/*Opsie 4*:**  W(external forces/*eksterne kragte*)= U + K ✓  Wexternal/ekstern = (mghf – mghi) + ( - )  7 x 105 ✓– 8,5 x 104 ✓ = 10 000(9,8)(hf – 0) ✓ + 0 ✓  6,15 x 105 = 10 000(9,8)hf  hf = 6,28 m ✓    **Option 5/*Opsie 5*:**  Ff =  =  = 3 695,65 N  Fapplied =  =  = 3,04 x 104 N  Fnet = 0  w(down incline) + Ff + Fappl = 0 ✓ mgsin + Ff + Fappl = 0  - (10 000)(9,8) ✓ - 3 695,65 ✓+ 3,04 x 104 ✓= 0 ✓ (sin  = )  hf = 6,28 m ✓ |  | (6) |

-1 if/*indien* g = 10 m∙s-2 – penalise once in this Question 6/*penaliseer eenmalig in Vraag 6*

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| 1.1.2 | **Option 1/*Opsie 1:***  W = Fxcos ✓  7 x 105 = F(23)(1) ✓  F = 3,04 x 104 N  P = Fv ✓ = (3,04 x 104) ✓ () ✓ = 1,69 x 105 W ✓  **Option 2/*Opsie 2:***  v =  ✓  ✓ =  ✓ t = 4,14 s  P =  ✓= ✓ = 1,69 x 105 W ✓ |  | (6) |

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| 1.2 | * Surface must provide sufficient friction (e.g. sand) ✓   *Oppervlak moet genoeg wrywing lewer (bv. sand)*   * Must be long enough for vehicle to stop. ✓   *Moet lank genoeg wees om die voertuig tot stilstand te bring* |  | (2)  **[14]** |

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| QUESTION 2/*VRAAG 2* |  |  |

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| 2.1 | The net work done on an object is equal to the change in the  Only/*Slegs* or/*of*  object's kinetic energy. ✓✓  *Die netto arbeid verrig op 'n voorwerp is* gelyk aan die  verandering in kinetiese energie *van die voorwerp.*  OR/*OF*  The work done on an object by a net force is equal to the change in the object's kinetic energy. / *Die arbeid verrig op 'n voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.* |  | (2) |

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| 2.2 |  |  |  |

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Fg/w/Force of earth on object / *Krag van aarde op voorwerp* 🗸

N/FN/Force of surface on object / *Krag van oppervlak op voorwerp* 🗸

f/Ff/Force of friction / *Wrywingskrag*  🗸

OR/*OF*

●

F / w / Component of gravitational force perpendicular to incline / *Komponent van die gravitasiekrag loodreg op skuinste*

N/FN/Force of surface on object / *Krag van oppervlak op voorwerp* 🗸

f/Ff/Force of friction / *Wrywingskrag*  🗸

Fg// / w// / Component of gravitational force parallel to incline / *Komponent van die gravitasiekrag parallel aan skuinste*

🗸

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| 2.3.1  🗸  **+** | =  + 2aΔx 🗸  = (0)2 + (2)(2)(10) 🗸  = 40 m2·s-2  Ekf = ½m 🗸  = ½(60)(40) 🗸  = 1 200 J 🗸  OR/*OF*    10 = (0)Δt ½(2) Δt**2**  Δt = 3,16 s  vf = vi + aΔt = 0 + (2)(3,16) 🗸 = 6,32 m·s-1  Ekf = ½m 🗸  = ½(60)(6,32)**2** 🗸  = 1 200 J 🗸 |  | (5) |
| 2.3.2 | |  |  |  |  | | --- | --- | --- | --- | |  | W**g** = w**//** Δxcosθ 🗸  = mgsin 25°🗸 (10)(cos 0°)🗸  = (60)(9,8)sin25°10(1)  = 2 485 J 🗸  OR/*OF*  W**g** = wΔxcosθ 🗸  = mghcos 0°  = (60)(9,8) 🗸 (10)sin25°(1) 🗸  = 2 485 J 🗸  OR/*OF*  W**g** = -ΔU 🗸  = - (0 – mgh) 🗸  = - (0 – (60)(9,8)(10)sin25° 🗸  = 2 485 J 🗸 |  | (4) | |  | (4) |

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| 2.3.3 | **OPTION 1/*OPSIE 1:***  Wnet = ΔEk🗸  Wg(parallel to slope/*parallel aan helling*) + Wf = ΔEk 🗸  2 485 + Wf = 1 200 🗸  Wf = - 1 285 J 🗸 (If/*Indien* + 1 285 J deduct 1 mark/*trek 1 punt af*)  Marking rule 1.6 *Nasienreël 1.6*  Marking rule 1.6 *Nasienreël 1.6*  Marking rule 1.6 *Nasienreël 1.6*  (U + K)i – Wf = (U + K)f  Marking rule 1.6 *Nasienreël 1.6*  Marking rule 1.6 *Nasienreël 1.6*  Wappl/toegep = U + K + Wf  **OPTION 3/*OPSIE 3*:**  W(applied/*toegepas*) = ΔEk + ΔEp - Wf  0 = (½m - 0) + (0 – mgh) - Wf **Max./*Maks.*:**  0 = ½m- mgh - Wf 🗸  0 = 1 200 - 2 485 - Wf 🗸  Wf = -1 285 J 🗸  **OPTION 4 / *OPSIE 4*:**  (U + K)i + Wf = (U + K)f **Max./*Maks.*:**  mgh + 0 + Wf = 0 + ½m 🗸  2 485 + Wf = 1 200 🗸  Wf  = - 1 285 J🗸 (If/*Indien* + 1 285 J deduct 1 mark/*trek 1 punt af*)  **OPTION 5/*OPSIE 5:***  Wnc = ΔEk + ΔEp 🗸  = (½m - 0) + (0 – mgh)  = ½m- mgh 🗸  = 1 200 - 2 485 🗸  Wnc = Wf = -1 285 J 🗸 (If/*Indien* + 1 285 J deduct 1 mark/*trek 1 punt af*) |  | (4) |

**Accept/*Aanvaar:***

Ek / K

v2 = u2 + 2as / s = ut + ½at**2**/ v = u + at

A mixture of the two allowed formulae is not accepted. / *‘n Mengsel van die twee erkende formules word nie aanvaar nie.*

**OPTION 2/*OPSIE 2***

Fnet = Fg(parallel to slope/*parallel aan helling* – Ff 🗸

ma = mgsin25° – Ff

(60)(2) = (60)(9,8)sin25° –Ff 🗸

Ff = 128,5 N 🗸

**OPTION 1/*OPSIE 1***

Wf = Ff Δxcosθ 🗸

- 1 285 = f(10)cos180° 🗸

Ff = 128,5 N 🗸

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| 2.3.4 | **OPTION 2/*OPSIE 2***  Fnet = Fg(parallel to slope/*parallel aan helling* – Ff 🗸  ma = mgsin25° – Ff  (60)(2) = (60)(9,8)sin25° –Ff 🗸  Ff = 128,5 N 🗸  **OPTION 1/*OPSIE 1***  Wf = Ff Δxcosθ 🗸  - 1 285 = f(10)cos180° 🗸  Ff = 128,5 N 🗸 |  | (3)  **[21]** |

**QUESTION 3/*VRAAG 3***

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| 3.1 | R: Force of incline (surface) on crate / N / Normal (force) / FN ✓  S: Gravitational force / Gravity / force of Earth on crate /  Fg / w / FEarth on crate ✓  T: Frictional force/Ff /Ffriction /f✓ |  | (3) |

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| 3.2 | The force is perpendicular to ✓ the displacement ✓of the crate.  **OR**  W = F ∆x cos 90° ✓ = 0 ✓ |  | (2) |

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| 3.3 | The following diagram is used for clarification in the solutions below.  ●  70°  f = 190 N  w//=mgsin20°  20°  w  20°  **OPTION 1**  Wnet = Ww + Wf ✓  = mgΔxcos70° + fΔxcos180°  = (70)(9,8) ✓ (12)(cos70°)✓ + (190)(12)(-1) ✓  Wnet = 535,51 J ✓  Accept:  cos180° or -1 |  |  |

**OPTION 3**

Wnet = Ww// + Wf ✓

= mgsin20°Δxcos0° + fΔxcos180°

= (70)(9,8)sin20°✓ (12)cos0°✓+ (190)(12)cos180°✓

Wnet = 535,51 J ✓

Accept:

cos0° or 1

cos180° or -1

**OPTION 2**

Fnet = w// + f

### *=* mgsin20° + (-190)

= (70)(9,8)sin 20°✓ – 190 ✓

= 44,63 N

∴Wnet = FnetΔxcosθ✓

= (44,63)(12)(cos0°) ✓

Wnet = 535,51 ✓

Accept:

cos0° or 1

3.3

**OPTION 4**

Wnet = Ww + Wf ✓

= mghcos0° + fΔxcos180°

= (70)(9,8) ✓ (12sin20°)cos0°✓+(190)(12)cos180°✓

Wnet = 535,51 J ✓

Accept:

cos0° or 1

cos180° or -1

**+**

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| 3.4 | The net work done (on an object) ✓is equal to the change in (the object’s) kinetic energy. ✓  **OR**  The work done (on an object) by a net force is equal to the change in (the object’s) kinetic energy. |  | (2) |

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| 3.5 | Wnet = ΔK✓ (OR Wnet = ΔEk)  535,51 = ½ m( – )  535,51✓= ½ (70)( - 4) ✓  vf = 4,39 m·s-1✓ |  | (4)  **[16]** |

**QUESTION 4/*VRAAG 4***

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| 4.1 | Impulse is the product of the (net/average) force and the time during which the force acts. ✓✓  *Impuls is die produk van die (netto/gemiddelde) krag en die tyd waartydens die krag inwerk.* ✓✓  **OR/*OF***  Impulse is the change in momentum. ✓✓  *Impuls is gelyk aan verandering in momentum.* ✓✓ |  | (2) |

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| 4.2 | **Option 1/*Opsie 1:***  Upward positive:/*Opwaarts positief*  ✓  = m(vf – vi)  = 0,15(3,62 - (-6,2)) ✓  = 1,473 N∙s / kg∙m∙s-1✓  upward/*opwaarts* | **Option 2/*Opsie 2:***  Upward negative:/O*pwaarts negatief*  ✓  = m(vf – vi)  = 0,15[(-3,62 - (6.2)) ✓  = -1,473 N∙s /kg∙m∙s-1  = 1,473 N∙s /kg∙m∙s-1 ✓  upward/*opwaarts* | |  |  |
|  | **Option 3/*Opsie 3:***  Upward positive: /*Opwaarts positief*  ✓  = mvf – mvi  = (0,15)(3,62) – (0,15)(-6,2) ✓  = 1,473 N∙s / kg∙m∙s-1✓  upward/*opwaarts* | **Option 4/*Opsie 4:***  Upward negative: /O*pwaarts negatief*  ✓  = mvf – mvi)  = (0,15)(-3,62) – (0,15)(6,2) ✓  = -1,473 N∙s /kg∙m∙s-1  = 1,473 N∙s /kg∙m∙s-1✓  upward/*opwaarts* | |  | (3) |
| 4.3 | (U + K)top/*bo* = (U + K)bottom/*onder*✓  mghf + ½ m= mghi + ½ m  (0,15)(9,8)h + 0 ✓ = 0 + ½(0,15)(6,2)2 ✓  h = 1,96 m✓  = 0,65 m  Yes/Meets requirements ✓  *Ja/Voldoen aan vereistes.* ✓ | | **K(bottom/*onder*) = U(top/*bo*)**  Max.: | | (5)  **[10]** |
| **Other formulae/*Ander formules*:**  Emech(A) = Emech(B) / Emech(i) = Emech(f)  Emech(top) = Emech(bottom)  (Ep + Ek)A = (Ep + Ek)B  (Ep + Ek)bottom = (Ep + Ek)top  Ep + Ek)i = (Ep + Ek)f  (U + K)i = (U + K)f  (U + K)A = (U + K)B  mghB +  = mghB + | |

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| **QUESTION 5/*VRAAG 5*** |  |  |

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| 5.1 | The energy of an object due to its position ✓  above the surface of the earth. ✓  *Die energie van 'n voorwerp as gevolg sy posisie* ✓  *bokant die oppervlak van die aarde*. ✓ |  | (2) |

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| 5.2 | **Option 1/*Opsie 1:***  Wnet = ∆K ✓  mg∆ycosθ + Wf = ½m– ½m  (2)(9,8)(2)cos0° ✓+ Wf ✓= ½(2)(5)2✓– 0 ✓  Wf = -14,2 J ✓ |  |  | (6) |
| **Option 2/*Opsie 2:***  Wnet = ∆K ✓  -∆U + Wf = ½m– ½m  mgh + Wf = ½m– ½m  (2)(9,8)(2) ✓+ Wf ✓= ½(2)(5)2✓– 0 ✓  Wf = -14,2 J ✓ |

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| 5.3 | No/Nee ✓  Friction is present/*Wrywing is aanwesig*. ✓ |  | (2) |

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| 5.4.1 | pbefore = pafter✓  (2)(5) + (9)(0) ✓= 2vf2 + (9)(1) ✓  vf2 = 0,5 m·s-1 ✓ | **Notes/*Aantekeninge:***  **Other formulae/*Ander formules*:**  m1vi1 + m2vi2 = m1vf1 + m2vf2  m1u1 + m2u2 = m1v1 + m2v2 | (4) |

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| 5.4.2 | K(total after/*total na*) = ½m1+ ½m2✓  = ½(2)(0,5)2 ✓+ ½(9)(1)2 ✓  = 4,75 J ✓  K(total before)  K(total after) ✓  inelastic  *K(totaal na)  K(totaal voor)* ✓  *onelasties* |  | (5)  **[19]** |

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| QUESTION 6/*VRAAG 6* |  |  |

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| 6.1  + | 200 x 1 000 = 2 x 105 kg ✓ |  | (1) |

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| 6.2 | Eki + Epi = Ekf + Epf✓ or/of Emech i= Emech f or/*of* ΔEp = ΔEk  0 + mghi = Ekf + 0  0 + (2 x 105)(9,8)(150) ✓= Ekf + 0 ✓  Ekf = 2,94 x 108 J ✓  OR/*OF*  Wnet = Ek  Fcosy = Ekf - Eki ✓  (200 000)(9,8)(cos 0o)(150) ✓= Ekf - 0✓  Ekf = 2,94 x 108 J ✓ |  | (4) |

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| 6.3 | Ekf = ½m✓  2,94 x 108 J = ½(2 x 105)vf2 ✓  vf = 54,22 m∙s-1 ✓ |  | (3) |

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| 6.4 | P =  x  = x  ✓  = 2,499 x 108 W ✓  OR/*OF*  Ek(effective/*effektief*) =  x 2,94 x 108 ✓= 2,499 x 108 J  P =  = 2,499 x 108 W ✓ |  | (2) |

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| 6.5 | Converted to sound / heat in turbine / other forms of energy. ✓ O*mgeskakel na klank / hitte in die turbine / ander vorms van energie* |  | (1)  **[11]** |

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| QUESTION 7/*VRAAG 7* |  |  |

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| 7.1 |  |  |  |

**Option 1/*Opsie 1*:**

Direction of motion as positive / *Rigting van beweging as positief:*

Fnet = ma ✓

-30 = (3)a ✓

a = - 10 m·s-2

✓

= (7)2 ✓+ 2(-10)(2) ✓

vf = 3 m·s-1

If/*Indien* K =  -  done separately before substitution into wrong formula/*apart gedoen voor substitusie in verkeerde formule: *

**Option 2/*Opsie 2*:**

Wnet = K✓ or/*of* Ek

Fnetxcos✓ =  - 

(30)(2)cos180° ✓ = (3) ✓- (3)(7)2 ✓

- 60 = 1,5 - 73,5  vf = 3 m·s-1

**Option 3/*Opsie 3*:**

Wappl = U + K - Wf **Max./*Maks.*: ****

0 = 0 + ( - ) - Ffxcos ✓

0 = 0 + (3) ✓- (3)(7)2 ✓ - (30)(2)cos180° ✓

0 = 1,5 - 73,5 + 60  vf = 3 m·s-1

Wappl = U + K + Wf **

**Option 4 / *Opsie 4*:**

(U + K)i + Wf = (U + K)f **Max./*Maks.*: ****

(0 + ) + Ffxcos ✓ = 0 + 

0 + (3)(7)2 ✓+ 30(2)cos180° ✓ = 0 + (3) ✓

73,5 – 60 = 1,5  vf = 3 m·s-1

(U + K)i – Wf = (U + K)f **

**Option 5 / *Opsie 5*:**

(U + K)i = (U + K)f - Wf **Max./*Maks.*:** **

(0 + ) = 0 + - Ffxcos  ✓

0 + (3)(7)2 ✓= 0 + (3) ✓ - 30(2)cos180° ✓

73,5 = 1,5 + 60  vf = 3 m·s-1

(U + K)i = (U + K)f +Wf **

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| 7.2 |  |  |  |

Any one of the following labels / *Enige een van volgende benoemings:*

* wparallel or/of w//
* Fg(parallel) or/of Fg//
* mgsin20°
* Component of weight parallel to incline / *komponent van gewig parallel aan skuinste*

•

w//

✓

✓

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| **Checklist / *kontrolelys***  Free-body diagram / *vrye kragtediagram* | |
| Direction of force indicated as parallel to and down incline (not needed to show incline)  *Rigting van krag getoon as parallel aan en afwaarts teen skuinste (skuinste hoef nie getoon te word nie)* | ✓ |
| Correct label / korrekte benoeming | ✓ |

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| 7.3 | |  | |  | |  | |

As single step/*As een stap:*

(U + K)i = (U + K)f ✓

0 + (3)(3)2 ✓= (3)(9,8)h + 0 ✓

(3)(3)2 = (3)(9,8) dsin20° ✓

 d = 1,34 m ✓

**Option 1/*Opsie 1*:**

(U + K)i = (U + K)f ✓

0 +  = mgh + 0

0 + (3)(3)2 ✓= (3)(9,8)h + 0 ✓

 h = 0,46 m

sin 20°= ✓ =   d = 1,34 m ✓

**Option 2/*Opsie 2*:**

Wnet = K✓ (or/*of* Ek)

Fg//xcos =  - 

(3)(9,8)sin20° ✓ (d)cos180° ✓ = 0 - (3)(3)2 ✓

- 10,06d = - 13,5  d = 1,34 m ✓

**Option 3/*Opsie 3*:**

Wnet = K✓ (or/*of* Ek)

Wgravity = Kf – Ki

mghcos180o ✓ =  - 

(3)(9,8)h(-1) ✓ = 0 - (3)(3)2 ✓  h = 0,46 m

sin20°=  ✓=   d = 1,34 m ✓

**Option 4 / *Opsie 4*:**

Direction of motion as positive / *Rigting van beweging as positief:*

Fnet = ma ✓

mgsin20° = ma

- (3)(9,8)sin20° = 3a ✓ a = - 3,35 m·s-2

✓

02= (3)2 + 2(-3,35)(d) ✓

d = 1,34 m✓

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|  |  |  | (5)  **[12]** |

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| QUESTION 8/*VRAAG 8* |  |  |

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| 8.1 | 0 (N)/Zero/*nul* ✓  no acceleration/constant velocity ✓  *geen versnelling/konstante snelheid* |  | (2) |

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| 8.2 | 0 (J)/Zero/*nul* ✓ |  | (1) |

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| 8.3.1  + | Option 4/*Opsie 4*:  W(external forces/*eksterne kragte*) = U + K ✓  OR/*OF*  Wapplied/t*oegepas* + Wfriction/w*rywing* = (Uf – Ui) + (Kf – Ki)/U + K  Wapplied/*toegepas* + (50)(10)(-1) ✓= (120)(9,8)(1,5) - 0) ✓ + 0 ✓  Wapplied/*toegepas* = 2 264 J ✓ (2,26 x 103 J)  Option 3/*Opsie 3*:  Wnet/*netto* = K ✓  Wapplied/*toegepas* + Wfriction/*wrywing* + Wgravity/*gravitasie* = K  Wapplied/*toegepas* + (50)(10)(-1) ✓- (120)(9,8)(1,5) ✓ = 0 ✓  Wapplied/*toegepas* = 2 264 J ✓ (2,26 x 103 J)  Option 1/*Opsie 1*:  U i + Ki + Wfriction/*wrywing* + Wapplied/*toegepas* = Uf + Kf ✓  0 + fx cos + Wapplied/*toegepas* = mgh (Ki = Kf)  0 + (50)(10)(-1) ✓ + Wapplied/*toegepas* = (120)(9,8)(1,5) ✓ ✓  Wapplied/*toegepas* = 2 264 J ✓ (2,26 x 103 J)  Option 2/*Opsie 2*:  For equilibrium:/*Vir ewewig:*  F = f + wparallel to incline/*parallel met helling* = f + mgsin (- angle of incline with horizontal/*hoek van helling met horisontaal*)  F = 50 ✓+ (120)(9,8)() ✓  F = 226,4 N  Wapplied/*toegepas* = Fxcos✓  = (226,4)(10)(cos0°) ✓ OR (226,4)(10)  = 2 264 J ✓ (2,26 x 103 J)  Accept/*Aanvaar*: Ek, Ep |  | (5) |

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| 8.3.2 | Wapplied/*toegepas* = Fxcos✓  2 264 J ✓= F(10)(1) ✓  F = 226,4 N ✓ (2,26 x 102 N)  **OR/*OF***  F = f + wpar to incline/*par met helling* = f + mgsin ✓ (- angle of incline with horizontal/*hoek van helling met horisontaal*)  F = 50 ✓ + (120)(9,8)() ✓  F = 226,4 N ✓ (2,26 x 102 N) |  | (4)  **[12]** |

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| QUESTION 9 |  |  |

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| 9.1 | The sum of the kinetic and (gravitational) potential energy is conserved / constant / remains the same / does not change✓  in an isolated / closed / system / no external work done / only conservative forces act on the system.✓  OR  The (total) mechanical energy is conserved/ constant✓  in an isolated system.✓ |  | (2) |

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| 9.2 | **OPTION 1**  Emech = U + K or Ep + Ek  = mgh + ½ mv2 ✓(any formulae)  = (0,5)(9,8)(0,6) ✓+ ½ (0,5)(3)2 ✓  = 5,19 J ✓ (5,25 J)  **OPTION 2**  Ep = mgh = (0,5)(9,8)(0,6) ✓= 2,94 J (3 J)  Ek = ½ mv2 = ½ (0,5)(3)2 ✓= 2,25 J  Emech = Ep + Ek ✓= 2,94 + 2,25  = 5,19 J✓ |  | (4) |

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| 9.3  **Accepted formulae**  Emech(A) = Emech(B) / Emech(i) = Emech(f) / Emech(top) = Emech(bottom)  (Ep + Ek)A = (Ep + Ek)B / (Ep + Ek)bottom = (Ep + Ek)top  (Ep + Ek)i = (Ep + Ek)f /(U + K)bottom = (U + K)top  (U + K)i = (U + K)f / (U + K)A = (U + K)B / mghi +  = mghf +  **OPTION 2**  Wnet = ΔEk ✓  mgΔycosθ = ½ m(vf2 – vi2)  (0,5)(9,8)(0,6)(1)✓= ½ (0,5)(vf2 – 32) ✓  ∴vf = 4,56 m·s-1  **OPTION 1**  (U + K)B = (U + K)C ✓  mghB + ½ m= mghC + ½ m  5,19 ✓ = 0 + ½ (0,5)v2 ✓  v = 4,56 m·s-1 | **Other formulae*:***  pt before = pt after  or m1vi1 + m2vi2 = m1vf1 + m2vf2  or m1u1 + m2u2 = m1v1 + m2v2 pbefore = pafter ✓ (0,5)(4,56) + 0 ✓ = (0,5)vf2 + (0,1)(3,5) ✓  vf2 = 3,86 m·s-1 ✓(to the right) (3,88 m·s-1) | | |  | | (7)  **[13]** | | |
| **QUESTION 10/*VRAAG 10*** | | |  | |  | | |
| **Accepted Labels** | | | | | | |
| N | | Normal / Force of surface on crate / FN / 269 N / 275 N | | | | |
| w | | Fg / force of Earth on crate / weight / 294 N /300 N mg / gravitational force | | | | |
| Fapplied | | F / force of worker on crate / 50 N / FA | | | | |
| f | | Ffriction / 20 N / Ff / friction | | | | |
| Fhorizontal / Fx / F// | | 43,30 N | | | | |
| Fvertical / Fy / F⊥ | | 25 N | | | | |

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| 10.1 |  |  |  |

**Accept:** Force diagram

OR

✓

f

N

Fhorizontal

✓

✓

Fvertical

w

✓

⚫

✓

✓

⚫

N

f

Fapplied

w

✓

✓

30o

OR

✓

f

N

Fhorizontal

✓

✓

Fvertical

w

✓

✓

✓

N

f

Fapplied

w

✓

✓

30o

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | (4) |

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| --- | --- | --- | --- |
| 10.2 | W = F∆x cos90o✓✓= 0  OR  They (normal force and the gravitational force) are perpendicular /at 90o to the (direction of the) displacement / motion / Δx✓✓of the crate.  OR  The angle between the force and displacement / motion / Δx is 90o.✓✓  OR  The crate moves horizontally and the forces act vertically.✓✓ |  | (2) |

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| 10.3 | Accepted symbols for applied force: Fappl / F / FA  Accepted symbols for frictional force: f / Ff / Ffriction  Accepted symbols for gravitational force: w / Fg / Fforce of Earth on crate / gravitational force |  |  |

**OPTION 1**

Wnet = Wappl + Wf  ✓ For either formula

= Fapp Δx cos θ + fΔx cos θ

= (50)(6)(cos30°)✓ + (20)(6)(cos180°) ✓

= 259,81 + (-120)

Wnet = 139,81 J ✓

**OPTION 5**

Fnet = Fhorizontal + f

ma = (50)(cos30°) + (-20) ✓

(30)a = (50)(cos30º) + (-20)

a = 0,776... m·s-2

vf2 = vi2 + 2aΔx

= (0)2 + 2(0,78...)(6)

vf = 3,052... m·s-1

Wnet = ∆K = ½ m(vf2 –vi2)

= ½ (30)(3,052...2 – 02) ✓

= 139,81 J✓

**OPTION 3**

Wnet = Wappl // + Wf  ✓ For either formula

= Fapp// Δx cos θ + fΔx cos θ

= (50)(cos30°)(6)cos 0°✓ + (20)(6)(cos180°) ✓

= 259,81+ (-120)

Wnet = 139,81 J ✓

✓one mark for all three formulas

**OPTION 2**

Wapplied = Fapp Δx cos θ

= (50)(6)(cos30°)✓

= 259,81 J

Wf = fΔx cos θ

= (20)(6)(cos180°) ✓

= -120 J

Wnet = Wapplied + Wf ✓ OR FappΔxcosθ + FΔxcosθ

= 139,81 J ✓

**OPTION 4**

Fnet = Fhorizontal + f

= (50)(cos30°) + (-20) ✓

= 23,30 N

Wnet = Fnet ∆x cos θ ✓

= (23,30)(6)(cos 0°) ✓

= 139,81 J✓

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|  |  |  | (4) |

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| 10.4 | **If:** W instead of Wnet  max  No marks for any other method  Wnet = ∆K / Wnet = ∆Ek ✓  = ½ mvf2 - ½ mvi2  139,81 = ½ (30)vf2 – 0 ✓  vf = 3,05 m·s-1 ✓ | | |  | | (3) | |
| 10.5 | | Greater than ✓  The horizontal component (of the force) / force in direction of motion will now be greater / Fnet will now be greater.✓  OR  As θ decreases cos θ increases✓  OR  For θ smaller than 30°, cos θ > cos 30°.✓ |  | | (2)  **[15]** | |

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| **QUESTION 11 / *VRAAG 11*** |  |  |

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| 11.1 | The net (total) work (done on an object) 🗸  is equal to the change in kinetic energy (of the object.) 🗸  *Die netto (totale) arbeid (verrig op 'n voorwerp)* 🗸  *is gelyk aan die verandering in kinetiese energie (van die voorwerp)* 🗸  **OR / *OF***  The work done (on an object) by a net (resultant) force 🗸  is equal to the change in (the object's) kinetic energy. 🗸  *Die arbeid verrig (op 'n voorwerp) deur 'n netto (resulterende) krag* 🗸  *is gelyk aan* *die verandering in kinetiese energie (van die voorwerp.)* 🗸 |  | (2) |

🗸

🗸

⚫

f

Fapplied/*applied*

w

🗸

|  |  |  |  |
| --- | --- | --- | --- |
| 11.2 |  |  |  |

|  |  |  |
| --- | --- | --- |
|  |  | (3) |

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| --- | --- | --- | --- |
| 11.3 | Gravitational force/weight (of soldier) 🗸  *Gravitasiekrag/gewig (van soldaat)* |  | (1) |

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| --- | --- | --- | --- | --- |
| 11.4 | Wnet = ∆K 🗸  F∆ycos+ Fw∆ycos+ Wf = ∆K  (960)(20)cos0° 🗸+ (80)(9,8)(20)cos180° 🗸 + Wf = 0 🗸  19 200 – 15 680 + Wf = 0  Wf = - 3 520 J 🗸 | |  | (5) |
|  |  |  | | **[11]** |

**QUESTION 12/*VRAAG 12***

12.1

⚫

F 🗸

N 🗸

w 🗸

(3)

12.2 The net (total) work (done on an object) is equal to 🗸the change in kinetic energy (of the object.) 🗸

*Die netto (totale) arbeid verrig (op 'n voorwerp) is gelyk aan 🗸die verandering in*

*kinetiese energie (van die voorwerp). 🗸* (2)

12.3

12.3.1 Wnet = ΔEk/ΔK 🗸 OR/OF FnetΔxcosθ = ½ m(vf2 – vi2)

Fnet(1,02)cos180° 🗸= ½ (1 200)(0 – 202) 🗸

|  |  |  |  |  |
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| 12.3.2 | **OPTION 1 /*OPSIE 1***  FnetΔt = mΔv 🗸  (-235 294,12)Δt 🗸= (1 200)(0 - 20) 🗸  Δt = 0,1 s 🗸(0,102 s) | **OPTION 2/*OPSIE 1***  🗸  1,02 🗸= 🗸  Δt = 0,1 s🗸 | | (4) |
|  |  | |  | **[13]** |

Fnet = 235 294,12 N 🗸 (2,35 x 105 N) (4)

**KEY FOR QUESTION PAPER REFERENCE FOR TEACHERS.**

**MULTIPLE QUESTIONS**

|  |  |  |
| --- | --- | --- |
| **Question in revision guide** | **Question Paper** | **Question in paper** |
| 1 | March 2009 | 4.2 |
| 2 | March 2011 | 2.3 |
| 3 | March 2012 | 2.2 |
| 4 | November 2008 | 4.2 |
| 5 | November 2011 | 2.2 |
| 6 | November 2012 | 2.3 |

**STRUCTURED QUESTIONS**

|  |  |  |
| --- | --- | --- |
| **Question in revision guide** | **Question Paper** | **Question in paper** |
| 1 | March 2009 | 6 |
| 2 | March 2010 | 6 |
| 3 | March 2011 | 5 |
| 4 | March 2012 | 4 |
| 5 | March 2012 | 5 |
| 6 | November 2008 | 7 |
| 7 | November 2009 | 5 |
| 8 | November 2009 (leacked) | 5 |
| 9 | November 2010 | 4 |
| 10 | November 2010 | 5 |
| 11 | November 2011 | 5 |
| 12 | November 2012 | 5 |